Mukhtarov, Shahriyar; Karacan, Rıdvan; Aliyev, Fuzuli et al.

Article

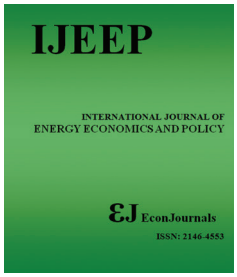
The effect of financial development on energy consumption: evidence from Russia

International Journal of Energy Economics and Policy

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

Reference: Mukhtarov, Shahriyar/Karacan, Rıdvan et. al. (2022). The effect of financial development on energy consumption: evidence from Russia. In: International Journal of Energy Economics and Policy 12 (1), S. 243 - 249. https://econjournals.com/index.php/ijeep/article/download/12534/6216. doi:10.32479/ijeep.12534.

This Version is available at:
http://hdl.handle.net/11159/8508



International Journal of Energy Economics and Policy

ISSN: 2146-4553

available at http: www.econjournals.com

International Journal of Energy Economics and Policy, 2022, 12(1), 243-249.

The Effect of Financial Development on Energy Consumption: Evidence from Russia

Shahriyar Mukhtarov[1,2,3]*, Rıdvan Karacan[4], Fuzuli Aliyev[5], Vuqar Ismayilov[6]

[1]Baku Engineering University, Baku, Azerbaijan, [2]Vistula University, Warsaw, Poland, [3]Azerbaijan State University of Economics (UNEC), Baku, Azerbaijan, [4]Kocaeli University, Kocaeli, Turkey, [5]ADA University, Baku, Azerbaijan, [6]Azerbaijan Technology University, Ganja, Azerbaijan. *Email: smuxtarov@beu.edu.az

Received: 19 October 2021 **Accepted:** 03 November 2021 **DOI:** https://doi.org/10.32479/ijeep.12534

ABSTRACT

This paper explores the effect of financial development, economic growth, and energy prices represented by consumer price index (CPI) on energy consumption in Russia by performing VECM, CCR, DOLS and FMOLS analyses to the annual data from 1995 to 2019. The findings of this empirical analysis reveal that financial development and economic growth have positive impact on energy consumption in Russia. Furthermore, the effect of energy prices expressed by CPI is revealed to be negative, which is consistent with the theory and expectations in practice. Based on the findings of this study, the nexus and impacts of financial development on energy consumption are discussed, as well as plausible explanations and policy implications.

Keywords: Economic Growth, Energy Consumption, Energy Prices, Financial Development; Russia, VECM
JEL Classifications: G00; Q40; P34; P18; F43

1. INTRODUCTION

Energy is very important for the continuation of vital activities. Increase in the human population and the widespread use of hi-tech products to meet basic needs such as education, health and housing require more energy consumption (EnCon thereafter). Thus, EnCon plays a vital role in shaping the economic policies of countries. Being either an energy-rich or an energy-poor country has a key role in shaping these policies. The primary goal of energy-poor countries is to provide the energy they need in a way that provides the maximum benefit. Energy-rich countries, however, have priorities such as providing a competitive advantage among themselves and having impact on the world energy market. In this regard, EnCon remains important for both groups of countries. The fact that energy is so critical makes determining the factors affecting EnCon a priority. financial development (FinDev thereafter) is a key factor affecting EnCon.

The financial sector is comprised of a set of institutions, instruments, and markets, as well as legal and regulatory frameworks, that allows transactions by lending. Basically, development in financial sector considers lowering the "costs" that the financial system is exposed to. This search, aimed at minimizing the transaction costs of obtaining information, implementing obligations, and trading, has yielded in the widespread of financial contracts, markets, and intermediaries (World Bank, 2021). The faster the level of FinDev of countries, the easier it becomes to meet the costs to be incurred as the results of increase in production and consumption. In order to meet the costs, a sustainable financial system must be found in developed and developing countries (Keskingöz and İnançlı, 2016).

