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The possible responsiveness of FDI to electric power consumption at different income levels

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ABSTRACT

Modern energy in the form of electricity is vital for economic activities such as getting clean water, and healthcare, getting stable and effective lighting, heating, and cooking. However, in developing countries, there is a huge shortage of electricity and big gaps in access, while access to electricity in developed countries almost reached a hundred percent. Hence, the purpose of this paper is to show the possible responsiveness of FDI to electric power consumption at different income-level. Hence, this study aims to address questions, including how is the relationship between economic activities such as FDI and electricity consumption at different income-level. For motivating the research, 131 countries' data have been collected from WDI and US-EIA from 1992 to 2016 and both quantitative and qualitative methods were used. The cross-country regression result shows that there exists an inverse-U shaped relationship between EPC and FDI net inflow because most high-income countries have a high level of EPC and therefore EPC becomes less important for them to attract FDI. But when we separate the total sample into two, EPC can significantly increase net FDI inflow for middle & low-income countries because for these countries, especially for low-income countries, sufficient electricity supply is important for FDI inflow.

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INTRODUCTION

Economic growth is the most powerful instrument for decreasing poverty and improving the quality of human well-being by creating the resources required for human development. It is motivated by several factors, including process, product, and organizational improvements established on technological transformation. Hence, the economic growth in the past several years has shown big progress. It is well known that for this progress different sectors have contributed a lot. Among those sectors, foreign direct investment and energy played an important role in each country. To know the importance of energy in economic growth, it is essential; to begin with, the role of energy (Apergis & Payne, 2011) in production because we can see that energy input is inducing production outputs very significantly. A more vibrant economy will have to use more energy to keep up with a higher level of production, as well as people's increasing demand for energy following the increased income level (Sadorsky, 2009). As the income per capita of a country increases, demand for electric energy also increases to secure its people's well-being as well as to build a strong and productive economic foundation.

Reliance and demand for energy in countries have been growing due to increased innovations, industrialization, and

globalization. The finding of Stern (2011) confirms that energy plays a matching role in labor and capital in the process of production. This means that with the use of energy in the production process, the efficiency of labor and capital grows together with the competitiveness of the nation (Stern, 2011). Moreover, the economic development of a country depends upon its investment level. FDI is a catalyst for productivity enhancements and improved output levels in the host economy, permitting the local industry to reinvest its profits into the industry. On the other hand, investment, in turn, depends on the availability of infrastructure like electrical energy. Numerous researchers have tried to study the relationship between net inflows of FDI and energy consumption. The research has concluded that as FDI allows for cheaper and easier access to capital, demand for energy increase with FDI inflows increase. This can, in turn, be used for expanding production, thus increasing energy demand and consumption (Mielnik & Goldemberg, 2002).

Modern energy facilities in the form of electricity are vital to human wellbeing and national economic growth. As a source of energy, electric power is transformed from the final form of energy using different technologies. Hence, as Apergis and Payne (2011) confirm it is mostly assumed that electricity has

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the widest means among other sources of energy and performs a critical role in the societal development of nations (Apergis & Payne, 2011). There are different reasons why electricity service is important to increase living standards for human development. Access to modern energy is important for the delivery of clean water, hygiene, and healthcare, for delivery of consistent and effective lighting, heating, cooking, mechanical power, transport, internet, television, and telecommunications services (IEA, 2016). When electricity is accessible, food and drug can be kept in the refrigerator for an extended period, which will help more people to read and raises the adult learning rate so that the living situation will improve.

On the other hand, the deficiency of access to electricity can have substantial consequences on public health. This was confirmed by WHO (2012) that exposed the emissions of CO₂ and hydrocarbons due to the burning of biomass frequently leading to sicknesses and death in several developing nations (WHO, 2012). In terms of number WHO (2018) report indicates that each year, due to household air pollution approximately 4 million people die using biomass fuels and kerosene that are cauterized as inefficient cooking practices (WHO, 2018). However, such an amount of premature death could be minimized by increasing access to electricity.

