

Analysis of Foreign Direct Investment Effect on Industry Energy Consumption in Indonesia

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Abstract: This study aims to analyze the effect of Foreign Direct Investment on Indonesia's industrial energy consumption during the year of 2000-2013. This study uses regression analysis to examine its effect. The results show that Foreign Direct Investment has an insignificant negative effect on the level of Indonesia's industrial energy consumption in 2000-2013. The R Square value which is 0.891 implies that 89.1% changes in industrial energy consumption variable can be explained by the Foreign Direct Investment.

Keywords: Foreign Direct Investment, Energy Consumption, Industry Sector

1. INTRODUCTION

According to Indonesian Economy Report (2015), on the domestic side, the Indonesian economy going forward is still faced with a variety of challenges for domestic structural problems that have not been fully resolved, including structural challenges for achieving food, energy and water security are the main input factors needed in the transformation process towards industrialization. In the energy sector, the imbalance between energy supply and demand is still ongoing. On the production side, various constraints to the development of energy infrastructure have led to the inability of domestic energy production to meet fuel needs. On the demand side, the lack of utilization of alternative fuels has not been able to shift the use of non-renewable energy sources.

The other structural challenge is to strengthen the carrying capacity of long-term sustainable financing and encourage foreign capital inflows in the form of Foreign Direct Investment (FDI). In an effort to answer the challenges of industrial competitiveness, the government will focus on implementing various development strategies. The focus of industrial policy is in the form of industrial development outside Java, increasing the industrial population, strengthening integration to the world value chain, and increasing competitiveness and productivity. In this regard, the involvement of foreign investors in the form of FDI is needed to expand the industry base and to increase productivity as part of strengthening the industrial structure in Indonesia as a whole.

According to Ministry of National Development Planning/ National Development Planning Agency (2013), energy use for the industrial sector in 2000 to 2011 has increased by an average of 3.06 percent from 258.18 million SBM to 359.62 million SBM. However, there was a decrease in the intensity of energy utilization of 2.16 percent from 0.78 SBM per million rupiah output in 2000 to 0.61 SBM per million rupiah in 2011. This decrease is caused by one or three of the following factors including the shift in the type of industry from energy-intensive industries to more capital-intensive industries, the shift from upstream industries that require large energy to downstream industries that require less energy, and new production processes and industrial machinery that consume less energy or save energy. In general, energy consumption in the period 2000 to 2011 is still dominated by the industrial sector.

The subject on Foreign Direct Investment and industrial energy consumption in Indonesia needs more attention. Therefore, through this study, we examine the effect of Foreign Direct Investment on Indonesia's industrial energy consumption during the period of 2000-2013.

2. LITERATURE REVIEW

2.1. Foreign Direct Investment (FDI) and Indonesia Industry Energy Consumption

According to Indonesia Energy Outlook (2016) of Secretariat General of National Energy Council, based on the energy user sector, the national final energy demand until 2025 will still be dominated by the industrial and transportation sectors as in 2015. After 2025, the industrial sector will dominate the national final

energy needs in line with the increase in industrial activities and slowdown in private vehicle activities due to change the mode to mass transportation. The share of the industry and the transportation sectors to the national energy needs is around 70% during the projection period. The remaining consumption is from the household, commercial, and other sectors include the use of raw materials, reductors, lubricants, additives, and other non-energy uses.

The industrial sector is a large gas user sector. The final energy needs of the industrial sector in 2050 reach 292 million Tonnes Oil Equivalent (TOE) Business as Usual, from the year 2015 consumption of 60 million TOE. The use of new renewable energy in the industrial sector is limited to biodiesel and commercial biomass. Biodiesel replaces diesel oil, which its use is still quite high.

There are ten industrial sectors in Indonesia which include fertilizer industry, petrochemical industry, oleochemical industry, steel / other metal industries, ceramic industry, glass industry, tire and rubber glove industries, pulp and paper industries, food and beverage industries, and textile and footwear industries. If seen from the level of energy intensive per unit in 2015, the industrial sector can be divided into three classifications:

- a. Energy-intensive manufacturing industries: food and beverages, pulp and paper, chemical fertilizers and rubber, cement, and non-metals and steel-based metals and iron (59%).
- b. Non-Energy-intensive manufacturing industries: textiles and leather goods, machinery equipment and transportation and other processing industries (39%).
- c. Non-manufacturing industries: wood and other forest products (2%).