The most important advantage of a sustainable and efficient financial system is that it ensures the continuity and stability of economic growth (Schumpeter, 1911; McKinnon, 1973). The growth hypothesis states that an increase in EnCon causes an increase in real GDP, given that the economy is dependent on energy (Apergis and Payne, 2009). Sadorsky (2010; 2011), and Mukhtarov et al. (2020b) mentioned three effects of FinDev that lead to an increase in EnCon. An initial effect is that with higher FinDev, consumers can easily borrow funds to purchase air

conditioners, automobiles, etc., leading to an increase in EnCon. In the other hand, in a well-functioning financial system, businesses can easily access financing to invest their capital and current assets in their business. The third effect appears in the form of wealth growth. It is known that more wealth can stimulate economic activity and increase EnCon.

Considering the above facts, it is important to analyse the nexus between FinDev and energy use in Russia, the 11th largest economy in the world according to an IMF report. Clearly Russia is a country with a very high potential of energy resources (Amelia, 2008; Bayraç, 2009; Mitrova and Melnikov, 2019). It produces the highest amount of crude oil, as well as condensate, and it is the second largest producer of dry natural gas. Russia also produces an important amount of coal. With these resources, it can be said that Russia has a significant influence on the global market (EIA, 2021; Kutcherov et al., 2020; Su et al., 2020). Considering that Russia produces just 3% of world GDP and has just 2% of the world population, it is impressive that it is the world's third-biggest producer and consumer of energy resources, after China and the US. With energy production of nearly 1470 mtoe, Russia exports a major portion of the primary energy it produces while supplying 16% of the global cross-regional energy trade, which makes Russia the world leader in energy exports (ERI RAS, 2019). Further, Russia's energy density is 2.19 times more than the world average density, and it exceeds the comparable index for European Union (EU) countries by 3.08 times. In 2007-2018 the Russian GDP grew by 14%, while it reduced EnCon by 12% (ACGRF, 2020). In Russia, several financial methods were developed to implement activities in the field of energy efficiency, though the main restriction regarding the implementation of an energy performance policy is the lack of present long-term borrowed funds. Accordingly, the most important function for the state is to create additional financing methods while maintaining the existing ones (Matraeva et al. 2019). Therefore, it is of great importance to research the extent and the long-term consequences of the relationship between the level of FinDev and the level of EnCon.

As far as we know, no research has been conducted on the nexus between EnCon and FinDev in Russia, employing different time-series methods, namely VECM, CCR, DOLS, and FMOLS that allow for the examination of country-specific aspects of this association. As a result, the goal of this research is filling this gap by investigating the influence of FinDev on EnCon for Russia, one of the largest crude oil producing economies, a unique case study for this study. The outputs of the research have significant implications for policymakers to formulate appropriate policies for sustainable energy use. Moreover, the outputs of this paper are also important for post-Soviet and developing oil-rich countries. The research's results are crucial for politicians as it will enable them to create appropriate policies in courtesy of sustainable EnCon. Furthermore, the findings of this paper are significant for other post-Soviet countries as well as developing oil-rich countries.

The remaineder of the study is laid out as following: Section 2 summarizes literature review. Section 3. Contains the method and data. Section 4 contains the empirical findings and the last, Section 5, contains the conclusion and suggestion.

2. LITERATURE REVIEW

A significance amount of empirical research and publications are focused on the impact of FinDev on EnCon in different countries with various funding models. Sadorsky (2010) studied the impact of FinDev on EnCon in 22 emerging economies using annual data for the period of 1990-2006. Using ARDL, VECM and Panel GMM models, he reported positive impact. Zhang et al. (2011) examined how the Chinese stock market influenced EnCon via the Granger causality test using 1992-2009 annual data, reporting a positive nexus. Many other studies such as Coban and Topcu (2013), Al-Mulali and Lee (2013), Islam et al. (2013), Chang (2014), Komal and Abbas (2015) and Mukhtarov et al. (2018) found positive effects of FinDev on EnCon in various countries. Also, Gaies et al. (2019) found the same result for MENA countries using the GMM model with 1996-2014 annual data.

However, Ali et al. (2015) reported a negative effect of FinDev on EnCon in Nigeria employing the ARDL model from 1972Q1 to 2011Q4.

Applying ARDL, Johansen cointegration, VECM and Granger causality test to annual data for the timeframe 1971-2008, Shahbaz and Lean (2012) reported a bidirectional causality between FinDev and EnCon in Tunisia. Kahouli (2017) and Bekhet et al. (2017) reported long run cointegration between FinDev and EnCon using ARDL models for the South Mediterranean and Gulf Cooperation Council countries respectively.

