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IMPACT OF ENERGY AND NATURAL RESOURCES RENT ON FDI: AN ANALYSIS THROUGH POLS, DK, 2SLS AND GMM MODELS

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ABSTRACT

The study aims to look into the effect of electricity, energy, and natural resource rent on Foreign Direct Investment (FDI). Panel data from 198 countries was compiled for the period 1990 to 2018. The OLS, POLS, DK, 2SLS, and GMM models are used in this study. In all of the models, we discovered that access to energy is positively related with FDI. In all models except POLS and GMM, the energy intensity level of primary energy and green power output had a significant positive relationship with FDI. In POLS model, energy intensity level of primary energy and renewable electricity output has significant negative relationship with FDI and in GMM model there is insignificant relationship. Renewable energy consumption has significant positive relationship with FDI in all the models except GMM model. Total natural resource rents have mixed relationship with FDI in different models. In POLS and GMM model, it has significant positive relationship with FDI and in the other model, there are insignificant relationship with FDI at 10% significance level.

Contribution/ Originality: This study contributes to the existing literature through a utilitarian way to investigate the relationship of FDI with energy and natural resources rent globally.

1. INTRODUCTION

In examining the significance of FDI inflows on the environment, a group of researchers includes energy consumption as another explanatory variable (in addition to income) in a model, known as the FDI–income–energy–environment nexus (e.g., (Kim & Baek, 2011; Kivyiro & Arminen, 2014; Lee & Brahmasrene, 2014; Pao & Tsai, 2011)).

From 1981 to 2010, Baek (2016) investigated the effect of FDI inflows, employment, and energy use on CO_2 emission in five ASEAN countries. His results, dependent on the pooled mean group (PMG) estimator of hierarchical tables, suggest that FDI increases CO_2 emissions, confirming pollution. Wages and energy use, he found, had a detrimental impact on CO2 pollution reduction.

Hübler and Keller (2010) investigated the effect of FDI inflows on developed country energy intensities. They began by replicating a basic ordinary least squares (OLS) approximation that depicts FDI-induced energy intensity reductions. The OLS calculation, on the other hand, is inaccurate and can only be used as a starting point for further research. They used macro-level panel data from 60 developed countries between 1975 and 2004, as well as other possible determinants of energy intensities, in their regressions, and conducted robustness tests for more reliable data. Their results refute the hypothesis that FDI inflows reduce the energy intensity of developing countries. Rather, it seems that international development aid is tied to improvements in energy efficiency.

Abdouli and Hammami (2017) examined the relationship between economic development, FDI inflows, and energy usage on a panel of 17 countries from 1990 to 2012. They used a structure and simultaneous-equation model defined by the generalized system of moments (GMM). Their findings revealed a bidirectional causal association between FDI inflows and economic development, as well as energy consumption and growth. Furthermore, for the global panel, there is a unidirectional causal association between energy use and FDI inflows. This assumes that as energy demand rises, FDI inflows to individual and collective countries will rise as well.

Doytch and Narayan (2016) investigated the association between FDI and energy usage. They found FDI is a form of financing that allows businesses to grow. In the other hand, FDI will serve as an innovative catalyst, promoting energy efficiency. The data on the effect of aggregate FDI inflows on energy demand is sparse and contradictory. To search for endogeneity, they used a Blundell–Bond functional panel estimator and removed predictor biases from our tables. Nonrenewable energy sources have a lower energy consumption effect, while renewable energy sources have a higher energy consumption impact, according to the findings.

According to Rafindadi, Muye, and Kaita (2018): the direction of FDI spillovers varies with the threshold variables' values. If the economy becomes more competitive, businesses are more inclined to use energy-efficient solutions. Spillovers that save energy are more prevalent in regions of less specialized agglomeration. Since the domestic technical level is comparatively strong and there is an obvious energy-biased infrastructure, FDI would have energy-biased spillovers. In addition, small labour flexibility helps FDI's energy-saving spillovers.

This paper has five sections. Section two discusses the review of the literature. Section three is the methods. Section four is about the findings and discussion and finally section five of this paper give some recommendations and conclusion.

2. LITERATURE REVIEW

Early studies typically examined the effect of FDI inflows on a country's environment for a given level of per capita income, known as the FDI– income–environment nexus (e.g., (Baek, Cho, & Koo, 2009; He, 2006; Hoffmann, Lee, Ramasamy, & Yeung, 2005; Talukdar & Meisner, 2001; Xing & Kolstad, 2002)).