2.2. Previous Research

The study objective of He, Gao, Wang (2012) is to test the existence and direction of Granger causality between energy consumption, economic growth and foreign direct investment in China, by using a multivariate VAR model of energy use, economic growth, carbon emissions based on data for Shanghai over the period 1985–2010. The result shows a unidirectional Granger causality coming from energy consumption to FDI which implies that the increase in foreign direct investment has good energy saving effect. They also find that the increase in foreign direct investment will lead to reduced energy consumption in the short term. Bento (2011) concluded that in the context of Portugal, there was also a negative effect of FDI on energy consumption, during the data period of 1980–2007.

The paper of Ting, Yin, Ying (2011) decomposes the change of energy consumption intensity from 1998–2008 in Jiangsu into FDI scale effect, FDI structure effect and FDI technology effect, applying the LMDI model. Decomposition and data analysis results reveal that FDI scale effect reduces the energy consumption intensity, whereas FDI structure does not contribute to the reduction of energy consumption intensity, for the whole. Therefore, to decrease the intensity of energy consumption in Jiangsu Province, they recommend that while extending FDI scale, they should implement unified energy-saving and emission-reducing requirements to FDI and domestic companies, and furthermore should adjust the FDI distribution industry structure.

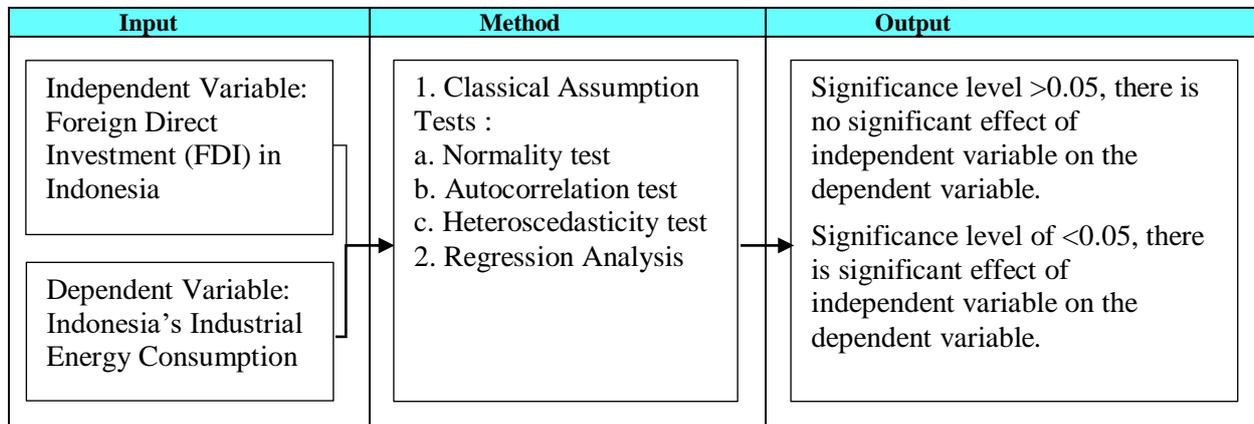
Leitao (2015) examined the relationship between energy consumption and foreign direct investment, for the period 1990–2011 by applying unit root test and panel data. The result has shown a positive impact of FDI on energy consumption and implied that energy consumption is necessary to attract foreign direct investment.

Omri and Kahouli (2013) test a global panel consisting of 65 countries with 1990–2011 dataset on the interrelationships between energy consumption, foreign direct investment and economic growth using dynamic panel data models in simultaneous-equations. They also investigate this interrelationship for the three income panels level of countries, that consists of high income, middle income, and low income panels. As the results they find that there are bi-directional causal relationships between energy consumption, FDI inflows and economic growth for the high-income countries, there is bi-directional causal relationship between economic growth and energy consumption, and between economic growth and FDI inflows; and bi-directional causal relationship from FDI to energy consumption for the middle-income countries, and there is also bi-directional causal relationship between energy consumption to FDI inflows for the low-income countries. However, for the global panel, they find an uni-directional causal relationship from FDI to energy consumption.

Sadorsky (2010) collected data of a sample of 22 developing economies and found a statistically positive significant relationship between energy consumption and FDI. Tang (2009) stated that the flow of FDI is generating energy consumption through the extensivication of industrialization, transportation and manufacturing sectors development while energy is needed to help the process of manufacturing. Mielnik and Goldemberg (2002) studied a sample of 20 developing countries and found a positive relationship between energy intensity and FDI.

2.3. Research Framework

Figure 1 Research Framework



2.4. Hypothesis

Based on previous research and FDI and the condition of industrial energy consumption in Indonesia, the hypothesis of this study is : there is a significant effect of Foreign Direct Investment on Indonesia's industrial energy consumption during the period of 2000-2013.

