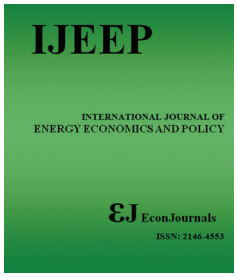

International Journal of Energy Economics and Policy

ISSN: 2146-4553

available at http: www.econjournals.com

International Journal of Energy Economics and Policy, 2022, 12(6), 30-36.

Dynamic Linkages between Energy Consumption, Foreign Direct Investment, and Economic Growth: A New Insight from Developing Countries in Asia

Ranti Darwin[1,2]*, Dyah Wulan Sari[3], Unggul Heriqbaldi[3]

[1]Doctoral Student in Economics, Faculty of Economics and Business, Airlangga University, Surabaya, Indonesia, [2]Department of Economics, Faculty of Economics and Business, Muhammadiyah University of Riau, Pekanbaru, Indonesia, [3]Department of Economics, Faculty of Economics and Business, Airlangga University, Surabaya, Indonesia.
*Email: ranti.darwin-2019@feb.unair.ac.id

Received: 20 July 2022 **Accepted:** 19 October 2022 **DOI:** https://doi.org/10.32479/ijeep.13552

ABSTRACT

This study aims to determine the dynamic relationship between energy consumption, FDI and economic growth in developing countries in the Asian Region by adding other control variables. This study uses a panel data model approach and a dynamic GMM panel with a dataset of 21 developing countries in the Asian Region from 2005-2019. The results of the panel data model report that FDI and energy consumption can significantly increase economic growth. However, poverty and interest rates can reduce economic growth. On the other hand, the dynamic GMM approach states that FDI and energy consumption can increase economic growth with a significant positive relationship. However, poverty, interest rates, and inflation have a negative and significant relationship to economic growth in developing countries in the Asian Region. In line with the study findings, these findings are of more interest to policymakers in this country. Therefore, policy recommendations are made to increase the economic growth of developing countries in the Asian Region.

Keywords: Energy Consumption, FDI, Economic Growth, Asia, Dynamic GMM Panel
JEL Classifications: F20, O40, Q40, Q43

1. INTRODUCTION

Meeting the energy needs of every country in the modern era as it is today is very crucial in supporting economic activity. The world's energy needs continue to increase. According to the International Energy Agency (IEA) projections, by 2030, the world's energy demand will increase by 45%, or an average increase of 1.6% per year. Around 80% of the world's energy needs are supplied from fossil fuels (IEA, 2021). Not only for developed countries but developing countries, the use of energy is a driving force for economic growth, one of which is for developing countries in the Asian continent. Therefore, economic activity in the Asian Region, which contributes to world economic growth, dramatically affects the world's energy demand. This reflects that economic activity as a form of economic growth for developing countries in Asia is highly dependent on the use or consumption of energy.

Economic growth and energy consumption are correlated, whereas higher economic growth requires greater energy consumption. On the other hand, more efficient energy use also needs to be supported by higher energy growth rates (Osabuohien-Irabor and Drapkin, 2022). Another view explains that the relationship between economic growth and energy consumption is essential in formulating policies related to energy, not only in developed countries but also in developing countries. However, the relationship between economic growth and energy consumption

is often ambiguous. This is because policymakers and researchers do not have the same confidence to ascertain when an increase in energy consumption can increase the country's economic growth or vice versa, when economic growth can become a stimulant for energy consumption assuming all other economic variables remain constant. However, in the last few decades, there have been several studies on economic growth and energy consumption, including research conducted by Lin and Benjamin (2018) which states that there is a two-way relationship between energy consumption and economic growth. These findings contradict Magazzino et al. (2021), which say there is no reported long-term relationship between energy consumption and economic growth.

The reality in today's world, without energy power, is that it is impossible to produce goods and services, control the production process, or market these goods and services to consumers appropriately (IEA, 2021). Therefore, each country has a responsibility to ensure the availability of energy in sufficient quantities with cost-effectiveness, safety, and quality to achieve the goal of sustainable growth and improve the welfare of the population in its country.