Economists have long been interested in the relationship between FDI, energy use, and output. This field of study can be categorized into four groups. The first field of research examines the relationship between energy use and economic development. In this sense, researchers use a variety of techniques and experiments, such as using a vector error correction model (VECM) time series model in Tunisia (Belloumi, 2009); the generalized method of moments estimation (GMM) techniques is used in 22 developing countries (Sadorsky, 2009); a vector error correction model was used to conduct Granger causality tests in 13 Eurasian countries (Apergis & Payne, 2010); Granger causality tests were used in 20 countries of the Organisation for Economic Co-operation and Development (OECD) (Apergis. & Payne, 2010); two causality studies, Toda–Yamamoto and bootstrap corrected causality, were conducted in the United States. Toda and Yamamoto (1995); the unit root test with splits, the Johansen cointegration test, and the Toda and Yama moto causality tests were all established in Vietnam. Tang, Tan, and Ozturk (2016); Panel data technique was used in 135 countries, and in transition countries, a bootstrap panel causality was performed (Wolde-Rufael, 2014); and Toda and Yamamoto causality experiments were used in Turkey (Ocal & Aslan, 2013) focuses on country characteristics, data, type of electricity, econometric methods, and empirical findings to provide a review of this literature.

Sbia, Shahbaz, and Hamdi (2014) studied the relationship between foreign direct investment, renewable energy, trade transparency, carbon emission, and economic development in the UAE from 1975Q1 to 2011Q4. They looked at structural breaks with variable unit properties. The ARDL bounds checking technique is used to assess cointegration by accommodating structural splits in the chain. To investigate the causal relationship between the causes, the VECM Granger causality technique is often used. The presence of sequence cointegration is supported by their observations. Electricity demand is reduced by both foreign direct investment and economic openness, as well as greenhouse gas emissions.

In South Asia, Arain, Han, and Meo (2019) found the methodological relationship between FDI, population, energy supply, and water supply. They used Chudik and Pesaran's newly evolved method for calculating co-integration, complex typical correlated effects (DCCE). In the case of cross-sectional dependency inside cross-sectional groups, this method yields important robust results. When cross-sectional dependency across cross-sectional units occurs, earlier models for long data, such as mean group (MG), pooled mean group (PMG), and augmented mean group (AMG), yield misleading results, according to the findings. In South Asia, there is a statistically important and negative relationship between FDI, population, energy production, and water availability. In order to improve the region's economies' long-term growth, South Asian policymakers will promote green FDI policies for water conservation, water safety, and natural resource preservation.

Salim, Yao, Chen, and Zhang (2017) investigated the long-term relationship and short-term dynamics of FDI and energy use in China. Using bounds checking methods on annual data from 1982 to 2012, they discovered that there is a strong FDI–energy nexus in the long run, with a 1% increase in FDI decreasing energy usage by 0.21 trillion. However, owing to the superiority of the scale effect, their analysis finds a beneficial linkage between FDI and energy intake in the short term. Various experiments and estimators had little impact on the findings. To thoroughly internalize FDI-related knowledge spillovers in energy conservation, the Chinese government should promote inward FDI in the tertiary and energy sectors, as well as improve local absorptive capacities.

Sun, Wu, and Chen (2011) conducted an observational analysis using global panel data from 74 countries of varying levels of growth from 1985 to 2008. They verified the hypothesis that FDI leads to higher energy output and lower energy consumption rates, as well as the applicability of the environmental Kuznets curve theorem to energy usage, namely an inverted U relationship between per capita income and energy use intensity. They have put in place partnership terms to ensure that higher per capita income will aid host countries in absorbing FDI by lowering energy use rates and increasing energy quality.

Carbon pollution rise in lockstep with energy demand, with the greatest effects at the top quantiles. Economic growth, FDI, energy demand, and CO2 emissions of 12 Asian most populated countries have relationships with Japanese incomes, according to Linh and Lin (2015), who used the Granger causality test to find both short and long-run causality correlations between these causes. On the other hand, their estimated figures showed that these countries were trading environmental destruction for economic activity. Furthermore, these findings backed the emissions haven theory, demonstrating that laxer environmental controls in host countries drew FDI inflows. However, FDI inflows are found to be important, but they do not worsen environmental pollution in these 12 Asian countries as a panel study.

