

The Correlation of Financial Development on Energy Consumption: A Study Case in Indonesia

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Abstract:

The relationship between energy consumption and financial development is still uncertain. This study aims to analyse the correlation between energy consumption, financial development, and energy price. This study will use regression model, ordinary least square (OLS) with time series data from 2002-2014. The result show that the regression model is statistically significant, but only energy price that positively significance to determine the model.

Keywords: *Financial development, Energy consumption, Energy price*

I. Introduction

Over the past decades, the relationship between economic growth and energy consumption has been a topic of academic interest among energy economist, environmental scientist and policy maker. Even so, the available evidence on the causality between economic growth and energy consumption remains uncertain. However, it is essential in several reasons to understanding the determinants of energy demand and its modelling for our nation as the economy growing up. First, the energy growth literature has emphasized the importance of energy in helping Indonesia economies to grow and prosper. Second, as the space for economic prosperity by many emerging economies intensifies, it also requires a lot of energy to produce almost all goods and services. Third, many emerging economies are growing very rapidly that has created a spurt in the demand for energy and compelled us to manage global emissions of greenhouse gases in the

future. Energy is the engine of the industry and all economic activity, thus it is definitely clear that to achieve the high industrial production which will trigger the high economic growth, a country needs to consume energy in the great amount [1].

Indonesia as one of country in emerging economies has lot of natural resources, mine, coal, and oils. The mining industry sector, such as oil, coal, and gas, uses 70% fossil energy from the total energy consumed [2]. As a country ranked fifth in coal production with a total of 502,653 thousand short tons making Indonesia the ninth largest energy producing country with total 15,159 quadrillion BTUs. Based on U.S. Energy Information Administration in 2016, Indonesia's energy consumption is 7.248 Quadrillion BTU. Although there was global recession in 2009, the major energy consumption

in Asia – China and India – have hardly been affected. The international Energy Agency (IEA) (2009) reports that the global energy use is expected to fall significantly in 2009, the first time since 1981. Nevertheless, the demand would be back on the long-run trend once the economic recovers quickly. Barring major policy changes, global demand for primary energy is projected to rise by 40% in 2030 from its 2007 level.

To the best of our knowledge, the energy literature has very little to say about the relationship between financial development and energy consumption especially for Indonesia, a recent issue that is likely to grow in tandem with the prosperity of emerging economies. Understanding the role of financial development is crucial because it allows a country to promote banking and stock market activities along with attracting the inflows of foreign direct investment that will increase the economic efficiency of a country's financial system and this can affect economic activity and also the demand for energy.

One of direct way for financial development can affect the demand for energy is by making it easier for consumers to borrow money to buy big items like automobiles, houses, or electronics. In other word, it would make consumers satisfy their wants and needs by higher up their financial development. [3] has run a study on the nexus between financial development and energy demand in a sample of 22 emerging economies and finds the positive effect of financial development on energy demand. Islam et al. examine the relationship among energy consumption, aggregate production, financial production, and population in Malaysia and they find that economic growth and financial development are effective on energy use both in the short and in the long run.

This paper primary purpose are: First, to see the correlation between financial development and energy consumption; and second, to examine which indicator – financial development, inflation, and income – affect energy consumption in Indonesia. This will give government or banker more view whether their lending to energy sector could help increasing energy consumption or not.

The outline of this article as follows: Section 2 presents the empirical literature while Section 3 provides data and methodology. Empirical findings of the paper presented in Section 4. In the last section, we conclude the study.

II. Literature Review

The Nexus between energy consumption and economic growth

The issue of energy consumption mainly focuses on the relationship between energy and income. Recently studies reviewed the energy-growth nexus and identified three prevailing viewpoints on this issue. The first view states that energy is an input of production, and thus forms a causality running from energy consumption to economic growth. A second view states that causality runs in the opposite direction – economic growth influences energy consumption. The third view is that the relationship is bidirectional – economic development affects energy consumption, and vice versa. While most other studies have focused on the causal relationship with in bivariate time series, there is still lack of literature that state more than two variables. These studies ignore several important factors of energy consumption (such as financial development and the previous level of energy consumption), as well as the specific characteristics across countries, and thus have failed to identify any consensus in the energy-growth correlation.

One recent study has considered specific characteristics across countries, dividing these countries into three groups: low income, lower middle income, and upper middle income [4] have ascertained that there is long-run Granger causality running from GDP to energy consumption in low-income countries, and bidirectional causality between energy consumption and GDP for middle-income countries. Although this studies use a panel dataset, they focused on a bivariate causality correlation, which eliminate factors that affect energy consumption such as financial development, the previous level of energy consumption and energy prices.

