DIGITALES ARCHIV

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

Polyakova, A. G.; Ramakrishna, Seeram A.; Kolmakov, V. et al.

Article

A model of fuel and energy sector contribution to economic growth

International Journal of Energy Economics and Policy

Provided in Cooperation with:

International Journal of Energy Economics and Policy (IJEEP)

Reference: Polyakova, A. G./Ramakrishna, Seeram A. et. al. (2019). A model of fuel and energy sector contribution to economic growth. In: International Journal of Energy Economics and Policy 9 (5), S. 25 - 31.

http://econjournals.com/index.php/ijeep/article/download/7849/4494. doi:10.32479/ijeep.7849.

This Version is available at: http://hdl.handle.net/11159/5079

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/

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. Alle auf diesem Vorblatt angegebenen Informationen einschließlich der Rechteinformationen (z.B. Nennung einer Creative Commons Lizenz) wurden automatisch generiert und müssen durch Nutzer:innen vor einer Nachnutzung sorgfältig überprüft werden. Die Lizenzangaben stammen aus Publikationsmetadaten und können Fehler oder Ungenauigkeiten enthalten.

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. All information provided on this publication cover sheet, including copyright details (e.g. indication of a Creative Commons license), was automatically generated and must be carefully reviewed by users prior to reuse. The license information is derived from publication metadata and may contain errors or inaccuracies.



https://savearchive.zbw.eu/termsofuse





International Journal of Energy Economics and Policy

ISSN: 2146-4553

available at http: www.econjournals.com

International Journal of Energy Economics and Policy, 2019, 9(5), 25-31.



A Model of Fuel and Energy Sector Contribution to Economic Growth

Aleksandra G. Polyakova^{1,2}, Seeram A. Ramakrishna³, Vladimir V. Kolmakov^{4*}, Dmitry V. Zavyalov²

¹Department of Economics and Production Setup, Industrial University of Tyumen, Tyumen, Russia, ²SAP Next-Gen Lab, Plekhanov Russian University of Economics, Moscow, Russia, ³Circular Economy Taskforce, National University of Singapore, Singapore City, Singapore, ⁴Department of Financial Management, Plekhanov Russian University of Economics, Moscow, Russia. *Email: vladimirkolmakov@mail.ru

Received: 15 March 2019 **Accepted:** 02 July 2019 **DOI:** https://doi.org/10.32479/ijeep.7849

ABSTRACT

The study examined the impact of foreign direct investment (FDI) in the fuel and energy sector and related industries on economic growth in response to the debates on FDI's impact on economic growth being positive (government officials and policymakers) or negative (the World Bank, some researchers). The hypothesis that a significant relationship is present between the Russian Federation gross domestic product (GDP) and gross FDI in Fuel and Energy Sector (fuels and non-fuels fossils mining, coke and petrochemicals production, rubber and plastic production, and energy supply) is introduced and validated by using a regression model. The derived model tests changes of regression results patterns of the Russian GDP against FDI in energy-related industries in different periods 1998-2004 and 2010-2017. GDP is assessed in five different measures: current US dollars, international US dollars (purchasing power parity), growth rates of the former and the latter, and physical growth index. It was concluded that, to a greater extent, economic growth is influenced by foreign investment in energy supply and petrochemical production in the both periods. Increased investment in power generation also contributes to economic growth, while other constituents of the sector, including mining, have a statistically insignificant or even retarding effect on economic growth, thus evidencing in favor of the World Bank's criticism towards FDI. Policy implications of the findings prove the necessity to introduce structural changes intended to redirect capital flows from oil and gas to prevent from economic growth deterioration in the long-term perspective.

Keywords: Economic growth, Foreign Direct Investment, Fuel and energy sector

JEL Classifications: C3, O4, O43

1. INTRODUCTION

Economic growth is an important characteristic of the economic system and is derived from many factors. There are various methods of stimulating economic growth, but with all their multiplicity, it is rather difficult to predict the effectiveness, since they are not easy to regulate and evaluate. Yet, it is the foreign direct investment that makes it possible to increase the revenue part of a country's budget and the volume of aggregate production.