Nathaniel, Aguegboh, Iheonu, Sharma, and Shah (2020) used a quantile panel data set for coastal Mediterranean countries to account for heterogeneity and distributional impacts of socioeconomic factors (CMCs). Their results suggest that the metrics used, as well as the original rate of environmental deterioration, have an effect on FDI's environmental impact.

Nathaniel et al. (2020) applied a Buhari, Lorente, and Nasir (2020) used a panel quantile regression model and evidence from thirty two European countries between 1995 and 2014. Global uncertainty, renewable energy use, trade openness, FDI, and structural competition all lead to economic growth, according to their study. Non-renewable energy usage has a favorable and negative impact in different quantiles, implying that renewable energy is better for economic growth compared to non-renewables.

Their findings have further consequences for stakeholders and politicians concerned with achieving the Paris Agreement's targets for balanced economic development and energy policy (COP21).

Linh and Lin (2014) studied the dynamic interactions between CO_2 pollution, electricity usage, FDI, and economic growth in Vietnam from 1980 to 2010. The experiments used the environmental Kuznets Curve (ekc) process, cointegration, and Granger causality. The ekc theory is not supported by observational observations in Vietnam. Since there is a short-run bidirectional link between Vietnam's income and FDI inflows, as the country's income increases, so does its potential to attract more foreign capital. FDI inflows, on the other hand, are a major driver of national income growth.

The presence of bidirectional partnerships has important policy implications in the long run. The role of state-level structural inequalities in attracting FDI in wind energy in India was explored by Kathuria, Ray, and Bhangaonkar (2015). The status of systemic inequalities is calculated by creating a policy index that includes five main wind energy policies: feed-in tariffs, open access transmission, third-party selling, banking, and wheeling charges. After accounting for many state-specific purposes, panel data techniques are used to measure the effect of policy deficits on FDI inflows in wind energy for eight Indian states with substantial resource capacity over a seven-year span (2004–05 to 2010–11). The findings show that a state-specific policy index for wind energy is essential in attracting FDI in a state, regardless of whether control variables are used or not.

Lee (2013) investigated the impact of net FDI inflows on green energy use, carbon emissions, and economic growth. He used cointegration experiments and fixed effects simulations to look into the magnitude of FDI inputs to the other variables, as well as cointegration experiments to look into a long-run equilibrium relationship between them. From 1971 to 2009, he examined panel evidence from the G20's 19 members. According to the results of the study, foreign direct investment (FDI) has a major impact on G20 economic growth while having a minor impact on CO2 emissions. He found no proof of a connection between FDI and the usage of renewable energy sources.

Khatun and Ahamad (2015) studied Bangladesh's current energy and power situation, as well as the causal relation between FDI in the energy and power sectors and economic development, from 1972 to 2010. Over this time cycle, there is a significant difference in power generation and energy demand. Furthermore, the trajectory of FDI inflows shifted over the time frame studied. They also discovered that FDI and energy use, as well as energy use and GDP growth, have strong short-run causal relationships that are both positive and unidirectional. Scientific proof for the energy demand equation confirms a causal link in the long term. Given the capital and technology gap, as well as the requirements for the creation of the energy and power industry, FDI in this area, which is critical to the targeted GDP expansion, should be encouraged.

From 1978 to 2010, Kuo, Chang, Chen, and Chen (2012) researched the relationship between economic growth, FDI, and energy usage in China. The results suggest a one-way Granger causality between GDP and energy use. Energy consumption will grow in lockstep with China's GDP, so enacting energy efficiency and demand management policies will have little effect on the country's economic growth. A bi-directional Granger causality between energy use and FDI has been discovered by researchers. This suggests that the Chinese government should carefully weigh the benefits and drawbacks of FDI inflows and commit time to implementing more effective environmental conservation policies.

For the nine countries listed in the Climate Change Performance Index (CCPI) 2018 report, Caglar (2020) examined the relationship between renewable energy use, nonrenewable energy use, FDI , economic growth, and carbon emission (Denmark, Finland, France, India, Italy, Morocco, Norway, Portugal, and Sweden). The research showed the impact of green energy usage and FDI on CO_2 emissions in countries with high CCPI scores using the recently adopted bootstrap autoregressive distributed lag (ARDL) methodology.