Electricity access refers to the percentage of individuals that have moderately basic, stable access to electricity (IEA, 2017) in a given region. The IEA electricity access explanation involves more than just supplying electricity to the household, which specifies the lowest threshold in the urban household per year is 500 kWh and in the rural household per year is 250 kWh (IEA, 2017). In general, at the global level, the population with access to electricity was growing over the past twenty-five years increasing from 73.45% in 1993 to 88.85% in 2017. Ritchie and Roser (2018) have also found that upper-middle-income countries have access to electricity around 89-100 percent (Ritchie & Roser, 2018). In this context, the global population in terms of their income level that represents access to electricity at the household level from 1990 to 2017 is shown in Figure 1.

From Figure 1, it can be understood that in terms of income level the global electricity access has grown. For instance, in 1990 access to electricity in the upper-middle-income and

middle-income countries was 89.23% and 69.9% and increased to 99.37% and 92.36% in 2017 respectively. Similarly, lower middle income and low-income countries' access to electricity also increased from 49.3% and 5.2% in 1990 to 86.76% and 40.97% in 2017 respectively. However, the finding shows that access to electricity is not equal among the upper-middle, middle, lower-middle, and low-income countries.

Moreover, when we examine in terms of geographic location as shown in Figure 2 below even if the access to electricity has grown, the distribution among the global population is not equal. For example, in 1990 access to electricity in Latin America & Caribbean, East Asia & Pacific, Middle East & North Africa, and Sub-Saharan Africa were 85.5%, 82.4%, 85.8%, and 23.5%; and that increased in 2017 to 98.13%, 97.59%, 97.34%, and 44.59% are respectively.

Furthermore, the share of inhabitants with access to electricity from 1993 to 2017 as shown in Figure 3 includes the rural, urban, and total population's access as a percentage of the population. As indicated in the figure 3 rural population was below in terms of access to electricity out of the entire population. The implication is that electrification in most nations in rural inhabitants is less than in urban areas. For instance, access to electricity in 1993 in rural, urban, and total were 59.8%, 93.1%, and 72.9% which was increased to 78.64%, 97.4%, and 88.85% in 2017 respectively.

On the other hand as per World Bank's (2018) report on Sub-Saharan Africa, it was even worse and nearly 45 percent of the people are living without electricity and most of those lacking electricity are in the rural areas (World Bank, 2018). The finding shows that in 1996 total access to electricity was 27.65%, of which rural only 9.1% and urban 68.49%. Access to electricity in this region didn't show significant improvement over the last 22 years, hence total access to electricity in 2017 reached 44.59 (% of the population), of which in rural areas 22.6 (% of the rural population) and in urban 78.96 (% of the population), as shown in Figure 4.

In summary, the global access to electricity as per the three perspectives discussed namely, in terms of income level (Figure 1), geographic location (Figure 2), and urban and rural (Figure 3)

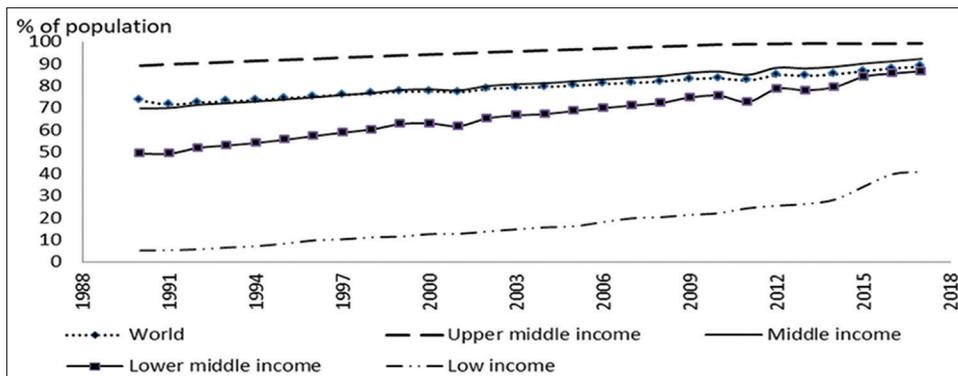


Figure 1: Access to electricity in terms of income in the global population
Data source: World Development Indicator