Foreign investment acts as a tool for integrating the national economic system into the world market and is the engine of production and world trade growth. The low share of foreign investments in the total volume of investment may indicate the orientation of the investment programs of companies to solve current problems or a country's investment climate unattractiveness even in those types of economic activity that traditionally are in high demand. The inflow of foreign investment is a factor that contributes to the competitiveness and economic growth of countries, since foreign capital can compensate for the relative lack of domestic resources and ensure the growth of investment activity.

The influx of investment contributes to the modernization of the economy, as it is accompanied by the introduction of new

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

technological solutions and modern business standards, which provides an increase in the competitiveness of both individual subjects and the country's economy as a whole. Thus, the modernization of economy identified as a priority objective of a country development cannot be implemented without a corresponding guarantee for the inflow of investments into the fuel and energy sector, as it is perceived to be the driving force of the entire economy development and largely determines the development and deployment of the country's productive potential.

The fuel and energy sector is a key sector of the Russian Federation economy, ensuring the livelihoods of all sectors of the country's economy and covering the household needs of the population. The export of the sector's products (crude oil, oil products, gas) ensures stable foreign currency earnings, providing a share in total Russian exports from 43% to 45%, while share of tax revenue contribution to all levels of national budget system reach 40%.

At the same time, the fuel and energy sector is the most attractive sector of the Russian economy from the foreign investors' point of view. According to estimates, announced by A. Novak, the Minister of Energy of the Russian Federation, by 2024 the volume of investment in the fuel and energy sector of Russia will increase by 50% to 7.5 trillion rubles. It is impossible to attract such a large amount of investment exclusively from the state budget and the internally generated funds of the domestic enterprises, and therefore it is crucial to ensure the investment attractiveness of enterprises and projects in the fuel and energy sector. Thus, it is necessary to ensure the formation of measures that would ensure the stable functioning of the fuel and energy sector and its effective development in the interests of the country. Overcoming the current negative trends in the fuel and energy sector of Russia, meeting the needs of a growing economy and population is impossible without large-scale investment attraction. Still, FDI risks, described in the literature review have to be considered regarding the World Bank's criticism consistent in cost-benefit misbalance, exploitation malpractices, environmental pressure and transfer of productivity gains abroad. All the latter need to be well-balanced and, thus estimated in terms of current and potential influence on economic growth. Thus, the paper aims to get a proof for the axiomatically taken idea that the Russian fuel and energy sector driven by foreign investment can facilitate the economic growth.

2. LITERATURE REVIEW

The fuel and energy sector is a sophisticated system, including a combination of production, processes, material devices for the extraction of fuel and energy resources, their transformation, transportation, distribution and consumption of both primary energy resources and transformed types of energy carriers. It includes oil industry, coal industry, gas industry, peat industry, electric power industry. Energy supply and energy related sectors of petrochemicals and several others are to be included as well.

A profound summary of investment climate contents and methodology was provided by the World Bank (2005) that defined investment climate as "the location-specific factors that shape the opportunities and incentives for firms to invest productively, create jobs, and expand" (p. 1). In that very manner Giang et al. (2018) examined the relationship between the investment climate – infrastructure, labor skills, regulatory governance and institutions, and access to finance – and firm total factor productivity and prove the positive interrelation of better investment climate and corporate productivity, especially through access to finance, including foreign investment.

Deeper insights in investment climate regarding its influence on FDI and economic growth can be found in several recent papers. E.g., Quazi and Tandon (2011) contribute to explanation of investment climate components' (infrastructure, financial market, monetary system, corruption, etc.) influence on FDI providing the quantity measures of their contribution. Bayraktar (2013) proposes to synonymize investment climate and "ease of doing business" and concludes that the improvement in ease of doing business indicators in developing countries can have a partial explanatory power in determining higher FDI flows to these countries. Highly relative to the Russian experience is the problem of the natural resource curse raised by Ye (2018) regarding the case of Canada positive effects of shifting FDI from primary sectors were described and estimated in terms of economic growth and sustainability.

The core point of raising foreign direct investment is fostering technological development and recovering the competitiveness gap by obtaining access to foreign technologies, competencies and know-hows. Those can be different sorts of innovation that is adopted by domestic economic agents: products, business solutions, business models, market strategies, financial instruments, regulations, policies, etc. Quantification of economic growth and innovation stemming from investment is provided in Kolmakov et al. (2015). More aspects of investment in innovation and its effects on economic growth described in Akhmetshin et al. (2018), Polyakova et al. (2018), Sycheva et al. (2018).