The need for energy in every developing country is increasing every day. However, this increase is not in line with the increase in the resources used to produce this energy, with limitations in the quantity and scale of energy produced. In addition, the coverage of the distribution of energy resources in all developing countries in the world tends to be uneven, and this is due to differences in the quantity of energy and energy coverage owned by each country. In addition, the effect of energy consumption on economic growth differs from country to country depending on the economic structure and process of economic growth (Syzdykova et al., 2020). This unequal allocation of energy resources applies not only to energy availability but also to consumption levels. This condition creates a significant imbalance between regions and countries concerning the utilization of energy resources worldwide. The scarcity of energy resources around the world triggers great competition in energy supply between countries.

Increasing the share of renewable energy in the energy mix for each country will simultaneously help bridge the gap for future growth in energy demand. At the same time, these conditions can affect economic growth and significantly reduce the environmental impact arising from the consumption of traditional energy sources such as fossil fuels. (Lin and Benjamin, 2018). Under these conditions, Foreign Direct Investment (FDI) is urgently needed to encourage economic growth in developing countries, especially in efforts to provide capital to meet future energy needs, because the level of capital formation is positively correlated with the rate of economic growth.

In the long term, FDI has a positive impact on encouraging the development of new production methods, engaging in international production, promoting economic growth, opening trade networks (Sridharan et al., 2009), technology transfer, job opportunities, management transfer (Gopalan and Rajan, 2016), improve export competitiveness, improve local community skills (Osano and Koine, 2015). However, the impact of FDI spillovers on developing countries affects energy consumption, impacting developing countries' ecological and environmental conditions. The existence of FDI is a dilemma for developing countries. On the one hand, FDI can positively affect the economy, but on the other hand, the presence of FDI will also affect the host country's environmental pollution. Although FDI inflows encourage rapid economic development, in the long run, environmental degradation will lead to a decline in economic activity and economic quality (Ren et al., 2021). Therefore, applying appropriate regulations is crucial to encourage investment and economic growth (Chong and Calderón, 2000).

This study aims to discuss the dynamic linkage between FDI and energy consumption on the economic growth of developing countries in the Asian continent, with the support of various other macroeconomic elements. In addition, this study's specific purpose also considers lagged economic growth as a determinant of economic growth in developing countries today. This study is also intended to find out how significant the role of FDI and the vital role of energy are for the economic growth of developing countries in Asia. In the end, the results of this study can also help in designing policies related to FDI management and energy development which will also influence the design of policies related to economic growth and long-term sustainable economic development in developing countries in the Asian Region.

The remainder of this paper is synthesized in the following order. Part one presents an introduction that describes the relationship between variables, aspects of novelty, and their contribution. Our second part provides a brief overview of the literature. Section three describes the data and methodology. Next, section four presents and explains the results and empirical discussion. The final section of the study presents the conclusions and policy implications.

2. LITERATUR REVIEW

Research related to FDI, energy consumption, and economic growth has been carried out by researchers in various parts of the world who examine parts of the variables similar to this study. For example, using the Structural Equation Modelling Approach, Zeeshan et al. (2021) discuss the relationship between FDI, energy consumption, natural resources, and economic growth in Latin American countries from 1990 to 2018. The empirical results show that FDI, energy consumption, and natural resources have a significant and positive relationship in Latin American countries. In line with this, Shah et al. (2015) explained that several factors contribute to economic growth, one of which is energy consumption. Therefore, there is a two-way causal relationship between energy consumption, FDI, financial development, and trade that supports economic growth in ASEAN countries (Indonesia, Malaysia, Philippines, Singapore, and Thailand).

Other related literature also explains the positive relationship between energy consumption and economic growth, where an increase in energy resources can increase employment opportunities, increase income and consumption. But on the other hand, the negative impact of energy consumption on economic growth occurs when an increase in energy use can lead to a rise in environmental pollution. This finding also explains the causal relationship between FDI and energy consumption, which

multiplies economic growth in sub-Saharan African countries (Akadiri and Ajmi, 2020).