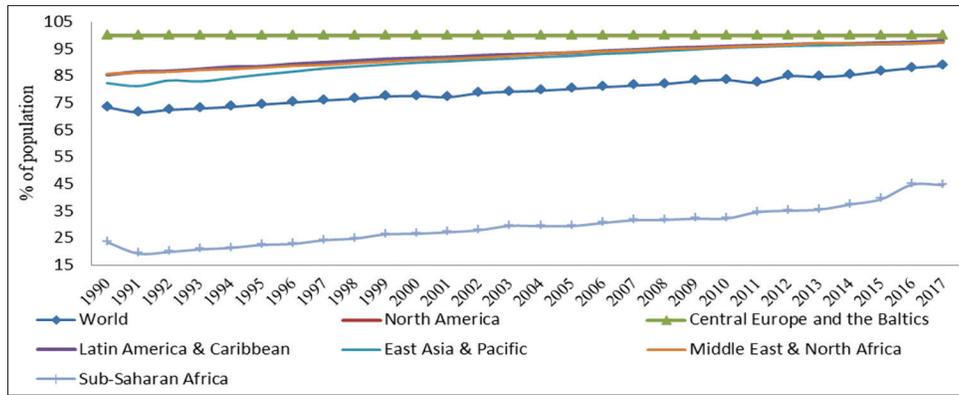


Figure 2: Access to electricity in terms of geography in the global population
Data source: World Development Indicator

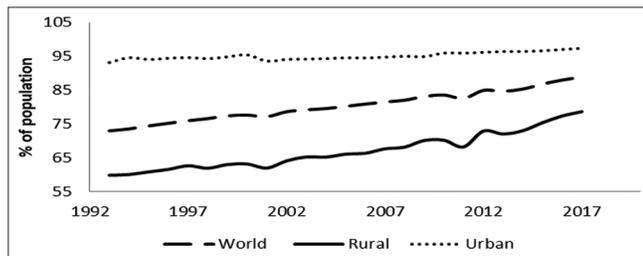


Figure 3: Access to electricity in urban, rural & total world population
Data source: World Development Indicator

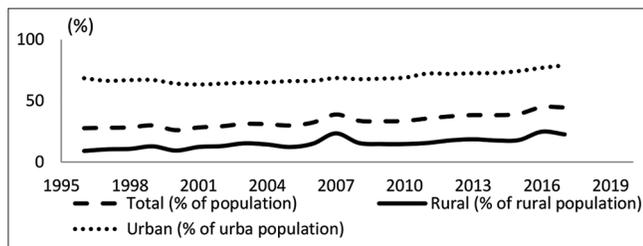


Figure 4: Sub-Saharan Africa's access to electricity
Data source: World Development Indicator

inhabitants was not equally distributed around the globe. These findings are confirmed by IEA (2017) report that about 1.1 billion people approximately 14% of the world's population yet not have access to electricity at home (IEA, 2017). Moreover, it was projected by IEA (2017) in 2030 that 2.5 billion will still be depending on biomass for cooking and still around 1 billion people lack electricity access (IEA, 2017). Sovacool (2012) also confirmed that lack of access to energy services in addition to challenging human development; inhibits the satisfaction of several human rights, such as improvement of society's living standard (Sovacool, 2012). Jumbe (2004) also found that as GDP shows a nation's development level, a nation's total and per-capita electricity consumption also reflects a measure of prosperity (Jumbe, 2004).

For realizing access to electricity the world would need to increase investments. This means considerable development effects can be attained by investing in electricity supply and that would have downstream economic special effects in return. Therefore, electric power access and utilization not only make life comfortable but also conserve time for production and

accelerate economic growth. Hence, it is important to give special consideration to electric power access as it could assist to boost human development. Moreover, as discussed above the world energy scheme is by its nature very much complex. Electric power is an essential agent of socioeconomic development (Maweje & Maweje, 2016), and growth in consumption of electric power is known as an indicator of national economic growth (Zhang *et al.*, 2017).