Thus, public policies aimed at investment climate development contribute not only to foreign direct investment inflow, but also to economic development and growth through innovation and efficiency, through import substitution and tax revenue development. Being a market enabler, FDI provides stimuli for domestic market expansion and exports potential development as well. That is why foreign direct investment is generally perceived not as a capital transfer solely, but as a complex engineering solution resulting in a quality shift of a recipient's economic potential.

Transmission channels of FDI impact are widely studied as well. Theoretical issues of causality study applied to transmission channels are discussed in Ekimova et al. (2017). One of the widely recognized facilitators of economic growth through FDI is energy supply, according to many sources. E.g., Latief and Lefen (2019) confirm a positive bi-directional short-run causal relationship between economic growth and energy consumption in Pakistan. The same conclusion on the Chinese dataset was obtained by Hao et al. (2018), who verify the existence of bilateral causal relationship between rural GDP and rural energy consumption in the short run. However, there is also an evidence of loosening interrelation of economic growth and energy consumption and

investment. Chovancová and Vavrek (2019) observe the strong decoupling of economic growth and energy consumption in the V4 group of countries (Czech Republic, Hungary, Poland and Slovakia) to consider it as positive trend. Thus net-importers of energy might have different growth patterns regarding FDI to energy sector. Presumably, the sector size does matter to have a significant positive contribution to economic growth, otherwise energy consumption will be treated as the value consumer.

Earlier work of Khatun and Ahamad (2015) examines the causal relationship between FDI in the energy and power sector, and economic growth in Bangladesh: they find robust positive and unidirectional short-run causal relationships running from FDI to energy use and from energy use to GDP growth. Further contribution of Ahmad and Zhao (2018) develops theoretical channels of relationship between energy investment and economic growth and establishes causal linkages between them.

Regional aspects of energy sector development also indicate strong dependency of growth on investment in sectors of competitive specialization, primarily in energy sector (Kolmakov et al., 2019), although macroeconomic influence of foreign direct investment is significantly wider than growth facilitation. A certain increase of wealth and life quality is expected to follow the capital inflows as new employments and career perspectives get discovered. The main problem is to provide differentiation of capital flows across the industries, because many economies face the same problem of overcapitalization of raw materials mining and extraction that leads to economies exploitation and different malpractices of nations becoming "under-sovereign." Risks of FDI in power sector are analyzed in several papers. One of the basic issues is crowding out the financial capital (Sirin, 2017) and intellectual capital (Ye, 2018; Miheeva et al., 2018) from other sectors, especially from the green energy and high-tech. Gamoori et al. (2017) introduce the risk of FDI misbalance that might lead to foreign trade loss.

The general risk factor of raising FDI is the mismatch, and even controversy of investors' and recipients' objectives that match only in a single term of "development" while the question that matters is the party to carry the expense of development. Explanation for that is quite obvious: factors positively influencing FDI inflow to Russia include the presence of numerous and relatively cheap natural resources (oil, gas, coal, metals, gems, wood, etc.), significant domestic market capacity, qualified labor availability, etc. To put it simple, many economies have already faced the profits and capitals outflow, unemployment and stagnation, intellectual potential depletion as the outcome of investment-friendly policy that gave away too much in exchange of the above-mentioned bonuses expectations. The lessons learnt indicate that a foreign investor has to lead the market, meaning that there have to be followers that a basically national: only in this case risk of overdependency on FDI provider is mitigated, and this is the only strategy for current era implementation.

3. DATA AND METHODOLOGY

There is a widespread opinion in scientific works that foreign investment acts as a factor of renewal and modernization of production processes, accelerating economic and technical progress, spreading successful management practices, providing additional jobs and stimulating employment.

At the same time, there are diverse views on the functioning of the fuel and energy sector, since the relatively higher success rate of its operation compared to other types of economic activity by the industries creates the illusion of its long-term well-being and makes the sector a permanent and major contributor to the budget. However, today the fuel and energy sector is operating in the mode of depletion of its production potential, which was provided by investments of the previous decades. The main production assets of the sector in terms of age structure, degree of depletion and technical condition are approaching a critical level.