In another related study, Chimbo (2020) examines the relationship between energy consumption, ICT, FDI, and economic growth in the context of African countries from 2001 to 2015 using random effects, fixed effects, pooled OLS, and dynamic GMM methods. The results of this study indicate that energy consumption has a significant positive impact on economic growth with a fixed effects approach, a positive and insignificant effect on economic growth through random effects, pooled OLS, and dynamic GMM methods. FDI has a positive and significant impact on growth through fixed and random effects. However, it has an insignificant positive relationship through the dynamic GMM method and insignificant and negative effects through the pooled OLS approach to economic growth. Another study from 54 African countries was also conducted by (Muazu et al., 2022) using the panel threshold regression model approach from 1990 to 2018. This study explains the significant negative impact of renewable energy consumption on economic growth in African countries.

Dat et al. (2020) examine Indonesia's energy consumption and economic growth from 2000 to 2019 through an autoregressive distributed lag co-integration approach. This finding reveals that energy consumption and economic growth have a relationship with each other. Therefore, energy consumption can predict Indonesia's economic growth. In another study, Luo et al. (2022) conducted a dynamic analysis of the impact of FDI on economic growth and carbon emissions in China, India, and Singapore from 1980-2020 using the co-integration panel approach. The results of this study indicate that consumption of renewable and non-renewable energy, FDI, and overall capital accumulation has a significant and progressive effect on economic growth.

Using the unit root panel and co-integration test Granger causality, Saidi et al. (2018) investigate the dynamics of energy consumption, ICT, FDI, and economic growth in 13 MENA countries. The study found a two-way relationship between energy consumption and ICT on economic growth in both the long and short term. In addition, there is unidirectional causality from economic growth to FDI. Esen and Bayrak (2017) also found that research using the same approach revealed a positive and statistically significant relationship between energy consumption and economic growth in the long run.

In another related study, Lin and Benjamin (2018) describe the causal relationship between energy consumption, FDI, and economic growth for Mexico, Indonesia, Nigeria, and Turkey (MINT) from 1990 to 2014. The author reveals a two-way causal relationship between economic growth and energy consumption, economic growth and FDI inflows, and the unidirectional causal relationship of FDI to energy consumption. In line with this, Osabuohien-Irabor and Drapkin (2022), in their research in 24 OECD countries, revealed that the impact of economic growth on energy consumption is positive in both the short and long term. This finding follows the growth hypothesis, which shows the economy depends on energy, an increase in energy consumption increases economic growth. Ahmed et al. (2013) also expressed the same finding, which examines the relationship between economic growth and energy consumption in Pakistan. The results explain the relationship between electricity consumption per capita and energy consumption on economic growth. Sriyana (2019) also conducted similar research in Indonesia using the ARDL method from 1990 to 2017. The author explains the significant influence of energy, electric power, and renewable energy consumption on economic growth.

Muhammad and Khan (2019) discusses the effect of bilateral FDI, energy consumption, CO2 emissions, and capital on economic growth in Asian countries using the GMM approach from 2001-2012. The author explains that energy consumption, FDI inflows and outflows, CO2 emissions, and the role of capital have essential contributions to the growth of Asian countries. This opinion is in line with Al-Mulali and Sab (2013), which investigated the long-term causal relationship between total primary energy consumption and CO2 emissions on economic development in 16 developing countries. The same result was previously found by Banday and Aneja (2018) in the countries that are members of the G7 (Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States).

3. METHODOLOGY

3.1. Data

This research is supported by panel data from 21 developing countries in the Asian Region for the period 2005-2019. The choice of country and period depends on data availability. The data in this study were obtained from various sources, including economic growth, poverty rates, exchange rates, interest rates, inflation, and energy consumption from the World Bank (World Development Indicator). In addition, FDI inflows data are sourced from the World Bank (World Development Indicator) and the Organization for Economic Co-operation and Development (OECD).