Hence, as illustrated in Figure 5 below, when we see the growth rate trends in GDP and electricity consumption in the world it shows that the world's economic growth rate kept a regular move with electricity consumption from 1971 to 2014 for more than four decades. The finding shows that electricity consumption per capita and GDP of the world in 1972 was 1273.64KWh and 984.92US\$, and increased to 3130.71KWh and 10928.87US\$ in 2014 respectively. In other words when the economic growth rate increase, electricity consumption increases, and vice versa. This situation was seen in 1973 and 2008 when the oil crises and the world economic crises occurred respectively and both economic growth and electricity consumption rate were below zero.

However, in those periods the consumption of electricity indicated a huge difference in the world. For example, the major electricity consuming nations in 2017 are the People's Republic of China (25.9%), the United States (17.5%), India (5.4%), Japan (4.5%), the Russian Federation (3.6%), Korea (2.4%), Germany (2.4%), Canada (2.4%), Brazil (2.3%), and France (2.0%). These are the top-ten electricity-consuming nations that account for more than two-thirds of worldwide electricity consumption.

On the other hand, as shown in Figure 6 below, even if the ups and down of FDI net inflows and EPC per capita of the world are not the same, there is an indication that both went to each other. For instance, in 1972 when FDI growth was positive, 28.14%, and electric power consumption growth was also positive, 5.48%, whereas in 2000 when FDI growth was negative 84.21% electric power consumption was also negative 0.27%. Moreover, in 2005 when FDI growth improved and became positive 29.88% electric power consumption growth was also improved to 2.79%, while in 2008 FDI growth became negative 76.61 and electric power consumption growth also negative 1.77%.

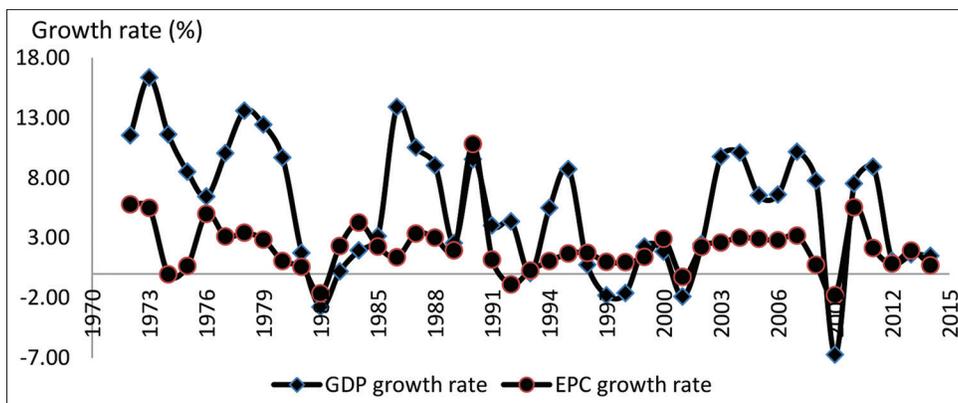


Figure 5: World growth rates of electricity consumption and GDP
Data source: World Development Indicator

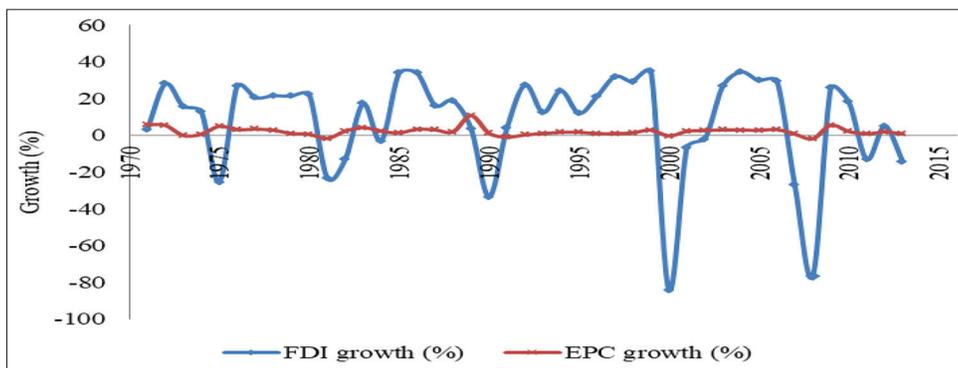


Figure 6: World growth rates of FDI and electricity consumption
Data source: World Development Indicator

Therefore, as the purpose of this paper is to investigate the possible responsiveness of FDI to electric power consumption at different income levels from a global perspective the next step is to see empirically what has been found and discussed theoretically above about electric power consumption, and global economic activities such as FDI and GDP. Hence, to investigate empirically 131 countries’ data have been collected from WDI and US-EIA from 1992 to 2016.