The unit root properties of the variables are tested using sharp and smooth structural break unit root checks (SOR, Shahbaz, Nasir, and Roubaud (2018)). McNown et albootstrap's ARDL test is then used to explore the nature of co-integration (2018). They still use Granger causality based on the bootstrap ARDL method to describe causal relationships between variables. In retrospective test results, there are just a few co-integration interactions between variables. However, he discovered significant long-term relationships between FDI, sustainable energy consumption, and economic growth in some countries, and findings have important policy implications, especially in relation to CO_2 emissions and FDI.

Zeng, Liu, Ding, and Xu (2020) looked at the relationship between energy use, FDI, and economic growth in China from 1993 to 2017. They used Zhejiang as an example. FDI is the driving force behind Zhejiang's open economy's rapid expansion, which not only stimulates economic growth but also increases energy demand. They use the vector auto-regression (VAR) model to try to understand the relationship between energy demand, FDI inflow, and economic growth in Zhejiang from 1993 to 2017. According to the findings, they seem to have a long-run equilibrium relationship. Energy usage promotes FDI inflow, and FDI inflow encourages energy consumption. Through the use of oil, FDI implicitly promotes long-term growth. As a result, growing energy efficiency and improving the quality of FDI have become unavoidable options for moving Zhejiang's economy from high-speed to high-quality growth.

3. METHODS

The following data and techniques were used to do exploratory analysis:

3.1. Data

For the years 1990-2018, secondary panel data was compiled for 198 countries around the world from the World Bank's World Development Indicators. The data is based on 198 countries, 29 years, and 6 variables. For the analysis, it was first log normalized. After that, the data were first degree separated to eliminate the autocorrelation problem.

3.2. Methods

A step-by-step model-based composite analysis was carried out. At first, The Ordinary Least Squares (OLS) model was used to describe the relationship between FDI and some variables related to energy and natural resources rent within these 198 countries. The relationship between FDI and some variables related to energy and natural resources rent was then determined using the Pooled Ordinary Least Squares (POLS) model. Second, The Drisc/Kraay (DK) model was carried out to find a connection between FDI and some variables related to energy and natural resources rent. Then the two stage least square model (2SLS) was used to describe the relationship between FDI and some variables related to energy and natural resources rent using STATA 15. Finally, the Generalized Method of Moments (GMM) was used to classify important explanatory variables that can explain why FDI and some variables related to energy and natural resources rent are related.

3.3. Variables and Description

LnFDI denotes log normal of FDI, net inflows (BoP, current) which is expressed in Billion USD. LnATE denotes log normal of Access to electricity and this variable is expressed in percentage of population of a country. LnEEL denotes log normal of energy intensity level of primary energy which is expressed in MJ$2011 PPP GDP. LnREO denotes log normal of renewable electricity output and expressed in percentage of total electricity output. LnREC denotes log normal of renewable energy consumption and expressed in percentage of total final energy consumption. LnNRR denotes log normal of total natural resources rents and expressed in percentage of gross domestic product.

4. RESULTS AND DISCUSSION

4.1. Descriptive Statistics

The below is a list of all the variables used in descriptive statistics. For each statistic, the table shows the number of measurements, mean value, standard deviations, minimum and maximum value.

Table-1. Descriptive Statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max
ID	5742	128.722	77.006	1	264
Year	5742	2004	8.367	1990	2018
LnFDI	5742	17.217	7.327	0	27.879
LnATE	5742	3.468	1.742	-4.605	4.605
LnEEL	5742	1.45	0.907	-6.416	4.06
LnREO	5742	2.017	1.956	-8.127	4.605
LnREC	5742	2.281	1.872	-6.34	4.588
LnNRR	5742	0.308	2.367	-8.337	4.46

Table 1 summarizes the data gathered for 29 years' data of 198 countries, based on six variables. The major dependent variable, FDI, shows an average of 17.217 billion dollars for the countries surveyed, with a high standard deviation of 7.327 billion dollars, indicating that there is a significant difference in FDI among the countries. The LnATE average is 3.468, while the LnEEL average is 1.450, according to the table. LnATE and LnEEL have standard deviations of 1.742 and 0.907, respectively. The average LnREO, on the other hand, is 2.017, the average LnREC is 2.281, and the average LnNRR is 0.308. LnREO, LnREC, and LnNRR have standard deviations of 1.956, 1.872, and 2.367, respectively.

4.2. Econometric Models

The dependent (LnFDI) and independent variables were used in multiple regression models (LnATE, LnEEL, LnREO, LnREC LnNRR). The effects of such models are discussed and interpreted in the following section.