For the fuel and energy sector to fully realize its potential, Russia needs to create an attractive, sustainable, politically stable and globally competitive investment regime. Stimulation of the real economy can be achieved through industrial restructuring, the acquisition of best practices and technologies. These require reasonable macroeconomic and financial management by the state, including the development of the banking sector, as well as massive national and foreign investment and the development of capital generation programs at both the federal and regional levels. New major investments in the Russian fuel and energy sector are possible due to the following main sources:

- own funds (profits) of oil producing companies;
- inflow of foreign capital under production sharing agreements;
- inflow of foreign capital through the issuance of securities (stocks and bonds) of oil companies, as well as through lending.

It should also be noted that, even in the case of a relatively prosperous economic environment, the aggregate financial resources of a significant part of Russian credit institutions are insufficient to ensure serious capital investments in industry, transport and communications.

An analysis of the prospects for the development of investment policy in the fuel and energy sector shows that the sector, subject to its modernization in the medium term, will remain a backbone for the Russian economy. According to the Ministry of Energy of the Russian Federation, the development of the fuel and energy sector of Russia over the past 5 years has been characterized by the following trends:

- there was the longest over 45 years more than two-fold drop in oil prices;
- the intensive development of technology and the rapid change in markets;
- a sharp increase in competition in the markets, including interfuel;
- changes in tax legislation;
- sectoral sanctions against the fuel and energy sector.

Table 1 shows the dynamics of the volume of extraction and production of energy resources by type.

Analyzing the dynamics of energy production in Russia, it should be noted that in 2016 a record of oil and gas condensate

production was set at 547.6 million tons. By intensifying the inflow of investment and directing them to the modernization of industry, Russia has the chance to become a major producer of food and consumer goods, products of the chemical industry and engineering. The use of foreign investment is an objective necessity due to the system of participation of the country's economy in the international division of labor and the flow of capital into attractive industries.

This is a widely studied category of contemporary economic research. To assess the effectiveness of attracting foreign investment was chosen method of analysis of multiple regression. The general form of the linear multiple regression model is $\tilde{y} = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_k x_k$. The evaluation of the equation consists in finding b_1 , which is an estimate of β_i .

The model is described by the following equation: $\tilde{y} = b_0 + b_1 x_1 + b_2 x_2 + \dots + b_k x_k$. The coefficient of the regression equation is the least squares method.

The coefficient b_1 represents the expected change in the value of Y when X1 is changed by one, and the remaining X remains constant. The coefficients b in the regression equation are called partial regression equations.

To model the economic growth dependent on net FDI to energy sector we assumed that energy supply factor has to be accompanied by fossils production and processing. As for the function, we tested several representations of GDP: in current US dollars, in international US dollars (purchasing power parity), their growth rates and physical growth index (Table 2).

The analysis was based on data from the Central Bank of the Russian Federation and the World Bank.

4. RESULTS AND ANALYSIS

Correlation analysis of factors (FDI net flows) indicates that multicollinearity is attributable only to fossil fuels and nonfuels that are negatively correlated with absolute r=0.77. Still, correlation is negative that is feature of the Russian economy: non-fuel fossils production is more attractive for investors that use non-fuels as safe havens when hydrocarbon markets fluctuate or move down. That allows not to eliminate that pair of factors and get them all in one model.

GDP regression by net flows of FDI to selected Russian energy related industries reveals significant sensitivity of coefficients' sign to GDP representation. Investment in fossil fuels mining is relatively the most significant in its positive contribution to GDP_{DDD}