Since financial series exhibit nonlinear structures Aliyev (2019), we look at some studies that focus on nonlinear dynamics. Mahalik et al. (2017) reported a non-linear inverted U-shaped association between FinDev and EnCon for the period of 1971-2011 using cointegration test and ARDL model in Saudi Arabia.

In recent studies, Danish et al. (2018), Khan et al. (2019), and Mukhtarov et al. (2020a) reported positive effect of FinDev on EnCon employing the DSUR, 3SLS, GMM, and VECM methods. Karacan et al. (2021) studied the impact of carbon dioxide emissions, income, and oil prices on renewable EnCon in Russia employing the Canonical Cointegrating Regression method and the VECM method for the period of 1990-2015. They found a negative relationship between oil prices and renewable EnCon, and a positive relationship between real GDP per capita and renewable EnCon.

Table 1 summarizes this literature review. As seen from this review, the impact of FinDev on EnCon in Russia has not been intensively studied using VECM, CCR, DOLS and FMOLS techniques for a wider timespan.

3. MODEL AND DATA

3.1. Equational Specification and Data

$$lnEnCon_t = \beta_0 + \beta_1 lnFinDev_t + \beta_2 lnEG_t + \beta_3 lnCPI_t + \varepsilon_t \# \quad (1)$$

Following Mukhtarov et al. (2018) and Mukhtarov et al. (2020a), the functional specifications in this paper are described as below:

Table 1: Overview of empirical researches in the literature

Author (s)	Time period	Country	Method (s)	Result (Effect of FinDev on EnCon)
Sadorsky (2010)	Annual, 1990-2006	22 Emerging countries	ARDL, VEC Granger causality and Panel GMM	Positive
Zhang et al. (2011)	Annual, 1992-2009	China	Granger causality	Positive
Sadorsky (2011)	Annual, 1996-2006	Central and Eastern European	Panel GMM	Positive
Al-Mulali and Sab (2012)	Annual, 1980-2008	Sub-Saharan African Economies	VECM and Pedroni cointegration	EnCon has an important role to raise FinDev.
Al-Mulali and Sab (2012)	Annual, 1980-2008	19 Developing and Developed Economies	VECM and Pedroni cointegration	FinDev is cointegrated with EnCon.
Shahbaz and Lean (2012)	Annual, 1971-2008	Tunisia	ARDL, Johansen cointegration, VECM and Granger causality	There is a long-run bidirectional causality between FinDev and EnCon.
Coban and Topcu (2013)	1990-2011	EU	GMM	Positive
Al-Mulali and Lee (2013)	Annual, 1980-2009	GCC economies	Pedroni cointegration and OLS	Positive
Islam et al. (2013)	Annual, 1971-2009	Malaysia	ARDL and VECM	Positive
Ali et al. (2015)	Quarterly, 1972-2011	Nigeria	ARDL	Negative
Chang (2014)	Annual, 1999-2008	53 economies	IPAT model	Positive
Komal and Abbas (2015)	Annual, 1972-2012	Pakistan	GMM	Positive
Alam et al. (2015)	Annual, 1975-2011	SAARC countries	Panel cointegration test	Positive
Furuoka (2015)	Annual, 1980-2012	12 Asian countries	Heterogeneous panel causality test	Positive
Shahzad et al. (2017)	Annual, 1971-2011	Pakistan	ARDL	There is a bi-directional causality between EnCon and FinDev.
Kahouli (2017)	Annual, 1995-2015	6 SMCs	ARDL and VECM	There is a long run cointegration between FinDev and EnCon.
Bekhet et al. (2017)	Annual, 1980-2011	GCC countries	ARDL	There is a relationship between EnCon and FinDev in the long run.
Mahalik et al. (2017)	Annual, 1971-2011	Saudi Arabia	Cointegration Test and ARDL	Precense of a non-linear inverted U-shaped association between FinDev and EnCon.
Mukhtarov et al. (2018)	Annual, 1992-2015	Azerbaijan	ADF, ARDL and VECM	Positive
Danish et al. (2018)	1990-2014	Next-11 countries	DSUR method	Positive
Gómez and Rodríguez (2019)	Annual, 1971-2015	NAFTA Economies	Dynamic OLS and Fully Modified OLS	Negative
Gaies et al. (2019)	Annual, 1996-2014	MENA countries	GMM	Positive
Khan et al. (2019)	Annual, 1990-2017	193 countries	3SLS and GMM	Positive
Mukhtarov et al. (2020a)	1993-2014	Kazakhstan	VECM	Positive

Where, $EnCon_t$ represents energy consumption, $FinDev_t$ is financial development, EG_t denotes economic growth, CPI_t denotes consumer price index as measure of energy prices, and ε_t is an error term.