Table-2. Ordinary least squares (OLS) model

LnFDI	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
LnATE	1.358	0.055	24.52	0	1.249	1.466	***
LnEEL	1.213	0.113	10.69	0	0.99	1.435	***
LnREO	0.113	0.063	1.80	0.072	-0.01	0.236	*
LnREC	0.254	0.07	3.63	0	0.117	0.392	***
LnNRR	-0.048	0.041	-1.18	0.238	-0.127	0.032	
Constant	9.959	0.3	33.22	0	9.371	10.546	***
Mean dependent var		17.217	SD dependent var			7.327	
R-squared		0.109	Number of obs			5742.000	
F-test		139.685	Prob > F			0.000	
Akaike crit. (AIC)		38517.234	Bayesian crit. (BIC)			38557.168	

Note:*** p<.01, ** p<.05, * p<.1.

Access to electricity, primary energy energy intensity, renewable electricity output, and renewable energy consumption all had strong positive relationship with FDI, as seen in Table 2. The more a country demonstrates access to electricity, primary energy energy production, renewable electricity generation, and green energy use, the more foreign direct investment it will get. On the other hand, Total natural resource rents have a negligible negative association with FDI, implying that a country with higher total natural resource rents would draw less foreign direct investment.

Table 3 shows access to electricity, renewable energy consumption and total natural resources rents have significant positive relationship with FDI. The more access to electricity, clean energy use, and overall natural resource rent are seen, the more FDI a country can get. Energy intensity level of primary energy and renewable electricity generation, on the other hand, has a strong negative relationship with FDI, implying that a country with a higher energy intensity level of primary energy and renewable electricity production would draw less foreign direct investment.

Table-3. Pooled Ordinary Least Squares (POLS) model.

LnFDI	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
LnATE	1.118	0.051	21.77	0	1.017	1.218	***
LnEEL	-0.652	0.141	-4.64	0	-0.928	-0.377	***
LnREO	-0.353	0.089	-3.98	0	-0.527	-0.179	***
LnREC	0.725	0.097	7.45	0	0.535	0.916	***
LnNRR	0.425	0.073	5.82	0	0.282	0.568	***
Constant	13.214	0.422	31.28	0	12.386	14.042	***

Mean dependent var	17.217	SD dependent var	7.327
Overall r-squared	0.050	Number of obs	5742.000
Chi-square	625.268	Prob > chi2	0.000
R-squared within	0.103	R-squared between	0.009

Table-4. Driscoll-Kraay pooled OLS model.

Regression with Driscoll-Kraay standard errors	Number of groups = 198
Method: Pooled OLS	F(5, 28) = 254.38
Group variable (i): ID	Prob > F = 0.0000
maximum lag: 3	R-squared = 0.1085
	Root MSE = 6.9208

LnFDI	Coef.	Std.Err.	t	P>t	[95%Conf.	Interval]
LnATE	1.358	0.094	14.520	0.000	1.166	1.549
LnEEL	1.213	0.517	2.340	0.026	0.153	2.272
LnREO	0.113	0.079	1.420	0.166	-0.050	0.276
LnREC	0.254	0.159	1.600	0.122	-0.072	0.581
LnNRR	-0.048	0.085	-0.560	0.580	-0.223	0.127
_cons	9.959	1.082	9.210	0.000	7.743	12.174

Table 4 shows access to electricity, energy intensity level of primary energy, have significant positive relationship with FDI. The more the shows access to electricity, energy intensity level of primary energy, the more will be foreign direct investment of a country. On the contrary total natural resources rents has insignificant negative relationship with the FDI which indicates that a country having more total natural resources rents will attract less foreign direct investment of a country. Renewable electricity output and renewable energy consumption have insignificant positive relationship with FDI. The next model is carried out for getting more robustness of the results.

Table-5. Two stage least square model.

Instrumental variables (2SLS) regression

LnFDI	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
LnATE	1.358	0.055	24.52	0	1.249	1.466	***
LnEEL	1.213	0.113	10.69	0	0.99	1.435	***
LnREO	0.113	0.063	1.80	0.072	-0.01	0.236	*
LnREC	0.254	0.07	3.63	0	0.117	0.392	***
LnNRR	-0.048	0.041	-1.18	0.238	-0.127	0.032	
Constant	9.959	0.3	33.22	0	9.371	10.546	***

Mean dependent var	17.217	SD dependent var	7.327
R-squared	0.109	Number of obs	5742.000
F-test	139.685	Prob > F	0.000

Note: *** p<.01, ** p<.05, * p<.1.