RELATED WORK

Economic Growth and Energy Consumption

Most of the literature shows that economic growth and energy consumption are very much related. This relationship between energy consumption and economic growth has been discovered widely. For example, Muhammad (2019) studied the relationship between economic growth, energy use, and CO₂ emissions in emerging, MENA, and developed countries from 2001 to 2017. In his research, he found that economic growth has a positive and significant effect on energy consumption but no significant effect on CO₂ emissions in emerging countries, while no significant effect on energy consumption but a positive significant effect on CO₂ emissions in MENA and developed countries. He also found that energy use has a positive significant effect on economic growth in emerging and developed countries, while no significant effect on economic growth in MENA countries. However, he found that in emerging,

MENA, and all developed countries energy use has a positive and significant effect on CO₂ emission (Muhammad, 2019).

Similarly, Ahmed *et al.* (2017), studied 1985 to 2015 the relationship between economic growth, energy use, trade, and CO₂ emission in Asian countries, and they found a positive relationship between energy use and CO₂ emissions, unidirectional causality to CO₂ emission and trade from economic growth for most of the countries, and they showed energy use as a key variable in the direction of environmental decline in the ASEAN countries (Ahamed *et al.*, 2017). Another study was done by Saidi and Hammami (2015) in 58 countries over the period 1990 on the relationship between energy use, CO₂ emission, and economic growth examined and found a positive effect of energy consumption on economic growth and a negative relationship between economic growth and CO₂ emissions (Saidi & Hammami, 2015).

Similarly, Salahuddin and Gow (2014) studied 1980-2012 the relationship between economic growth, energy consumption, and CO₂ emissions in Gulf countries, and empirical results found a positive significant relationship between CO₂ emissions and energy consumption and also a positive significant relationship between economic growth and energy consumption both in the long run and short-run (Salahuddin & Gow, 2014). In the earlier studies, Apergis and Payne (2011) found a positive relationship between economic growth and energy consumption (Apergis & Payne, 2011).

FDI and Energy Consumption

Numerous researchers have tried to study the relationship between net inflows of FDI and energy consumption. The research has concluded that as FDI allows for cheaper and easier access to capital, demand for energy increase with FDI inflows increase. This can, in turn, be used for expanding production, thus increasing energy demand and consumption (Mielnik & Goldemberg, 2002). The power and energy sector of Pakistan had received a higher amount of FDI than other sectors of the economy with trends in energy production and energy usage (Latief & Lefen, 2019). Moreover, Zhang and Xu (2016) found that energy consumption structures and FDI were advantageous in improving carbon productivity in resource-intensive sectors (Zhang & Xu, 2016). Doytch and Narayan (2016) studied the environmental outcomes of FDI inflows and they claim that FDI is an essential driver of the increase in renewable energy consumption in upper-middle-income countries, while the effect in lower-middle-income countries is not as large (Doytch & Narayan, 2016).

METHODOLOGY

Regression is a common methodology for evaluating the statistical relationship between variables, which explains the relationship within an equation (Sarstedt & Mooi, 2014). To examine the relationship between the variables multiple linear regressions model is used because it is more suitable to explain the change of the dependent variable (Uyanik & Güler, 2013). FDI flows to a particular country, are either demand driven by the large market size of the host country, or supply-driven by the abundant labor supply and good infrastructure in the host country. The study uses GDP to represent the market size of the host country, the total labor force to represent the labor supply, and electricity consumption to represent the supply infrastructure.