We utilized 1995-2019 annual data for the EnCon, FinDev, economic growth and energy prices. The dependent variable is EnCon, and is expressed by kilogram of oil equivalent. Our key independent variable is FinDev, which is expressed by domestic loans to the private sector as a percentage of GDP. Economic Growth (EG) is proxied by real GDP per capita (2010 US dollars). The consumer price index (CPI) (2010=100) is used to measure the energy prices. Because data on energy prices for all countries and all years is not readily available, energy prices are proxied by the consumer price index, as in previous studies by Sadorsky (2010; 2011), Komal and Abbas (2015), Chang (2015), Mukhtarov et al. (2018), Mukhtarov (2020a), and Mukhtarov (2020b). The data for EnCon was compiled from Enerdata (Enerdata, 2021) while FinDev was obtained from the database of Federal Reserve Bank of St. Louis (FRED, 2021). The EG and CPI data were provided

from the World Bank database (WB, 2021). We used logarithmic expressions of all variables for empirical estimation.

3.2. Methodology

We evaluated the effect of FinDev, economic growth, and energy prices expressed by CPI on EnCon using the VECM, CCR, DOLS, and FMOLS techniques. In the beginning step, the Augmented Dickey Fuller (ADF) unit root test is employed to define non-stationarity characteristics of variables under study. As the next step, since the orders of integration of the variables are the same, Johansen cointegration test is used to define if they are cointegrated.

Ultimately, we applied the Vector Error Correction Model (VECM) to assess the long-term relationship between the variables. The VECM method is the first-best choice if there is just one cointegration link between the variables under study. In order to achieve more reliable findings, we also used the Canonical Cointegrating Regression (CCR), Fully Modified Ordinary Least Squares (FMOLS), and Dynamic Ordinary Least Squares (DOLS) tests.

To conserve space and avoid confusing readers with econometric complexities, we do not discuss the above-mentioned approaches here. In addition, these methods are extensively used and well-known. Dickey and Fuller (1981), Johansen (1988), Phillips and Hansen (1990), Johansen and Juselius (1990), Hansen (1992a; b), Park (1992), and Stock and Watson (1993), have all published research that provide extensive information.

4. EMPIRICAL FINDINGS AND DISCUSSION

ADF unit root test verifies the stationarity characteristics of the variables and the findings of ADF are summarized in Table 2. As seen from the test results all variables are non-stationary at their level, though they are stationary at their first difference. Thus, the cointegration test may be applied.

To identify the optimal lag interval on the sample, a Vector Auto Regressive (VAR) model with the endogenous variables of *EnCon*, *FinDev*, *EG*, and *CPI* was initially specified through a random-selected lag interval, then defining test of lag interval was employed to the model residuals. Table 3 shows the results of the analysis. In this study, three lag selection criteria indicated that a lag of order two is optimum, which is naturally suitable regarding the less observations in the sample.

It's worth noting that, the VAR model with two lags successfully passes all residual diagnostic tests, as well as the stability test, as exhibited on Panels A-D of Table 4.

Panels E and F of the Table 4 above show the outputs of the Johansen cointegration test on the transposed form of the VAR, that is the VECM model with one lag. The variables have one cointegration relationship, according to the trace and max-eigenvalue test results. Thus, we decide that the variables under study are cointegrating.

Having verified the cointegration among the variables, VECM, CCR, DOLS, and FMOLS techniques are utilized to assess coefficients of the long-run link among the variables. If there is just one cointegration link between the variables, the VECM technique is the first-best option. Furthermore, the VECM residuals were explored in diagnostic testing. Table 5 shows the outputs of the VECM, CCR, DOLS, and FMOLS techniques.

Table 5 shows that VECM residuals carry no problems about serial correlation, instability or heteroscedasticity. As a consequence, the assessed specifications' residuals fulfill the requirements of residual diagnostics tests, confirming the estimation findings' robustness.