Each variable must be defined to determine the variable measurement technique in this study. Where: (1) Economic Growth (GDP) is the GDP in a country which is calculated in real terms (the constant year 2010) in units of billions of US$; (2) Foreign Direct Investment (FDI), this variable is seen from the annual FDI inflows in units of billions of US$; (3) Poverty (POV), is the ratio of the number of poor people on the national poverty line in the host country in units (%); (4) Exchange Rate (ER), variable official exchange rate of the home country (Local Currency Units (LCU) per US$); (5) Interest Rate (IR), the variable used is lending interest payment in units (%); (6) Inflation (INF); is inflation consumer price in units (%); and (7) Energy Consumption (EC), is the energy consumption of fossil fuel comprising coal, oil, petroleum, and natural gas products in units (%).

3.2. Model Panel Data

To analyze the dynamic relationship between energy consumption, FDI, and economic growth in this study, this study uses several estimation techniques, namely the panel data model consisting of three approach models: pooled OLS, fixed effects model, and random effects model. The entire model of this approach will be analyzed in detail in this study.

Panel pooled data combines cross-section and series data (Baltagi, 2005). In other words, panel data is data from several individuals observed over a certain period. For example, if an observation has a T period (t = 1, 2,…, T) and N number of individuals (I = 1, 2,…, N), then the panel data will show the total unit of observation as much as NT. According to Gujarati (2011), panel data can be divided into two, namely: (1) A balanced panel occurs when the length of time for each cross-section unit is the same; (2) An unbalanced panel occurs if the length of time is not the same for each unit cross-section. This study attempts to construct the relationship between economic growth, energy consumption, FDI, poverty, exchange rates, interest rates, and inflation in developing countries in the Asian Region. Then the functional form of the relationship between the variables of the linear model is as follows:

$$GDP_{it}=f(FDI_{it}, EC_{it}, POV_{it}, ER_{it}, IR_{it}, INF_{it}) \quad (1)$$

Next, we start by estimating the specifications of the panel data model in this study as follows:

$$GDP_{it}=\alpha_0+\alpha_1 FDI_{it}+\alpha_2 EC_{it}+\alpha_3 POV_{it} +\alpha_4 lnER_{it}+\alpha_5 IR_{it}+\alpha_6 INF_{it}+u_{it} \quad (2)$$

where subscripts i = 1, 2,…, N and t = 1,2,…, T denotes 21 developing countries in Asia, and a year respectively, and α_0 to α_7 are the unknown parameters to be estimated while u is an error term.

3.3. Generalized Method of Moments Test

Panel data analysis can be used on dynamic models that are often used for dynamic adjustment analysis. For example, regarding the existence of a cross-section or time series model, a dynamic relationship characterized by panel data by including the lag of the dependent variable or variable as a regressor in the regression. However, endogeneity problems arise as a result, so if the model is estimated using fixed effects or random effects approach, it will produce biased and inconsistent estimators. Therefore, the Generalized Method of Moments (GMM) approach emerged. As an illustration, it can be seen with the following dynamic panel model (Baltagi, 2005):

$$y_{it}=\delta y_{i,t-1}+ X_{it}^{T}\beta +\mu_{it} \quad (3)$$

i = 1,2,3,…, n; t = 1,2,3,…,T

Where δ represents a scalar quantity, represents a matrix of size $1\times k$ and β is of size $k\times 1$. In this case μ_{it} is assumed to follow the one-way error component model as follows:

$$\pi_{it} \sim IID(0,\sigma_{\pi}^2) \quad (4)$$

where $\omega_i \sim IID(0,\sigma_{\omega}^2)$ represent the individual influence and $\pi_{it} \sim IID(0,\sigma_{\pi}^2)$ represent errors that are independent of each other.