In line with this theory, efforts are made to include factors such as the market represented by GDP (Gross Domestic Product) per capita; infrastructure represented by electricity consumption per capita, and labor represented by the labor force. We assume FDI (Foreign Direct Investment) flows are affected by market sizes such as the population and economic growth (GDP) measures in the host country. Similarly, infrastructure such as electricity, water, and road also affect FDI flows. Moreover, the Labor force affects the flow of FDI in the form of labor supply and the cost of labor.

$$FDI_t = F(\text{Market}, \text{Infrastructure}, \text{Labor})_t \quad (1)$$

Where:

FDI_t , Market_t , Infrastructure_t , and Labor_t respectively represent foreign direct investment inflow, gross domestic product per capita, electricity per capita, and labor force.

Using this equation (1) the finding of the global perspective begins with a motivation question to evaluate the

relationship between economic activities such as foreign direct investment and electricity consumption. This means the relationship between total FDI inflow (\$US), per capita GDP (\$US), per capita EPC (Electric Power Consumption) (KWh), and labor force (in thousands) was examined. In the analysis, panel data and FE are applied to evaluate the relationship between the dependent variable FDI and the independent variables within countries. The reason for using the FE method is it will help us to control the individual characteristics of a country like the political or cultural situation that may have some effect on FDI and electricity per capita; hence, this is the reason for the assumption of the error term (Oscar, 2007). Second, we further check how renewable energy plays a role in the supply of electricity in different countries.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n + \varepsilon \quad (2)$$

$$FDI_{it} = \beta_0 + \beta_1 GDP_{it} + \beta_2 Electricity_{it} + \beta_3 Labor_{it} + \alpha_i + year_t + \varepsilon_{it} \quad (2a)$$

Since the data is panel data, we also control country fixed effect and year fixed effect, which is a common time shock for all countries.

Where:

FDI_{it} , GDP_{it} , $Electricity_{it}$, and $Labor_{it}$, respectively represent - total foreign direct investment net inflow, per capita gross domestic product, per capita electricity power consumption, and total labor force, "i" denotes country i, and "t" denotes year "t", " α_i ", is the fixed effect of the country "I" that controls all characteristics of the country that is constant over the sample period, $year_t$ - control the yearly random shocks that are common to all countries in a year, ε_{it} the error.

Since our regression equation includes two endogenous variables, GDP and EPC, making it necessary to test the endogeneity if $E[\varepsilon | X_1, X_2, X_n] = 0 \forall X_j$, then we say that we have explanatory exogenous variables.

If, for some reason such as the omission of relevant variables, measurement errors, simultaneity, etc., X_j is correlated with " ε ", we say that X_j is an endogenous explanatory variable (Wooldridge, 2013). Hence, we will test endogeneity in the regression equation by predicting the " X_j " residual and letting X_j be " ε ". If the p-value of the residual " ε " is small it indicates that there is an endogeneity problem that also shows the estimation of the model is not consistent. We also use Instrument Variable (IV) method to estimate the equation. Therefore, we will use the lag of GDP, EPC, and EPC2 as an instrument.

$$xtivreg FDI LF(GDP EPC = 1.GDP 1.EPC 1.EPC2), fe \quad (2b)$$

Lagged explanatory variables remain commonly used as instrumental variables (IVs) to address endogeneity concerns in empirical studies with observational data Bascle (2008). Finally to test the exogeneity we used the STATA command "dmexogxt"

which gives the Guilhem Bascale test of exogeneity. Hence, as will be shown below, the regression analysis results confirm that the electricity supply is very important for countries, especially low and middle-income countries, to attract FDI and drive economic growth.

Data

To choose the best suitable and appropriate materials as resources for the research topic numerous data had been collected from different sources. Most importantly world development indicators of World Bank, US-EIA, and IRENA data were utilized for the analysis. Hence, annual data from 1992 to 2016 for the 131 countries (Table 1) including “gross domestic product per capita (US\$)”, “foreign direct investment inflow per capita (million US\$)”, and “total labor force (thousands)” had been collected from WDI, which available online at <http://www.worldbank.org>. While electricity consumption in kWh data is found from US-EIA available online at <https://www.eis.gov/beta/international/data/browse>, then per capita EPC in kWh and renewable electricity consumption share was calculated.