As seen from the outputs, the long-run coefficients of all approaches are statistically significant and remarkably near in significance value and sign. The outputs of the VECM model, which are exhibited on the top row of Table 5, are prioritized, as stated in the methodology. According to the VECM findings, FinDev has a statistically significant positive impact on EnCon. According to the findings, a 1% rise in FinDev caused a 0.02% rise in EnCon. This means that when FinDev increases, so does the demand for energy. Our findings are consistent with several studies conducted by Sadorsky (2011), Shahbaz and Lean (2012), Coban and Topcu (2013), Islam et al. (2013), Mallick and Mahalik (2014), Tang and Tan (2014), Shahbaz (2015), Mahalik et al. (2017), Mukhtarov et al. (2018), and Mukhtarov et al. (2020a) for different economies. Furthermore, we discovered that EG has a positive and statistically significant influence on EnCon. And this means that a 1% increase in EG corresponds to a 0.45% increase in EnCon. The results we obtained are in line with the traditional expectation. Furthermore, according to the findings, energy prices

Table 2: ADF unit root test results

Variables	Level	1st difference	Result
	Actual value	Actual value	
EnCon	0.0126	−5.0703***	I (1)
FinDev	0.1612	−3.3827**	I (1)
EG	−0.6905	−3.6405`**	I (1)
CPI	1.9667	−3.4132**	I (1)

Notes: At 10%, 5%, and 1% significance levels, accordingly, *, **, and *** imply null hypothesis rejection

Table 3: Lag interval tests

		Information criteria				
Lag	LogL	LR	FPE	AIC	SC	HQ
0	−649.2032	NA	5.47e+19	56.80028	56.99776	56.84994
1	−537.0302	175.5751*	1.31e+16	48.43741	49.42480*	48.68574
2	−515.9300	25.68723	9.78e+15*	47.99391*	49.77121	48.44090*

*refers to lag order selected by the criterion

Table 4: The outcomes of VAR residual diagnostics and cointegration tests.

Panel A: LM test		
Lags	LM-Statistic	P-value
1	20.81359	0.1858
2	18.81412	0.2784
3	7.072581	0.9718
4	14.70726	0.5462

Panel B: Normality Test[b]			
Statistic	χ^2	d.f.	P-value
Jarque-Bera	12.879	8	0.116

Panel C: Test for Heteroscedasticity[c]			
White	χ^2	d.f.	P-value
Statistic	166.95	160	0.337

Panel D: Test for Stability	
Modulus	Root
0.952699	0.952439−0.022284i
0.952699	0.952439+0.022284i
0.591714	0.328937−0.491859i
0.591714	0.328937+0.491859i

Panel E: Trace Rank Test (Johansen Cointegration)				
Null hypothesis	Eigenvalue	Trace statistics	0.05 critical value	P-value
None*	0.849359	71.15367	55.24578	0.0011
At most 1	0.580314	27.61805	35.01090	0.2470
At most 2	0.272330	7.648327	18.39771	0.7186
At most 3	0.014522	0.336448	3.841465	0.5619

Panel F: Maximum Eigenvalue Rank Test (Johansen Cointegration)				
Null hypothesis:	Eigenvalue	Max-Eigen Statistic	0.05 Critical value	P-value
None*	0.849359	43.53562	30.81507	0.0009
At most 1	0.580314	19.96972	24.25202	0.1668
At most 2	0.272330	7.311880	17.14769	0.6788
At most 3	0.014522	0.336448	3.841465	0.5619

[a]The null hypothesis of the LM Test refers to absence of serial correlation in residuals at a 2nd order lag; [b]The hypothesis of the Normality Test represents multivariate normality of residuals;

[c]The null hypothesis of the White Heteroscedasticity Test affirms that the residuals have no cross terms heteroscedasticity; [d] The results of the VAR stability test assert that all of the characteristic polynomial's roots are limited inside the unit circle; χ^2= The Chi-square distribution; d.f. represents degree of freedom.