Table 5 illustrates access to electricity, energy intensity level of primary energy, renewable electricity output and renewable energy consumption have significant positive relationship with FDI. The more the shows access to electricity, energy intensity level of primary energy, renewable electricity output and renewable energy consumption, the more will be foreign direct investment of a country. On the contrary total natural resources rents has insignificant negative relationship with the FDI which indicates that a country having more total natural resources rents will attract less FDI of a country. The next model is run for more robustness of the results.

Table-6. Generalized method of moments (GMM) model.

LnFDI	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
L.LnFDI	0.178	0.019	9.28	0	0.141	0.216	***
LnATE	0.723	0.084	8.65	0	0.559	0.887	***
LnEEL	0.045	0.222	0.20	0.84	-0.391	0.481	
LnREO	-0.049	0.15	-0.32	0.745	-0.344	0.246	
LnREC	0.157	0.168	0.94	0.348	-0.172	0.486	
LnNRR	0.25	0.115	2.17	0.03	0.024	0.475	**
Constant	11.364	0.481	23.62	0	10.421	12.307	***
Mean dependent var		17.386	SD dependent var			7.216	
Number of obs		5346.000	Chi-square			209.203	

Note: *** p<.01, ** p<.05, * p<.1.

Table 6 shows access to electricity and total natural resources rents have significant positive relationship with FDI. That is, more access to electricity and total natural resources rents lead to more FDI. Energy intensity level of primary energy and renewable energy consumption have positive relationship with FDI and renewable electricity output has negative relationship with FDI but insignificant nature of relationship with FDI though the overall model is significant at 10% level.

Table-7. Summary of all models.

Variables	OLS Model		POLS Model		DK Model		2SLS Model		GMM Model	
	Coef.	Sig	Coef.	Sig	Coef.	Sig	Coef.	Sig	Coef.	Sig
LnATE	1.358	***	1.118	***	1.358	0	1.358	***	0.723	***
LnEEL	1.213	***	-0.652	***	1.213	0.03	1.213	***	0.045	
LnREO	0.113	*	-0.353	***	0.113	0.17	0.113	*	-0.049	
LnREC	0.254	***	0.725	***	0.254	0.12	0.254	***	0.157	
LnNRR	-0.048		0.425	***	-0.048	0.58	-0.048		0.25	**
Constant	9.959	***	13.214	***	9.959	0	9.959	***	11.364	***

The findings of all of the models used in this analysis are summarized in Table 7. In both of the models, it was discovered that access to energy has a substantial positive linkage with FDI.

In all models except GMM and POLS, the energy intensity level of primary energy and renewable electricity output has a significant positive relationship with foreign direct investment. In the POLS model, primary energy energy intensity and renewable electricity output have a substantial negative interaction with FDI, while the relationship is negligible in the GMM model. In all models except the GMM model, renewable energy consumption has a significant positive association with FDI. In various models, total natural resource rentals have a mixed relationship with foreign direct investment. It has a significant favorable relationship with foreign direct investment in the POLS and GMM models, but there is an insignificant relationship with FDI in the other model at the 10% significance level.

6. CONCLUSION

Using panel data for 198 countries from 1990 to 2018, this research aims to illustrate the effect of electricity, energy, and natural resources on FDI. The findings demonstrate that there is a favorable association between FDI and access to electricity using OLS, POLS, DK, 2SLS and GMM models.

A country's ability to draw more FDI will be aided by increased access to electricity. Any of the models used in the analysis show a favorable association between primary oil energy intensity and FDI. In the OLS, POLS and DK model, renewable electricity output has a strong positive association with FDI.

Renewable energy consumption has substantial positive relationship with FDI except the GMM model, indicating that more renewable energy consumption will draw more foreign direct investment for a region. In pooled ordinary least square (POLS) and generalized methods of moments (GMM) models, total natural resource rent has a significant positive relationship. The results are critical in developing strategies for a country's energy and natural resource rent.

Because of the database's limitations, statistics for all countries of the world were not obtained. Furthermore, evidence spanning on than 29 years may have been more convincing. For research, data had to be converted, which could result in inconsistencies. Furthermore, several factors were left out of this study. Other than these considerations, future research should focus on determining the most significant determinants of FDI.