RESULTS AND DISCUSSION

Table 2, column (1) reports the regression results for all countries that show the GDP size and total labor force of a country can significantly increase FDI inflow, while EPC has a negative but insignificant effect on FDI inflow. Since EPC is vital for production, it supposedly to increases FDI. We suspect that most high-income countries have a high level of EPC and therefore EPC becomes less important for them to attract FDI. We hence include the square term of EPC in the second column (2), and the result shows that there is an inverse-U shaped relationship between EPC and FDI. That means as EPC increases, FDI increases first and then becomes flat or falls with a threshold value of $31,272 = (3.415 / (2 * 0.0000546))$ kWh.

Table 1: Descriptive statistics for whole 131 countries

Variable	Obs	Mean	Std.Dev.	Min	Max
FDI	2947	10914.98	38275.91	-29700	734000
GDP	2947	11245.08	16633.73	102.645	119000
EPC	2947	3416.56	4958.428	0.721	54439.96
LF	2947	23296.61	79765.68	137.5	786000

Table 2: All country's data to test the possible responsiveness of FDI to electric power consumption (EPC)

Variables	(1)	(2)	(3)
GDP	1.325*** (0.092)	1.287*** (0.093)	1.064*** (0.089)
EPC	-0.250 (0.319)	3.415*** (1.107)	3.135** (1.298)
LF	0.994*** (0.073)	-5.46e-05*** (1.58e-05)	-4.97e-05*** (1.82e-05)
Constant	-25400*** (3,474.48)	0.974*** (0.073)	0.938*** (0.077)
		-35900*** (4605.02)	-31900*** (3566.16)

*** represents significance at 1%.

However, we also suspect an endogenous problem in variables (GDP and EPC), we test endogeneity in the regression equation by predicting the “e” residual. The small p-value of the residual “e” indicates that there is an endogeneity problem that also shows the estimation of the model is not consistent. So it can be concluded that there is an endogeneity bias in the OLS fixed estimates and it needs to instrument the variables (GDP, EPC, and EPC²) to make them exogenous.

Hence, we use the lag of GDP, EPC, and EPC² as an instrument. Lagged explanatory variables remain commonly used as instrumental variables (IVs) to address endogeneity concerns in empirical studies with observational data Bascale (2008). To test the exogeneity we used the STATA command “dmexogxt” which gives the Bascale test of exogeneity a higher p-value of 0.5166 so that the model gives good results without an endogeneity problem.

Therefore, according to Table 2 column (3), the coefficient of lagged GDP of 1.064 implies that with one dollar increase in GDP per capita, the FDI inflow per capita will be increased by around 1.064 dollars one year later, ceteris paribus and statistically significant at 1%. Similarly, the coefficient of lagged EPC is 3.135, which suggests that with one unit increase in EPC, FDI inflow also increased by 3.135 dollars one year later, ceteris paribus and statistically significant at 5%. Finally, the coefficient of LF 0.974 implies that with one unit increase in the total labor force, FDI net inflow per capita increases by about 0.974 dollars, ceteris paribus, and is statistically significant at 1%.

After doing the whole country panel data analysis to test the possible responsiveness of FDI to EPC at different income level, we separate the total sample into two subsamples: high-income, middle & low-income countries as shown in Table 3 above. Hence, when we see Table 3 column (1) the regression result of EPC for only high-income countries is not significant, which implies EPC has no impacts on net FDI inflow in high-income countries. Because electricity supply in high-income countries is abundant and is not a concern for consumption and production, that means EPC will not be a factor to be considered for foreign investors. In other words since most high-income countries have a high level of EPC it becomes less important for them to attract FDI.

Then we include the square term of EPC in in Table 3 column (2), and the result shows that there is an inverse-U shaped relationship between EPC and FDI. That means as EPC increases, FDI increases first and then becomes flat or falls. The threshold value is $37,947 = (3.180 / (2 * 0.0000419))$ kWh. However, since we already identified an endogenous problem in variables (GDP and EPC), it needs to instrument the variables (GDP, EPC, and EPC²) to make them exogenous and we use the lag of GDP, EPC, and EPC² as an instrument and tested the exogeneity the result shows a higher p-value 0.2888 so that the model gives good results without endogeneity problem.