Table 5: Long-run coefficients of different methods

Methods	*FinDev*	*EG*	*CPI*
Coefes. (t-Statistic)	Coefes. (t-Statistic)	Coefes. (t-Statistic)	
VECM	0.02 (5.301)***	0.45 (6.289) ***	−0.10 (−5.008) ***
CCR	0.02 (3.790)***	0.39 (5.535) ***	−0.05 (−2.303)**
DOLS	0.01 (2.954)***	0.36 (5.001) ***	−0.04 (−1.804) *
FMOLS	0.02 (3.811)***	0.40 (4.551) ***	−0.05 (−1.887) *
Outcomes of VECM residuals diagnostics tests			
LM_{SC}	14.69 [0.547]		
χ^2_{HETE}	99.66 [0.491]		
JB_N	13.41 [0.098]		

$EnCon_t$ shows dependent variable; ***, **, and * represent significance levels of 1%, 5%, and 10%, accordingly; *P* values are in brackets; LM_{SC} represents Lagrange multiplier statistic for serial correlation test; χ^2_{HETE} represents Chi-squared statistic for heteroscedasticity; JB_N test represents Jarque-Bera statistic for normality test

represented with CPI has a negative and statistically significant influence on EnCon, which is reflected in economic theory.

5. CONCLUDING REMARKS

This paper examines the influence of FinDev, economic growth, and energy prices denoted with CPI on EnCon in Russian Federation. ADF unit root test results show all variables have the same integration order, which is *I(1)*. Therefore, the cointegration link between the variables may then be tested. Long-run co-movement was tested using the Johansen cointegration test. The VECM, DOLS, CCR and FMOLS techniques were employed to estimate possible long-run relationships.

The empirical results stated that FinDev and economic growth exhibit positive effect on EnCon, whereas the energy prices expressed by CPI has a negative impact on EnCon in Russia. The positive influence of economic growth on EnCon shows that Russia uses its expanding revenues to increase energy sources. The positive impact of FinDev, as measured by bank loans to the private sector as GDP, indicates that the Russian financial system leads to a reduction in both material and transaction costs in debt markets. This enables households and companies to find "easy" money. In this way, economic units that earn more income will be able to buy the goods and services they need.

Since an increase in FinDev results in higher EnCon and that FinDev is a favourable economic outcome, a policy recommendation from our findings is that the Russian government should exploit alternative energy resources such as hydropower, wind and biomass. Considering the positive impact of economic growth on EnCon, transition from fossil fuels to renewable energy resources is important for sustainable economic growth within Russia. Moreover, our findings suggest to policymakers as well as to researchers the need to envision the relationships between FinDev, economic growth, and EnCon for sustainable development goals and federal macroeconomic stability in Russia and similar oil-rich countries.

REFERENCES

Alam, A., Malik, I.A., Abdullah, A.B., Hassan, A., Faridullah, A.U., Ali, G., Zaman, K., Naseem, I. (2015), Does financial development contribute to SAARC'S energy demand? From energy crisis to energy reforms. Renewable and Sustainable Energy Reviews, 41, 818-829.

Ali, H.S., Yusop, Z.B., Hook, L.S. (2015), Financial Development and Energy Consumption nexus in Nigeria: An application of autoregressive distributed lag bound testing approach. International Journal of Energy Economics and Policy, 5(3), 816-821.

Aliyev, F. (2019), Testing market efficiency with nonlinear methods: Evidence from Borsa Istanbul. International Journal of Financial Studies, 7(2), 27.

Al-mulali, U.; Sab, C.N.B.C. (2012), The impact of energy consumption and CO2 emission on the economic growth and financial development in the Sub Saharan African countries. Energy, 39, 180-186.

Al-mulali, U.; Sab, C.N.B.C. (2012), The impact of energy consumption and CO2 emission on the economic and financial development in 19 selected countries. Renewable and Sustainable Energy Reviews, 16, 4365-4369.

Al-Mulali, U., Lee, J.Y. (2013), Estimating the impact of the financial development on Energy Consumption: Evidence from the GCC (gulf cooperation council) countries. Energy, 60, 215-221.

Amelia, H. (2008), EU-Russia energy relations: Aggregation and aggravation. Journal of Contemporary European Studies, 16(2), 231-248.

Analytical Center for the Government of the Russian Federation (ACGRF). (2020), Voluntary National Review of the Progress Made in the İmplementation of the 2030 Agenda for Sustainable Development. Available from: https://www.sustainabledevelopment.un.org/content/documents/26962vnr_2020_russia_report_english.pdf [Last accessed on 2021 Sep 05].