Furthermore, the dynamic panel data regression model in this study is as follows:

$$GDP_{it}=\alpha_0+\alpha_1 GDP_{it-1}+\alpha_2 FDI_{it}+\alpha_3 EC_{it}+\alpha_4 POV_{it}+\alpha_5 ER_{it} +\alpha_6 IR_{it}+\alpha_7 INF_{it}+u_{it} \quad (5)$$

The dynamic GMM panel estimation technique consists of two models: first-differences GMM and System GMM. This estimation technique is believed to provide precise and reliable results when the number of time series (T=15) has a lower number of cross-sectional observations (N=21). GMM panel dynamic estimator theory was developed by Arellano and Bond (1991) using the first-differences series as an instrument known as first-differences GMM. This concept explains that additional tools can be obtained in the dynamic panel data model when using orthogonality conditions (no correlation with error term) on lagged values. Moreover, first-differences GMM can effectively overcome endogeneity in explanatory variables and residual heteroscedasticity.

In the following method, the GMM system is often used to estimate the first-difference equation system, and at its level, the instrument used at that level is the first-difference lag of the series itself (Blundell and Bond, 1998). The GMM system estimator combines the first-difference equation group with level values as the instrument combined with the first-difference equation group as the instrument. The validity of this additional instrument can be determined using the Sargan test for over-identifying instruments. Next, a test was conducted to test the null hypothesis that the error terms of the different equations were not serially correlated, especially in the second order (AR2).

4. RESULTS AND DISCUSSION

This study combines several analytical tools to determine the dynamic analysis of energy consumption, FDI, and economic growth in various developing countries in the Asian Region. Empirical results from this literature are reported in Table 1. This study elaborates on the panel data model and dynamic panel GMM to strengthen the analysis of the dynamic movement of energy consumption, FDI, and economic growth in developing countries in Asia. The panel data model displays the test results from the pooled OLS model, fixed effects, and random effects. Furthermore, the GMM dynamic panel model presents the results of the GMM and System GMM first-differences test. Referring to the analytical tools Chimbo (2020) used, in this study, we analyze dynamic GMM from the perspective of first-differences GMM and System GMM.

In the panel data model, this study uses the results of the pooled OLS, fixed effects, and random effects tests as a reference for comparison in analyzing this study. As for the dynamic model, the prob value of the Sargan test results in the first-difference GMM and System GMM models is more significant than 0.05, and the hypothesis (H) is accepted, which means that the over-identifying restriction condition in the use of this model is valid. Furthermore, the p-value of AR (2) is more significant than 0.05, indicating no serial correlation density problem in the second order. Therefore, the model is feasible to use, and it can be concluded that the error term in the model does not have a serial, and the estimator used is efficient.

Consistent with Chimbo (2020), based on the dynamic GMM estimation results, the lag of economic growth has a positive and

Table 1: Summary of model panel data and generalized method of moments (GMM) test

Variable	Pooled OLS	Fixed effects	Random effects	FD-GMM	Sys-GMM
Constanta	77.278 (0.643)	3176.895 (0.002)***	274.522 (0.230)	85.678 (0.425)	−188.758 (0.368)
GDP Lag	-	-	-	1.073 (0.000)***	1.038 (0.000)***
FDI	34.321 (0.000)***	16.666 (0.000)***	32.229 (0.000)***	0.459 (0.009)***	0.893 (0.001)***
Energy Consumption	1.306 (0.391)	28.951 (0.031)***	0.758 (0.073)*	0.059 (0.073)*	3.603 (0.100)*
Poverty	−6.410 (0.022)***	−18.738 (0.000)***	−9.308 (0.007)***	−11.410 (0.016)**	1.972 (0.360)
Exchange Rate	−0.002 (0.733)	−0.001 (0.901)	−0.003 (0.587)	−0.0168 (0.353)	−0.009 (0.332)
Interest Rate	13.722 (0.011)***	−12.947 (0.349)	10.457 (0.152)	−4.983 (0.001)***	−1.578 (0.652)
Inflation	−2.375 (0.621)	−0.674 (0.882)	−0.328 (0.946)	−0.395 (0.739)	−10.883 (0.016)**
Time-Spesific Effet	No	No	No	Yes	No
Hausman test	-	79.04 (0.000)	79.04 (0.000)	-	-
Sargan test (P-value)	-	-	-	0.74 (0.691)	13.48 (0.412)
Hansen test (P-value)	-	-	-	2.74 (0.254)	13.83 (0.386)
AR (2) (P-value)	-	-	-	1.23 (0.219)	-0.86 (0.391)
Adj. R^2	0.876	0.498	0.877	-	-
F-Stat	369.29 (0.000)	15.41 (0.000)	103.98 (0.000)	-	-
Obs	315	315	315	249	264