3. RESEARCH METHODOLOGY

3.1. Data and Sample

Data have been collected from the website of Indonesia BPS. The samples were the foreign direct investment and Indonesia's industrial energy consumption data during the years of 2000-2013.

3.2. Data Analysis

1. Classical Assumption Tests

Before starting data analysis using regression analysis, we run classical assumption tests on data variables.

a. The Normality test

Normality test was used to determine the data distribution. The regression model is considered good if the data were normally distributed. The histogram and the normal p-p plot regression test were used in this study.

b. The Autocorrelation test

Autocorrelation test was used to determine the correlation between residues in a time series data. A good regression model did not have an autocorrelation indication. The Durbin-Watson test was used in this study. If the value of Durbin-Watson (DW) = 2, it indicates there is no autocorrelation. If the value of DW<2, then there is a possibility of a positive autocorrelation indication. Meanwhile, if the value of DW>2, then there is a possibility of a negative autocorrelation indication. Furthermore, the DW value was compared to the Durbin-Watson table.

c. The Heteroscedasticity test

Heteroscedasticity test was used to determine the inequality variant of the residual value among observations. The regression model was good if there is no heteroscedasticity indication. There is no occurrence of heteroscedasticity if the value of the significance level is >0,05.

2. Regression Analysis

Regression analysis performed using software IBM SPSS Statistics version 24. The following equation is the regression models used in this study: $Y = \beta_0 + \beta_1 * X_1 + e$.

We apply the partial test (t-value) to determine whether the independent variable has a significant effect on the dependent variable. The effect was significant if the p value < 0.05.

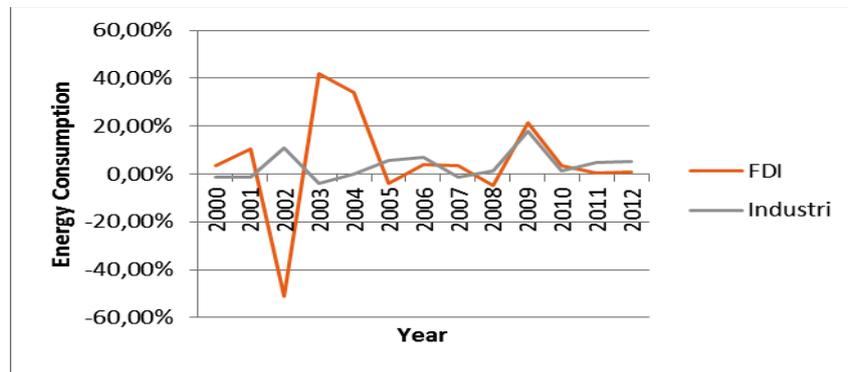
We also analyzed the R2 value to determine how far the dependent variable can be explained by the independent variable. The higher R2 value is desirable.

4. RESULTS AND ANALYSIS

4.1. Overview of Data

The graph below shows the growth of FDI and Indonesia industrial energy consumption from 2000 to 2013. The Foreign Direct Investment (FDI) and Indonesia's industrial energy consumption data in 2000-2013 fluctuates. Data from the year 2000 to 2005 have a negative correlation. However, both data have a similar shape fluctuation during the year 2006-2010. The increase and decrease of industrial energy consumption variable follow the pattern of FDI data, as shown in Figure 2.

Figure 2 FDI and Industrial Energy Consumption Data Fluctuations in 2000-2012

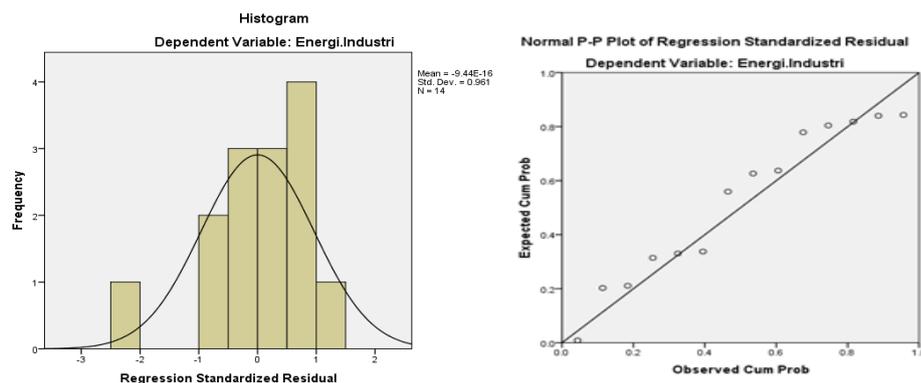


4.2. Classical Assumption Tests

a. Normality test:

The normality test in this study conducted using the histogram graph. The histogram of the normality test on figure 3 (a) shows a bell-shaped curve. It shows that the data is normally distributed. We also perform a test with normal p-p plot of regression to ensure the data is normal linear data. The result shows the data was scattered around the slanted line and distributed normally, as shown in figure 3 (b).