Table 1: Dynamics of mining and production of main energy resources in Russia

Resources type	2000	2011	2012	2013	2014	2015	2016	2017
Oil and gas condensate production, million tons	323.5	511.4	518.1	523.4	526.8	534.3	547.6	546.8
y/y growth, %	-	-	1.3	1.0	0.6	1.4	2.5	-0.1
y/2000 growth, %	-	58.1	60.2	61.8	62.8	65.2	69.3	69.0
Gas production, million m ³	584.0	670.7	654.5	667.8	642.0	635.5	640.2	691.1
y/y growth, %	-	-	-2.4	2.0	-3.9	-1.0	0.7	8.0
y/2000 growth, %	-	14.8	12.1	14.3	9.9	8.8	9.6	18.3
Coal mining, million tons	247.1	336.7	354.6	352.1	359.0	374.0	386.9	408.9
y/y growth, %	-	-	5.3	-0.7	2.0	4.2	3.4	5.7
y/2000 growth, %	-	36.3	43.5	42.5	45.3	51.4	56.6	65.5
Power generation, billion kWh	862.8	1040.5	1054.0	1045.0	1047.4	1049.9	1071.9	1073.7
y/y growth, %	-	-	1.3	-0.9	0.2	0.2	2.1	0.2
y/2000 growth, %	-	20.6	22.2	21.1	21.4	21.7	24.2	24.4

Table 2: Net FDI flow to Russian industries (selected), millions of current USD

Factors (industries)	2010	2011	2012	2013	2014	2015	2016	2017
Net flows								
Fossil fuels mining	1 771	2 439	4 938	6 535	6 957	10 778	25 738	7 472
Fossil non-fuels mining	1 988	2 110	-131	566	-2412	710	-3434	857
Coke and Petrochemicals production	-235	71	1 425	20 707	-1491	358	-537	793
Rubber and plastic production	118	4	195	248	333	374	118	121
Energy supply	1 410	2 207	1 869	1 768	1 682	-1940	-98	1 173
Gross inflows								
Fossil fuels mining	7 261	12 129	12 141	22 702	15 844	15 843	30 332	25 418
Fossil non-fuels mining	3 422	4 633	3 394	3 453	495	1 592	2 051	3 059
Coke and Petrochemicals production	173	1 560	4 989	21 618	1 295	3 013	857	1 690
Rubber and plastic production	569	203	1 095	997	1 365	953	751	904
Energy supply	2 144	3 297	4 000	2 831	3 251	1 120	1 143	2 265
Functions (GDP)								
GDP _{ppp} current international USD	2 928 121	3 475 385	3 692 393	3 765 661	3 768 772	3 621 746	3 640 302	3 817 201
Growth rate, %	105.8	118.7	106.2	102.0	100.1	96.1	100.5	104.9
GDP in current prices	1 524 917	2 051 662	2 210 257	2 297 128	2 063 663	1 368 401	1 284 728	1 577 524
Growth rate, %	124.7	134.5	107.7	103.9	89.8	66.3	93.9	122.8
Physical GDP index	104.5	104.3	103.7	101.8	100.7	97.5	100.3	101.6

USD: United states dollar, GDP: Gross domestic product, FDI: Foreign direct investment

(in terms of beta coefficient) but its increase undermines growth rates of GDP_{ppp} and physical GDP as well as GDP in current prices to the most significant extent (Table 3).

Even though all the models have rather credible R-squared values, there is a big probability of spurious regression according to very high values of p-level far above 5%. Longer retrospective might change the outcomes of modeling procedure, still the models provide rather informative explanation of the currently observed mismatch between net FDI outflows from Russia and positive GDP growth rates.

Regarding the physical GDP growth, only FDI in coke and petrochemicals manufacturing contributes positively, as well as it is the only negative contributor to current GDP growth. Since regression coefficients lack credibility, the above-mentioned conclusions have to be verified using alternative models based on the following methodological assumption: net FDI flows, calculated as the difference of inflows and outflows per given period of time, have a certain mismatch with the logic of investment's contribution to growth. No matter what the reasons were to withdraw capital form the country, that capital was formerly invested and made some GDP impact, at least through capital expenditure and contracting. This means outflow of foreign capital might cause working capital misbalances and liquidity issues, but not the growth downturn. Due to this, we assume that the gross inflow of FDI should be a proper factor explaining the Russian economy growth fluctuations under changing capital consumption by energy related sectors.

Direct verification of a model by factor substitution affirmed the conclusion that the Russian GDP_{ppp} demonstrates no statistically significant dependence on FDI inflows to energy related sectors: although the model is highly deterministic (R-squared equal to 76.1%), the regression is rather spurious since t-tests and F criterion fail to prove the opposite (Table 4).