Source: Author's compilation, the statistical significance of the estimates at ***, **, and *denote significance at 1%, 5%, and 10% levels of significance, respectively

significant relationship to the economic growth of developing countries in Asia, which states that the economic growth occurred in the previous period can affect the current economic growth. Assuming other variables in the model are considered constant or cateris paribus. Therefore, economic growth will continue to experience dynamic movements over time. Economic growth cannot be separated from various indicators supporting economic growth in these developing Asian countries, and policymakers will set appropriate regulations according to the period in spurring sustainable economic growth in this country.

The estimation results of panel data and dynamic GMM models, pooled OLS, fixed effects, random effects, FD-GMM, and Sys-GMM at a significant level of 1% explain that Foreign Direct Investment (FDI) has a positive and significant relationship with economic growth. The coefficient of FDI in fixed effects is 16,666, which shows that if there is an increase in FDI of 1 unit, then economic growth will increase by 16,666 billion US$. The FDI coefficient on the FD-GMM is 0.459. Therefore, if there is an increase in FDI of one unit, it can increase the economic growth of developing countries in Asia by 0.459 billion US$. This finding is in line with studies such as Lin and Benjamin (2018), Muhammad and Khan (2019), Abdouli and Omri (2021), and Luo et al. (2022), which reveal a causal relationship between FDI, energy consumption, and economic growth.

Energy consumption (EC) was found to have a positive and significant impact on economic growth in the fixed effects, random effects, FD-GMM, and Sys GMM models. However, it has an insignificant and positive impact on the pooled OLS model. The energy consumption coefficient (EC) has a positive and significant effect on economic growth, with a coefficient of 28,951 on fixed effects, 0.758 on random effects, 0.059 on FD-GMM, and 3.603 on Sys GMM. This study's results align with the research found by Shah et al. (2015), which states that there is a two-way causal relationship between energy consumption and economic growth.

Poverty is known to have a significant negative relationship with the economic growth of developing countries in Asia in the pooled OLS, fixed effects, random effects, and FD-GMM models at a significant levels of 1% and 5%. Poverty has a coefficient of -11,410 in influencing economic growth in the FD-GMM model. On the other hand, in the Sys-GMM model, it is known that poverty shows an insignificant positive relationship with economic growth in developing countries in the Asian Region. This finding is in line with the literature created by Breunig dan Majeed (2020), his study revealed a negative relationship between poverty and economic growth.

The panel data model and the dynamic GMM model report that the exchange rate has a negative but insignificant relationship with the economic growth of developing countries in Asia. This research is in line with the analysis proposed by Shi (2019), which reveals that a country tends to receive increased FDI inflows when a country's currency depreciates to increase the country's economic growth. Next, interest rates have a positive and significant relationship in the pooled OLS model, as well as on the FD-GMM it is known that interest rates have a negative and significant relationship to economic growth in developing countries in Asia. These results align with research from Shaukat et al. (2019), which states that interest rates negatively and significantly impact economic growth. On the other hand, the fixed effects, random effects, and Sys-GMM approaches show a negative and insignificant relationship to economic growth in developing countries in Asia.

Inflation has a negative and significant relationship at a significant level of 5% to economic growth in developing Asian countries in the Sys GMM model. On the other hand, the pooled OLS, fixed effects, random effects, and FD-GMM approaches show an insignificant negative relationship to the economic growth of developing countries in the Asian Region. The results of this study resonate with the literature from Tahir and Azid (2015), whose study noted that inflation volatility significantly affects economic growth.