Figure 3 (a) Histogram of Dependent Variable (b) Normal P-P Plot of Regression



b. Autocorrelation test

The Durbin-Watson test has conducted and obtained the DW value of 1,772. This value is compared to the Durbin-Watson table.

Table 1 Durbin-Watson Test Result

Model	Std Error of the Estimate	Durbin Watson
1	18,1352432	1,772

a Predictors (constant), FDI

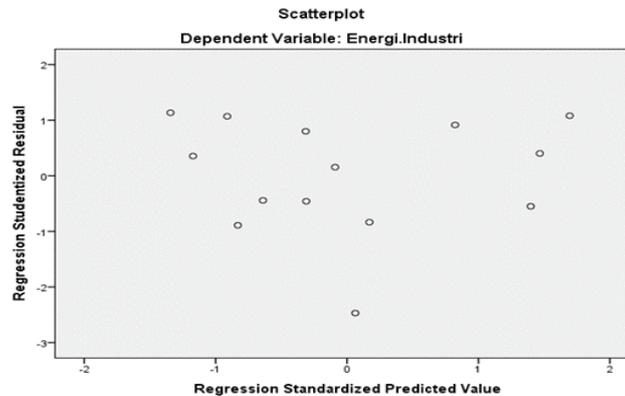
b Dependent variable: Industry Energy Consumption

Analysis of the data shows the value of dL and dU, 1,772 and 1,350 respectively. Therefore, this result shows that there is no autocorrelation as indicated by the value of $dU < dW < (4-dU)$ or $1,350 < 1,772 < 2,650$, respectively.

c. Heteroscedasticity Test

We perform the test using the scatterplot, and the following figure 4 is the result.

Figure 4 Scatterplot Dependent Variable



Based on the scatterplot graph, the residues were evenly distributed without a specific pattern. Therefore, scatterplot indicates that the heteroscedasticity is not found.

4.3. Regression Analysis

The regression analysis was performed using IBM SPSS Statistics software version 24, and generated results as follows:

Table 2 Model Summary

Model	R	R Square	Adjusted R Square
1	0,944 ^a	0,891	0,881

a Predictors (constant), FDI

b Dependent variable: Energy Industry

The regression summary shows a strong positive correlation between the independent variable (FDI) and the dependent variable (Indonesia industrial energy consumption). The correlation was shown by the R-value of 0,944. Furthermore, the R2 value of 0,891 indicates that 89,1% alteration in the industrial energy consumption can be explained by the fluctuations of FDI

Table 3 The Regression Test Result

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std Error	Beta	t	Sig.	Tolerance	VIF
1	constant	14,194	3,629		3,911	0,002		
	FDI	-0,041	0,309	-0,038	-0,132	0,897	1,000	1,000

From the table above, the new regression equation is as follows: Industrial Energy Consumption = 14,194 - (0,041 * Foreign Direct Investment) + e.

The equation shows that there is an insignificant negative effect of Foreign Direct Investment on Indonesia’s industrial energy consumption in 2000-2013.

4.4. Discussion

The model of this study has passed the classic assumption test and signify that the model is valid for decision making or data analyzing. The result showed that the FDI has not a significant negative effect on Indonesia’s industrial energy consumption. The regression equation stated that every FDI value increment would decrease the consumption of industrial energy. The insignificant negative influence of FDI on industrial energy consumption can be explained by starting the development of green manufacturing sector and beginning to encourage Research and Development in green technology. This result is in line with Bento (2011) that showed a negative effect of FDI on energy consumption in the context of Portugal, during the period of 1980–2007.

From the economic point of view, FDI is a potential source of capital for the country's development and industrial development. Therefore, governments can make some efforts to attract the inflows of foreign direct investment and increase investment in energy infrastructure and encourages Research and Development in green technology.

5. CONCLUSIONS

From the regression analysis shows the result that the effect of Foreign Direct Investment on Indonesia's industrial energy consumption in 2000-2013 was negative insignificant. R square value obtained was 0.891. This number indicates that 89,1% changes on the industrial energy consumption can be explained by the FDI variable. Furthermore, for further study, we suggested to do research about the correlation between industrial energy consumption and CO2 emissions in Indonesia and compared to other countries.

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