The same conclusion is applicable to the growth rates of GDP in current and physical terms. Yet, the dollar value of current GDP

is reliably dependent on FDI inflows to coke and petrochemicals production (beta = 0.54 at p-level = 0.01), negatively contributed by FDI in non-fuel fossils mining (beta = -0.41 at p-level = 0.05) while the most significant contribution is attributable to FDI in energy supply (beta = 0.98 at p-level = 0.004).

In absolute terms regression results indicate that foreign investment in Russian energy supply sector generates the cumulative value-added effect of 381 million dollars per 1 million dollars invested due to the sector's direct and the most significant indirect influence on economic activity. Tests of lagged dependence that is rather obviously present in economic growth and investment interrelation, do not change outcomes to better proving as we got that from vector autoregressive models made for the same function and factors.

Gross FDI inflows were found to be an influential factor of GDP_{PPP} growth dynamics. Again, this factor has the most significant beta (0.763) which is statistically reliable with high level of determination.

The current situation of interrelation between FDI to energy related sectors and economic growth is continuous. It is widely perceived that the high rates of GDP growth of the Russian economy were mainly reinforced by oil and gas manufacturing and exports facilitated by foreign direct investment inflows. Economically, it is more correct to state that the Russian growth was funded by cash inflows from exports while the core contributors to growth were alternative factors and industries. Our previous research of the deeper retrospective (1998-2004) can be used to verify the above findings regarding the recent period.

The 1998-2004 model employed the same theoretical principle, but the factors' representation was slightly different due to the differences of statistic data collection methodologies then and now: we used FDI inflows to electricity supply, oil extraction, gas extraction, coal mining and oil refining. Modelling

Table 3: Beta coefficient estimates of GDP=f (net FDI)

Table 5. Deta coefficient estimates of GDI – J (net 1 DI)								
Function								
GDP_{ppp}	GDP _{ppp} growth	Current GDP	Current GDP growth	Physical GDP index				
17.4972	-3.2617	-0.5658	2.3429	-3.8430				
14.4339	-2.4531	-0.4044	2.2710	-3.0270				
-4.6652	0.7567	0.3772	-0.7162	0.9691				
10.6228	-2.4403	0.1390	0.8404	-2.5797				
13.1223	-2.0381	0.4966	2.2009	-2.1842				
0.7215	0.8743	0.8328	0.9811	0.9151				
0.2436	0.6322	0.8899	0.4075	0.5465				
	GDP _{PPP} 17.4972 14.4339 -4.6652 10.6228 13.1223 0.7215	GDP _{ppp} GDP _{ppp} growth 17.4972	GDP _{ppp} GDP _{ppp} growth Current GDP 17.4972 -3.2617 -0.5658 14.4339 -2.4531 -0.4044 -4.6652 0.7567 0.3772 10.6228 -2.4403 0.1390 13.1223 -2.0381 0.4966 0.7215 0.8743 0.8328	Function GDP _{ppp} GDP _{ppp} growth Current GDP Current GDP growth 17.4972 -3.2617 -0.5658 2.3429 14.4339 -2.4531 -0.4044 2.2710 -4.6652 0.7567 0.3772 -0.7162 10.6228 -2.4403 0.1390 0.8404 13.1223 -2.0381 0.4966 2.2009 0.7215 0.8743 0.8328 0.9811				

Table 4: Beta coefficient estimates of GDP=f (gross FDI inflow)

The test to be the control of the co									
Argument	Function								
	GDP_{ppp}	GDP _{ppp} growth	Current GDP	Current GDP growth	Physical GDP index				
Fossil fuels mining	0.7648	0.1716	0.0039	0.2139	-0.0730				
Fossil non-fuels mining	-0.1764	0.0106	- 0.4102 (p=0.049)	0.6774	0.5700				
Coke and petrochemicals production	0.0465	-0.1501	0.5403 (p=0.009)	-0.3332	-0.2183				
Rubber and plastic production	0.2125	-0.8360 (p=0.041)	-0.3480	-0.1517	-0.0592				
Energy supply	0.5190	0.7630 (p=0.0213)	0.9826 (p=0.0037)	0.4117	0.4728				
R-squared	0.7614	0.9902	0.9972	0.8003	0.7983				
Best p-level	0.2170	0.0213	0.0037	0.4882	0.4562				

2.5 2.15 2 1.5 0.82 0.5 0 -0.5 -0.10-0.49-1 -1.5 -1.29Energy supply Oil production Oil refining Gas production Coal mining ■ Beta ● p-level

Figure 1: Beta coefficients of the Russian GDP growth rate regression by sectors' gross foreign direct investment inflows, 1998-2004

outcomes indicate that oil and gas production provided negative contribution to real GDP growth rates, as well as coal mining (Figure 1).