Apergis, N., Payne, J.E. (2009), Energy consumption and economic growth in Central America: Evidence from a panel co-integration and error correction model. Energy Economics, 31(2), 211-216.

Bayraç, H.N. (2009), Global energy policies and Turkey: A comparison regarding oil and natural gas resources. ESOGU Journal of Social Sciences, 10(1), 115-142.

Bekhet, H.A., Matar, A., Yasmin, T. (2017), Co_2 emissions, Energy consumption, economic growth, and financial development in GCC countries: Dynamic simultaneous equation models. Renewable and Sustainable Energy Reviews, 70, 117-132.

Burakov, D., Freidin, M. (2017), Financial development, economic growth and renewable energy consumption in russia: A vector error correction approach. International Journal of Energy Economics and Policy, 7(6), 39-47.

Chang, S.C. (2015), Effects of financial development and income on energy consumption. International Review of Economics and Finance, 35, 28-44.

Coban, S., Topcu, M. (2013), The nexus between financial development and Energy consumption in the EU: A dynamic panel data analysis. Energy Economics, 39, 81-88.

Dickey, D., Fuller, W. (1981), Likelihood ratio statistics for autoregressive time series with a unit root. Econometrica, 49, 1057-1072.

Danish, S.S., Baloch, M.A., Lodhi, R.N. (2018), The nexus between energy consumption and financial development: estimating the role of globalization in Next-11 countries. Environ Sci Pollut Res 25, 18651–18661. https://doi.org/10.1007/s11356-018-2069-0

Enerdata (2021). Russia Related Research. Available online: https://www.enerdata.net/estore/energy-market/russia/ [Last accessed on 2021 Sep 02].

Federal Reserve Bank of St. Louis-FRED. (2021), Federal Reserve Economic Data. Available from: https://www.fred.stlouisfed.org [Last accessed on 2021 Feb 11].

Furuoka, F. (2015), Financial development and energy consumption: Evidence from a heterogeneous panel of Asian countries. Renewable and Sustainable Energy Reviews, 52, 430-444.

Gaies, B., Kaabia, O., Ayadi, R., Guesmi, K., Abid, I. (2019), Financial development and energy consumption: Is the MENA region different? Energy Policy, 135, 111000.

Gómez, M., Rodríguez, J.C. (2018), Energy consumption and financial development in NAFTA countries, 1971-2015. Applied Sciences, 9(2), 1-11.

Hansen, B.E. (1992a), Efficient estimation and testing of co-integrating vectors in the presence of deterministic trends. Journal of Economics, 53, 87-121.

Hansen, B.E. (1992b), Tests for parameter instability in regressions with I(1) processes. Journal of Business and Economic Statistics, 10, 321-335.

IMF, World Economic Outlook Database. (2018), Available from: https://www.imf.org/external/pubs/ft/weo/2018/01/weodata/download.aspx [Last accessed on 2019 Aug 09].

Islam, F., Shahbaz, M., Ahmed, A.U., Alam, M.M. (2013), Financial development and energy consumption nexus in Malaysia: A multivariate time series analysis. Economic Model, 30, 435-441.

Johansen S., Juselius, K. (1990), Maximum likelihood estimation and inference on co-integration with applications to the demand for money. Oxford Bulletin of Economics and Statistics, 52, 169-210.

Johansen, S. (1988), Statistical analysis of co-integration vectors. Journal of Economic Dynamics and Control, 12, 231-254.

Kahouli, B. (2017), The short and long run causality relationship among economic growth, energy consumption and financial development: Evidence from South Mediterranean Countries (SMCs). Energy Economics, 68(C), 19-30.

Karacan, R., Mukhtarov, S., Barış, İ., İşleyen, A., Yardımcı, M.E. (2021), The impact of oil price on transition toward renewable energy consumption? Evidence from Russia. Energies, 14(10), 2947.

Keskingöz, H., İnançlı, S. (2016), The causality between financial development and energy consumption in Turkey: The period of 1960-2011. Eskişehir Osmangazi University Journal, 11(3), 101-114.