Energy consumption has an essential role in determining the economic growth of developing countries in the Asian region. The positive sign on the energy consumption coefficient indicates that the increase in energy consumption is supported by stable economic conditions and the selection of appropriate institutional

implications. This condition also cannot be separated from the criteria for the economic structure of different countries in developing countries. Theoretically, energy consumption is one of the keys that guide economic development and growth in a country with the ultimate goal of increasing income. Institutional policymakers have an essential role in revealing the relationship between energy consumption and economic growth. This condition relates to the design of investment budget allocations for domestic investment and FDI for energy management in developing countries. Guarantees for the effectiveness of energy consumption in developing countries cannot be realized if it is not supported by optimal policies to encourage the realization of economic growth in developing countries. The increase in energy consumption will align with the rise in economic growth. However, energy consumption not accompanied by good management will hurt the environment and humans.

5. CONCLUSION

The study of dynamic analysis of energy consumption, FDI, and economic growth of developing countries in Asia revealed that the panel data model of FDI and energy consumption could significantly increase economic growth. On the other hand, poverty and interest rates can reduce economic growth. Furthermore, in dynamic GMM, it is known that FDI and energy consumption can increase economic growth with a significant positive relationship. On the other hand, poverty, interest rates, and inflation have a negative and significant relationship to economic growth in developing countries in the Asian Region.

This finding indicates that to increase economic growth, one of them is the proper management of FDI and energy consumption and optimal institutional governance in making targeted policies in making plans for each period.

6. ACKNOWLEDGEMENT

We would like to thank the BPP-DN Ministry of Education and Bank Indonesia Institute for funding and supporting this research. In addition, the promoter team and reviewers have provided helpful input while conducting this research. We also thank the Doctoral of Economics at Airlangga University, Muhammadiyah University of Riau, and various parties who have helped the team prepare this paper.

REFERENCES

Abdouli, M., Omri, A. (2021), Exploring the nexus among FDI Inflows, environmental quality, human capital, and economic growth in the mediterranean region. Journal of the Knowledge Economy, 12, 788-810.

Ahmed, W., Zaman, K., Taj, S., Rustam, R., Waseem, M., Shabir, M. (2013), Economic growth and energy consumption nexus in Pakistan. South Asian Journal of Global Business Research, 2(2), 251-275.

Akadiri, S.S., Ajmi, A.N. (2020), Causality relationship between energy consumption, economic growth, FDI, and globalization in SSA countries: A symbolic transfer entropy analysis. Environmental Science and Pollution Research, 27(35), 44623–44628.

Al-Mulali, U., Sab, C.N.C. (2013), Energy consumption, pollution and economic development in 16 emerging countries. Journal of Economic Studies, 40(5), 686-698.

Baltagi, B. H. (2005), Econometric Analysis of Panel Data Third Edition (3rd ed.). John Wiley & Sons, Ltd.

Banday, U.J., Aneja, R. (2018), Energy consumption, economic growth, and CO_2 emissions: Evidence from G7 countries. World Journal of Science Technology and Sustainable Development, 16(1), 22-39.

Blundell, R., Bond, S. (1998), Initial conditions and moment restrictions in dynamic panel data models. Journal of Econometrics, 87(1), 115-143.

Arellano, M., Bond, S. (1991), Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. Review of Economic Studies, 58(2), 277-297.

Breunig, R., Majeed, O. (2020), Inequality, poverty, and economic growth. International Economics, 161, 83-99.

Chimbo, B. (2020), Energy consumption, information and communication technology and economic growth in an African context. International Journal of Energy Economics and Policy, 10(4), 486-493.

Chong, A., Calderón, C. (2000), Institutional quality and poverty measures in a cross-section of countries. Economics of Governance, 1, 123-135.

Dat, N.D., Hoang, N., Huyen, M.T., Huy, D.T.N., Lan, L.M. (2020), Energy consumption and economic growth in Indonesia. International Journal of Energy Economics and Policy, 10(5), 601-607.

Esen, Ö., Bayrak, M. (2017), Does more energy consumption support economic growth in net energy-importing countries? Journal of Economics, Finance and Administrative Science, 22(42), 75-98.

Gujarati, D.N. (2011), Econometrics by Example. New York: McGraw-Hill.