Therefore, according to Table 3 column (3), the coefficient of lagged GDP of 0.877 implies that with one dollar increase in GDP per capita, the FDI inflow per capita will be increased by around 0.877

Table 3: Separating the total sample into high-income, and middle & low-income countries

Variables	High-income			Middle & Low-income	
	(1)	(2)	(3)	(4)	(5)
GDP	0.917***	0.889***	0.877***	1.188***	0.890***
EPC	(0.203)	(0.204)	(0.239)	(0.186)	(0.225)
EPC ²	-0.424	-3.180	-3.326	8.090***	11.65***
LF	(0.501)	(2.360)	(2.815)	(0.815)	(1.314)
Constant	9.116***	-3.91e-05***	-7.88e-06	0.777***	0.788***
	(0.752)	(3.27e-05)	(3.25e-05)	(0.034)	(0.038)
	-113512***	9.111***	9.043***	-37300***	-42300***
	(14,524.74)	(0.752)	(0.832)	(2036.42)	(2356.36)
		-94675.89***	-92900***		
		(21,432.01)	(25,312.35)		

*** represents significance at 1%.

dollars one year later, ceteris paribus and statistically significant at 1%. Similarly, the coefficient of LF 9.043 implies that with one unit increase in the total labor force, FDI net inflow per capita increases by about 9.043 dollars, ceteris paribus, and is statistically significant at 1%. But for EPC, even after the lagged effect was incorporated the result show statistically insignificant because EPC is not a factor for high-income countries to attract investors.

On the other hand, considering only middle and low-income countries the results are reversed. For these countries, especially for low-income countries, an abundant electricity supply is important for FDI inflow as shown in Table 3 columns (4) & (5), which show EPC can significantly increase net FDI inflow. As we already identified an endogenous problem in variables (GDP and EPC), it needs to instrument the variables (GDP and EPC) to make them exogenous and we use the lag of GDP and EPC as an instrument and tested the exogeneity. The result shows a higher p-value of 0.9295 so the model gives good results without an endogeneity problems.

Therefore, according to Table 3 column (5), the coefficient of lagged GDP of 0.890 implies that with one dollar increase in GDP per capita, the FDI inflow per capita will be increased by around 0.890 dollars one year later, ceteris paribus and statistically significant at 1%. Similarly, the coefficient of lagged EPC per capita is 11.65 and statistically significant at 1%, which implies that with one unit increase in EPC the net inflow FDI would increase by 11.65 units. Moreover, the coefficient of LF 0.788 implies that with one unit increase in the total labor force, FDI net inflow per capita increases by about 0.788 dollars, ceteris paribus, and is statistically significant at 1%.

CONCLUSION

In the finding of this research we have seen theoretically that electric power consumption increased in the past several years and electric power consumption is as an essential input for production and an indispensable good for the driving force of economic activities. Especially, a stable and abundant supply of electric power is crucial to attracting foreign direct investment (FDI). The cross-country regression also shows that there exists an inverse-U shaped relationship between EPC and economic growth such as FDI net inflow in the whole 131 countries panel data. That means as EPC in an economy increases, the net FDI increases first and then keeps rather stable or falls.

Furthermore, by separating the sample into two, high income, and middle & low-income countries, it is shown that the impact of EPC on FDI mainly comes from the middle & low-income countries. The regression results show that EPC can significantly increase net FDI inflow for middle & low-income countries but has no impact on net FDI inflow in high-income countries. Because as electricity supply in high-income countries is abundant and is not a concern for consumption and production, which means EPC will not be a factor to be considered for foreign investors. However, for middle & low-income countries, the results are reversed. For these countries, especially low-income countries, a sufficient electricity supply is important for FDI inflow. Therefore, we conclude that to improve economic development for middle and low income countries it is essential to raise the electricity supply.

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