Khan, M.T.I., Yaseen, M.R., Ali, Q. (2017), Dynamic relationship between financial development, energy consumption, trade and greenhouse gas: Comparison of upper middle income countries form Asia, Europe, Africa and America. Journal of Cleaner Production, 161, 567-580.

Khan, S., Peng, Z., Li, Y. (2019), Energy consumption, environmental degradation, economic growth and financial development in globe: Dynamic simultaneous equations panel analysis. Energy Reports, 5, 1089–1102.

Komal, R., Abbas, F. (2015), Linking financial development, economic growth and energy consumption in Pakistan. Renewable and Sustainable Energy Reviews, 44, 211-220.

Kutcherov, V., Maria, M., Valery, B., Alexey, L. (2020), Russian natural gas exports: An analysis of challenges and opportunities. Energy Strategy Reviews, 30, 100511.

Mahalik, M.K., Babub, M.S., Loganathan, N., Shahbaz, M. (2017), Does financial development intensify energy consumption in Saudi Arabia? Renewable and Sustainable Energy Reviews, 75, 1022-1034.

Matraeva, L., Solodukha, P., Erokhin, S., Babenko, M. (2019), Improvement of Russian energy efficiency strategy within the framework of "green economy" concept (based on the analysis of experience of foreign countries). Energy Policy, 125, 478-486.

Mitrova, T., Melnikov, Y. (2019), Energy transition in Russia. Energy Transit, 3, 73-80.

Mukhtarov, S., Humbatova, S., Hajiyev, N.G.O., Aliyev, S. (2020b), The financial development-renewable energy consumption nexus in the

case of Azerbaijan. Energies, 13, 6265.
Mukhtarov, S., Humbatova, S., Seyfullayev, I., Kalbiyev, Y. (2020a), The effect of Financial development on energy consumption in the case of Kazakhstan. Journal of Applied Economics, 23(1), 75-88.
Mukhtarov, S., Mikayilov, J.I., Mammadov, J., Mammadov, E. (2018), The impact of financial development on energy consumption: Evidence from an oil-rich economy. Energies, 11, 1536.
Park, J. (1992), Canonical co-integrating regressions. Econometrica, 60, 119-143.
Phillips, P.B., Perron, P. (1988), Testing for unit roots in time series regression. Biometrika, 75, 335-346.
Sadorsky, P. (2010), The impact of financial development and energy consumption in central and eastern european frontier economies. Energy Policy, 39, 999-1006.
Sadorsky, P. (2011), Financial development and energy consumption in central and eastern european frontier economies. Energy Policy, 39, 999-1006.
Shahbaz, M., Lean, H.H. (2012), Does financial development increase energy consumption? The role of industrialization and urbanization in Tunisia. Energy Policy, 40, 473-479.
Shahzad, S.J.H., Kumar, R.R., Zakaria, M., Hurr, M. (2017), Carbon emission, energy consumption, trade openness and financial development in Pakistan: A revisit. Renewable and Sustainable Energy Reviews, 70, 185-192.
Stock, J.H., Watson, M. (1993), A simple estimator of co-integrating vectors in higher order integrated systems. Econometrica, 61, 783-820.
Su, C.W., Meng Q., Ran, T., Muhammad, U. (2020), Does oil price really matter for the wage arrears in Russia? Energy, 208, 118350.
Tang, C.F., Tan, B.W. (2014), The linkages among energy consumption, economic growth, relative price, foreign direct investment, and financial development in Malaysia. Quality and Quantity, 48, 781-797.
The Energy Research Institute of the Russian Academy of Sciences (ERI RAS). (2019), Global and Russian Energy Outlook 2019. Available from: https://www.eriras.ru/files/forecast_2019_en.pdf [Last accessed on 2021 Sep 04].
World Bank (WB). (2021), Financial Development. Washington, DC, United States: World Bank. Available from: https://www.worldbank.org/en/publication/gfdr/gfdr-2016/background/financial-development [Last accessed on 2021 Sep 02].
World Bank (WB). (2021), World Development Indicators. Washington, DC, United States: World Bank. Available from: https://www.data.worldbank.org/indicator [Last accessed on 2021 Feb 11].
Zhang, Y.J., Fan, J.L., Chang, H.R. (2011), Impact of China's stock market development on energy consumption: an empirical analysis. Energy Procedia, 5, 1927-1931.