International Energy Agency (IEA). (2021), World Energy Outlook 2021. Paris: International Energy Agency.

Lin, B., Benjamin, I.N. (2018), Causal relationships between energy consumption, foreign direct investment and economic growth for MINT: Evidence from panel dynamic ordinary least square models. Journal of Cleaner Production, 197(1), 708-720.

Luo, Y., Guo, C., Ali, A., Zhang, J. (2022), A dynamic analysis of the impact of FDI on economic growth and carbon emission, evidence from China, India, and Singapore. Environmental Science and Pollution Research, 1, 1-15.

Magazzino, C., Mutascu, M., Mele, M., Sarkodie, S.A. (2021), Energy consumption and economic growth in Italy: A wavelet analysis. Energy Reports, 7, 1520-1528.

Muazu, A., Yu, Q., Liu, Q. (2022), Does renewable energy consumption promote economic growth? An empirical analysis of panel threshold based on 54 African countries. International Journal of Energy Sector Management, 16(6), 1-22.

Muhammad, B., Khan, S. (2019), Effect of bilateral FDI, energy consumption, CO_2 emission and capital on economic growth of Asia countries. Energy Reports, 5, 1305-1315.

Osabuohien-Irabor, O., Drapkin, I.M. (2022), The impact of technological innovation on energy consumption in OECD economies: The role of outward foreign direct investment and international trade openness. International Journal of Energy Economics and Policy, 12(4), 317-333.

Osano, H.M., Koine, P.W. (2015), Role of foreign direct investment on technology transfer and economic growth in Kenya: A case of the energy sector. Journal of Innovation and Entrepreneurship, 5(1), 1-25.

Ren, Y.S., Apergis, N., Ma, C., Baltas, K., Jiang, Y., Liu, J.L. (2021), FDI, economic growth, and carbon emissions of the Chinese steel industry: New evidence from a 3SLS model. Environmental Science and Pollution Research, 28, 52547-52564.

Saidi, K., Mbarek, M.B., Amamri, M. (2018), Causal dynamics between energy consumption, ICT, FDI, and economic growth: Case study

of 13 MENA countries. Journal of the Knowledge Economy, 9(1), 228-238.

Shah, I., Abidin, Z., Haseeb, M., Azam, M., Islam, R. (2015), Foreign direct investment, financial development, international trade, and energy consumption: Panel data evidence from selected ASEAN countries. International Journal of Energy Economics and Policy, 5(3), 841-850.

Shaukat, B., Zhu, Q., Khan, M.I. (2019), Real interest rate and economic growth: A statistical exploration for transitory economies. Physica A Statistical Mechanics and its Applications, 534, 122193.

Shi, J. (2019), Vertical FDI and exchange rates over the business cycle: The welfare implications of openness to FDI. Journal of Development Economics, 138, 274-293.

Sridharan, P., Narayanamurthy, V., Chandra Sekhara Rao, K. (2009), Causal relationship between foreign direct investment and growth: Evidence from BRICS countries. International Business Research, 2(4), 198-203.

Sriyana, J. (2019), Dynamic effects of energy consumption on economic growth in an emerging economy. International Journal of Energy Economics and Policy, 9(4), 283-290.

Syzdykova, A., Azretbergenova, G., Massadikov, K., Kalymbetova, A., Sultanov, D. (2020), Analysis of the relationship between energy consumption and economic growth in the commonwealth of independent states. International Journal of Energy Economics and Policy, 10(4), 318-324.

Tahir, M., Azid, T. (2015), The relationship between international trade openness and economic growth in the developing economies: Some new dimensions. Journal of Chinese Economic and Foreign Trade Studies, 8(2), 123-139.

Zeeshan, M., Han, J., Rehman, A., Bilal, H., Farooq, N., Waseem, M., Hussain, A., Khan, M., Ahmad, I. (2021), Nexus between foreign direct investment, energy consumption, natural resource, and economic growth in Latin American countries. International Journal of Energy Economics and Policy, 11(1), 407-416.