Again, energy supply shows significant positive impact on physical GDP growth rates. Explanation and verification can be found, for example, in Latief and Lefen (2019) who confirm a positive bi-directional short-run causal relationship between economic growth and energy consumption, growth of which is – in our case – reinforced by foreign direct investment inflows in energy supply. Pradhan et al. (2018) using the case of FATF countries provide one more evidence that energy consumption patterns are significant long-term drivers of economic growth, thus enhancing the long-run economic prosperity upon sophistication of resources to develop the energy sector.

Thus, the economic growth pattern seems to reproduce itself in different economic environments and different levels of market development. To sum up, the hypothesis of bigger returns on foreign direct investment in energy supply sector in terms of GDP growth has found verification in our research. We managed to prove that compared to several other energy related sectors, primarily fossil fuel mining, FDI in energy supply is the best performing in economic growth facilitation. Formally it provides 2 times bigger relative contribution than investment in petrochemicals production, while raw fossil production acts like growth consumer.

Along with the changes in energy balances, hydrocarbons manufacture for energy generation purposes will continue to dilute the value created by economies due to technological, environmental and humanitarian changes. The mankind is going to get more energy-dependent, thus energy supply as an industry will continue to promote its positive influence on growth only if it will follow the progressive trends of sustainable development and meet the core principles of circular economy. Russia and other hydrocarbon exporters face capital expenditure issues regarding the following matter: to invest in solar-wind-geothermal power generation or keep on investing in fossil fuels production development. Presumably the growth of renewables share in total power generation is meant to increase regional value in different extent depending on structure of an economy and many other factors. Our further research is devoted to the "fossil vs. renewable" dilemma.

5. CONCLUSION

The category of economic growth is the most important characteristic of general output in any economic systems. To solve many economic problems, a material base is needed. The increase of revenues and funds of a country, i.e. economic growth rate is possible through encouraging investment, including foreign. The investment factor plays an important role in enhancing competitive positions in all industrially developed countries, creating for them an advantage over the rest of the world. Large amounts of investment and their effective use can compensate for the lack or loss of competitive advantages associated with some parties with natural resources, for others with a geographical position, and for almost every one of them with a shortage or high cost of labor. From the above, we can conclude: an important factor affecting economic growth is foreign investment.

The performed analysis of the impact of attracting foreign investment in the fuel and energy sector on economic growth using the method of multiple regression analysis indicates that foreign direct investment in the electric power industry and petrochemistry largely affect economic growth. Increased investment in power generation also contributes to economic growth, while other sectors of the fuel and energy sector, including mining, do not have a statistically significant effect on economic growth, and gross investments in rubber and plastics have a retarding effect on economic growth.

One of the determining factors for the slowdown in economic growth is the dependence of the Russian fuel and energy sector on equipment imports. The share of domestic refining catalysts for 2014-2017 increased from 31.8% to 61.6%, and petrochemistry - from 34.2% to 73.5% still remaining dangerously low. This still largely puts the effectiveness of the contribution of the fuel and energy sector to economic growth depending on the volatility of the ruble exchange rate and foreign trade restrictions.

Summarizing all the above, it can be noted that attracting foreign investment in the Russian economy requires significant legislative and organizational efforts from both the Russian federal and regional authorities and individual enterprises and financial institutions. In general, these efforts should be aimed at improving the overall investment climate in Russia. The implementation of the investment policy and the implementation of measures to

improve the investment climate and stimulate investment activity can increase the efficiency of investment activity and ensure the growth of foreign investment in the fuel and energy sector of the Russian Federation.