The Nexus between financial development and energy consumption

The relationship between income and financial development has been discussed widely over the past few decades [3]. [3] study found that an efficient financial system creates more products, and the inputs for these products increase the demand for energy. Thus, financial development is a factor which should be taken into account in energy consumption. The relationship between financial development and energy consumption has been discussed in recent previous studies [5]; [6]; [3]. [6] discussed the effect of FDI on energy intensity in 20 developing countries. They found a clear decline in energy intensity as FDI increases, because governments can provide financing support and encourage the licensing of sustainable energy technologies and services.

The Indicator of financial development

Based on International Monetary Fund on their balance-of-payment data, the degree of financial development correlates with financial account, which are related to international short- and long-term financial flow of the private and public sector. The indicator used to assess the

development of financial institution: domestic private credit and domestic credit by the banking sector as a share of GDP, representing banking-sector depth and financial sector development in terms of size.

Empirical methodology

We gathered annual data for the period 2002–2014. The data of energy consumption is measured as energy use in kg of oil equivalent per capita and real GDP per capita is measured as constant 2005 US dollars. Energy price are proxied using the consumer price index (cpi, 2005=100). Financial development is measured by outstanding of investment loans/credits in rupiah and foreign currency of commercial and rural banks in billions of rupiah, collected from Bank Indonesia data statistics. Coal production are measured by thousand short tons and collected from U.S. Energy Information Administration. Inflation are measured by the annual growth rate of GDP implicit deflator shows. The GDP implicit deflator is the ratio of GDP in current currency to GDP in constant currency.

To estimate which variables in particular significant to predict energy consumption in Indonesia, we will use multilinear regression. These regressions will estimate the relationship between energy consumption, financial development, and energy price. The function relationship among energy consumption, financial development, and energy price can be represented as follows:

$$EC_t = \beta_0 + \beta_1 FD_t + \beta_2 EP_t + \varepsilon_t$$

Hypotheses:

H_0 : all independent variables are not significant influence dependent variable

H_1 : all independent variables are significant influence dependent variable.

Multi collinearity test

Multilinear regression assumes that the independent variables are not highly correlated with each other. In this result, it shows that energy consumption and financial development

has positive correlation as high as 0.8175. Energy price and energy consumption has positive correlation on 0.9101. Financial development and energy price has positive correlation a little lower as 0.8915.

Energy Consumption (EC)	Financial Development (FD)	Energy Price (EP)	
1.000	0.8175	0.9101	EC
	1.000	0.8915	FD
		1.000	EP

Homoscedasticity test

Homoscedasticity assumption states that the variance of error terms are similar across the values of the independent variables. The standardized residuals plots can shows the

predicted value whether points are equally distributed across all values of the independent variables. The assumption tests and plots can be automatically included while conducting a regression.

1. Result

Variable	Coefficient	Std. error	z	p-value
FD	0.000117919	0.000837522	0.1408	0.8880
EP	1.68721	0.438810	3.845	0.0001
Const	666.551	26.4192	25.23	1.89e-140
R-squared	0.828550	Adjusted R-squared	0.794261	
S.E. of regression	19.80061	S.D. dependent var	43.65357	
F(2, 10)	154.0486			
P-value(F)	3.07e-08			

The regression model as follow:

$$EC_i = 666.511 + 0.000117919FD + 1.68721EP$$

FD at 5% significant level financial development is not significant to determining energy consumption in Indonesia. Coefficient FD is 0.0001179, indicates that an increase in financial development by one billion rupiah will leads to increasing energy consumption by 0.000117919. This can confirm by the previous study that not all financial development give a significant effect on energy consumption.

EP at 5% significant level energy price confirmed as significant to energy consumption. Coefficient EP is 1.68721, indicates that an

increase in energy price by one poin will leads to increasing energy consumption by 1.68721.

Over all the null hypothesis of F-test is rejected at 5% significant level (p-value 3.07e-08) proving the model is statistically significant. The result also indicates 82,8% variation in energy consumption explained by independent variables on regression equation. Thus, this regression model is appropriate to analysis the determinant of energy consumption.

III. Conclusion

Two different factors evaluated in this research using regression model. The result showed that only one factor that significance to this regression model is energy price, while the

whole regression model is statistically significant. From the analysis, it can conclude that financial development is still uncertain, proven by the result not significant. From this

research we also adding more prove to previous study that even energy price is rising, energy consumption will also be rising.

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