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Appendix-1. List of Countries.

SL	Name of country	SL	Name of country	SL	Name of country
1	Afghanistan	41	Costa Rica	81	India
2	Albania	42	Cote d'Ivoire	82	Indonesia
3	Algeria	43	Croatia	83	Iran, Islamic Rep.
4	Andorra	44	Cuba	84	Iraq
5	Angola	45	Curacao	85	Ireland
6	Argentina	46	Cyprus	86	Israel
7	Armenia	47	Czech Republic	87	Italy
8	Aruba	48	Denmark	88	Jamaica
9	Australia	49	Djibouti	89	Japan
10	Austria	50	Dominica	90	Jordan
11	Azerbaijan	51	Dominican Republic	91	Kazakhstan
12	Bahamas, The	52	Ecuador	92	Kenya
13	Bahrain	53	Egypt, Arab Rep.	93	Kiribati
14	Bangladesh	54	El Salvador	94	Korea, Dem. People's Rep.
15	Barbados	55	Equatorial Guinea	95	Korea, Rep.
16	Belarus	56	Eritrea	96	Kosovo
17	Belgium	57	Estonia	97	Kuwait
18	Belize	58	Eswatini	98	Kyrgyz Republic
19	Benin	59	Ethiopia	99	Lao PDR
20	Bermuda	60	Euro area	100	Latvia
21	Bhutan	61	Fiji	101	Lebanon
22	Bolivia	62	Finland	102	Lesotho
23	Bosnia and Herzegovina	63	France	103	Liberia
24	Botswana	64	Gabon	104	Libya
25	Brazil	65	Gambia, The	105	Liechtenstein
26	Brunei Darussalam	66	Georgia	106	Lithuania
27	Bulgaria	67	Germany	107	Luxembourg
28	Burkina Faso	68	Ghana	108	Macao SAR, China
29	Burundi	69	Greece	109	Madagascar
30	Cabo Verde	70	Greenland	110	Malawi
31	Cambodia	71	Grenada	111	Malaysia
32	Cameroon	72	Guatemala	112	Maldives
33	Canada	73	Guinea	113	Mali
34	Chad	74	Guinea-Bissau	114	Malta

35	Chile	75	Guyana	115	Marshall Islands
36	China	76	Haiti	116	Mauritania
37	Colombia	77	Honduras	117	Mauritius
38	Comoros	78	Hong Kong SAR, China	118	Mexico
39	Congo, Dem. Rep.	79	Hungary	119	Micronesia, Fed. Sts.
40	Congo, Rep.	80	Iceland	120	Moldova

Appendix-1. Continue

SL	Name of country	SL	Name of country
121	Mongolia	161	Solomon Islands
122	Morocco	162	Somalia
123	Mozambique	163	South Africa
124	Myanmar	164	South Asia
125	Namibia	165	Spain
126	Nepal	166	Sri Lanka
127	Netherlands	167	St. Kitts and Nevis
128	New Caledonia	168	St. Lucia
129	New Zealand	169	St. Martin (French part)
130	Nicaragua	170	St. Vincent and the Grenadines
131	Niger	171	Sudan
132	Nigeria	172	Suriname
133	North Macedonia	173	Sweden
134	Northern Mariana Islands	174	Switzerland
135	Norway	175	Tajikistan
136	Oman	176	Tanzania
137	Pakistan	177	Thailand
138	Palau	178	Timor-Leste
139	Panama	179	Togo
140	Papua New Guinea	180	Tonga
141	Paraguay	181	Trinidad and Tobago
142	Peru	182	Tunisia
143	Philippines	183	Turkey
144	Poland	184	Turkmenistan
145	Portugal	185	Uganda
146	Puerto Rico	186	Ukraine
147	Qatar	187	United Arab Emirates
148	Romania	188	United Kingdom
149	Russian Federation	189	United States
150	Rwanda	190	Uruguay
151	Samoa	191	Uzbekistan
152	Sao Tome and Principe	192	Vanuatu
153	Saudi Arabia	193	Venezuela, RB
154	Senegal	194	Vietnam
155	Serbia	195	West Bank and Gaza
156	Seychelles	196	Yemen, Rep.
157	Sierra Leone	197	Zambia
158	Singapore	198	Zimbabwe
159	Slovak Republic		
160	Slovenia		

Source: World Bank