REFERENCES

- Ahmad, M., Zhao, Z.Y. (2018), Causal linkages between energy investment and economic growth: A panel data modelling analysis of China. Energy Sources, Part B: Economics, Planning and Policy, 13(8), 363-374.
- Akhmetshin, E.M., Dzhavatov, D.K., Sverdlikova, E.A., Sokolov, M.S., Avdeeva, O.A., Yavkin, G.P. (2018), The influence of innovation on social and economic development of the Russian regions. European Research Studies Journal, 21(2), 767-776.
- Bayraktar, N. (2013), Foreign direct investment and investment climate. Procedia Economics and Finance, 5, 83-92.
- Chovancová, J., Vavrek, R. (2019), Decoupling analysis of energy consumption and economic growth of V4 countries | [Analiza rozprzężenia relacji pomiędzy poziomem konsumpcji energii a wzrostem ekonomicznym krajów grupy v4]. Problemy Ekorozwoju, 14(1), 159-165.
- Ekimova, K., Kolmakov, V., Polyakova, A. (2017), The credit channel of monetary policy transmission: Issues of quantitative measurement. Economic Annals-XXI, 166(7-8), 51-55.
- Gamoori, A., Jorjorzadeh, A., Mehrabani, F. (2017), Investigation the links between foreign investment, economic growth and energy usage: Organization of the Islamic conference countries. International Journal of Energy Economics and Policy, 7(2), 304-309.
- Giang, M.H., Xuan, T.D., Trung, B.H., Que, M.T., Yoshida, Y. (2018), Impact of investment climate on total factor productivity of manufacturing firms in Vietnam. Sustainability, 10, 4815.
- Hao, Y., Wang, L., Zhu, L., Ye, M. (2018), The dynamic relationship between energy consumption, investment and economic growth in China's rural area: New evidence based on provincial panel data. Energy, 154, 374-382.
- Khatun, F., Ahamad, M. (2015), Foreign direct investment in the energy and power sector in Bangladesh: Implications for economic growth. Renewable and Sustainable Energy Reviews, 52, 1369-1377.

- Kolmakov, V.V., Polyakova, A.G., Karpova, S.V., Golovina, A.N. (2019), Methodological approach to sector development based on competitive specialization of regions. Economy of Region, 15(1), 1-10
- Kolmakov, V.V., Polyakova, A.G., Shalaev, V.S. (2015), An analysis of the impact of venture capital investment on economic growth and innovation: Evidence from the USA and Russia. Economic Annals, 60(207), 7-37.
- Latief, R., Lefen, L. (2019), Foreign direct investment in the power and energy sector, energy consumption, and economic growth: Empirical evidence from Pakistan. Sustainability, 11(1), 192.
- Miheeva, N.M., Voronkova, O.Y., Magsumov, T.A., Bulanakova, M.A., Kulchytskiy, A.V., Polyakova, A.G. (2018), Public diplomacy development stages through the black sea economic cooperation organization. International Journal of Mechanical Engineering and Technology, 9(11), 1382-1391.
- Polyakova, A.G., Akhmetshin, E.M., Goloshchapova, L.V., Rakhmeeva, I.I., Noeva, E.E., Rakovskiy, V.I. (2018), A model of regional economic space modernization. European Research Studies Journal, 21(2), 624-634.
- Pradhan, R.P., Arvin, M.B., Nair, M., Bennett, S.E., Hall, J.H. (2018), The dynamics between energy consumption patterns, financial sector development and economic growth in financial action task force (FATF) countries. Energy, 159, 42-53
- Quazi, R., Tandon, S. (2011), Foreign direct investment and investment climate in china and India: A comparative analysis. International Journal of Business and Economics Perspective, 6, 70-79.
- Sirin, S.M. (2017), Foreign direct investments (FDIs) in Turkish power sector: A discussion on investments, opportunities and risks. Renewable and Sustainable Energy Reviews, 78, 1367-1377.
- Sycheva, I.N., Ovchinnicov, Y.L., Voronkova, O.Y., Akhmetshin, E.M., Kolmakov, V.V., Vasilieva, A.G. (2018), Economic potential and development prospects of small businesses in rural areas. European Research Studies Journal, 21(4), 292-303.
- World Development Report. (2005), A Better Investment Climate for Everyone. New York: World Bank and Oxford University Press.
- Ye, Z. (2018), Shifting Foreign Direct Investment (FDI) to High-Growth Sectors in Canada: The Role of Investment Climate in FDI Diversification. Ottawa, Canada: Information and Communications Technology Council (ICTC).