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The Relationships between Energy Consumption, Energy Prices, and Economic Growth for Investment Opportunities in the Money Market: A Case Study of Time Series in Asian Newly Industrialized Countries

ความสัมพันธ์ระหว่างการบริโภคพลังงาน ราคาพลังงาน และความเติบโตทางเศรษฐกิจ เพื่อโอกาสลงทุนในตลาดเงิน: กรณีศึกษาอนุกรมเวลา ในประเทศอุตสาหกรรมใหม่ของเอเชีย

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บทคัดย่อ

งานวิจัยนี้ศึกษาความสัมพันธ์เชิงสาเหตุระหว่างการบริโภคพลังงาน ราคาของพลังงานและรายได้ในประเทศอุตสาหกรรมใหม่ในเอเชีย 6 ประเทศ ได้แก่ อินเดีย อินโดนีเซีย มาเลเซีย ฟิลิปปินส์ ไทย และจีน โดยทำการทดสอบด้วยวิธีหาความสัมพันธ์เชิงดุลยภาพระยะยาว (Cointegration) และใช้แบบจำลองการวิเคราะห์ความสัมพันธ์เชิงดุลยภาพระยะสั้น (Error-Correction Model) ผลจากการทดสอบความเป็นเหตุเป็นผล (Granger Causality Model) พบว่าอินเดียมีความสัมพันธ์ระยะสั้นแบบสองทิศทางในการบริโภคพลังงานและรายได้ รวมถึงมีความสัมพันธ์ระยะสั้นในทิศทางเดียวคือราคาพลังงานเป็นสาเหตุของการบริโภคพลังงาน ส่วนความสัมพันธ์ในเชิงระยะยาวนั้น การบริโภคพลังงานและราคาพลังงานเป็นสาเหตุของรายได้ในประเทศอินเดีย และอินโดนีเซีย ในขณะที่ประเทศมาเลเซียและฟิลิปปินส์ผลของการทดสอบพบว่ารายได้และการบริโภคพลังงานเป็นสาเหตุของราคาพลังงาน สำหรับประเทศไทยการบริโภคพลังงานเป็นสาเหตุของราคาพลังงาน ดังนั้นราคาพลังงานและการบริโภคพลังงานไม่ได้เป็นสาเหตุของรายได้ในประเทศมาเลเซีย, ฟิลิปปินส์ และไทย ประเทศเหล่านี้สามารถใช้นโยบายประหยัดพลังงานหรือส่งเสริมการใช้พลังงานทดแทนได้โดยจะไม่มีผลกระทบต่อรายได้ของประเทศ

คำสำคัญ: การบริโภคพลังงาน ความสัมพันธ์เชิงดุลยภาพระยะยาว การทดสอบความเป็นเหตุเป็นผลด้วยวิธีของแกรนเจอร์

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ABSTRACT

In this research investigation, the researchers study the causal relationships between energy consumption, energy prices, and income in six Asian newly industrialized countries i.e. India, Indonesia, Malaysia, the Philippines, Thailand, and China using the techniques of cointegration and an error-correction model. The Granger causality model found that India exhibited the short-run bidirectional causality relationship between energy consumption and income and the short-run unidirectional causality relationship with energy prices which were the cause of energy consumption. In regard to cointegration, energy consumption and energy prices were the causes of income in India and Indonesia. In Malaysia and the Philippines, the test showed that income and energy consumption were the causes of energy prices. In Thailand, energy consumption was the cause of energy prices. Therefore, energy prices and energy consumption were not the causes of income in Malaysia, the Philippines, and Thailand. These countries could use an energy conservation policy or promote the use of renewable energy without having an effect on their national incomes.

Keywords: Energy Consumption, Cointegration, Granger Causality

Introduction

Energy price fluctuations have long been one of the key economic indicators for predicting the economic growth. Policy makers, researchers, and investors in financial markets are concerned with the effects of the energy price changes because it is one of the variables for producers and consumers to consider in making a strategic planning and project evaluation as well as for investors who interested in investing in energy-related activities, risk management, and portfolio allocation. (Benkraiem, Lahiani, Miloudi, & Shahbaz, 2018). The empirical studies show that the supply and demand shock in energy markets has impacted the real returns in U.S. bond index (Kang, Ratti, & Vespignani, 2016), also in S&P 500 prices, the key economic variables that explain the short run and long run stock market dynamics are crude oil and natural gas (Benkraiem et al., 2018).

There are several studies that have investigated the causal relationships between energy consumption and economic growth in the past two decades, using employment or real income as a proxy. However, the empirical outcomes are rather mixed and conflicting. Kraft and Kraft (1978) found the Granger causality running from GNP to energy consumption in the United States, employing US data from 1947 to 1974. As well as Akarca and Long (1979) who employed the same method, found the unidirectional causality running from energy consumption to employment from the US monthly data of 1973-1978, estimated long-run elasticity of total employment regarding with the energy consumption is negatively impacted.

Conversely, there are numerous empirical findings that have found no causal relationships between income (defined by GNP) and energy consumption; supported by Akarca and Long (1980), Erol and Yu (1987), Yu and Hwang (1984), and Yu and Choi (1985). In the case of energy consumption and employment causal relationships, Yu and Jin (1992), Yu, Chow, and Choi. (1987) and Erol and Yu (1989) found the neutral impacts, referred to as “neutrality hypothesis”.

This paper tests the energy-income relationship for energy-dependent Asian six newly industrialized countries according to Bozyk (2012), Guillen (2003), Mankiw (2014), and Waugh (2000), which consist of India, Indonesia, Malaysia, the Philippines, Thailand, and China. These countries are taken due to the heavy dependence on the industrialization and have not yet reached a developed countries status. In this study we consider a trivariate model (energy consumption, real income, and price) to offer the additional viewpoint to study other channels in the causal relationship between energy consumption and economic growth.

The significant of investigating the causal relationship among price, energy consumption and economic growth is crucial for the policy implementation. The unidirectional causality running from economic growth to energy consumption or price reflect that the energy conservation policy may have little or no influence on income. Conversely, if there is a causal relationship running from energy consumption to economic growth can be interpreted that the less energy consumed would lead to less income or the nation’s wealth. The policymakers should be cautious when implementing the energy conservation policy.

Literature review

The conflicting empirical findings came from the variety of approaches and testing procedures employed to test the relationships. Earlier research used simple log-linear models by ordinary least square methods (OLS) without any concern for the stationarity properties of time series data. Later, Newbold and Granger (1974) have proven that most of the economic time series data are non-stationary at levels. Hence, the results could mislead relationships among variables.

With the advancement of time series analysis in the last decade, the recent studies have found the bivariate causality between energy and growth relationship based on Granger (1969) and Sims (1972) tests. Still, these tests can lead to conflicting results and may fail to spot additional channels of causality. For example, Glasure and Lee (1998) used cointegration and error correction modeling along with the standard Granger test to examine the causality between energy consumption and GDP for South Korea and Singapore. By testing standard Granger test, they found no causal relationship between GDP and energy consumption in South Korea while the unidirectional running from energy consumption to GDP was found in Singapore. However, once they took cointegration and error correction model, the bidirectional causality between income and energy consumption was found in both countries.

The directional causality relationship is significant for the policy implications. For instance, if there is a unidirectional running from energy consumption to income, reduce energy consumption may lead to the fall of income and employment. Conversely, if there is a negative causality relationship (Akarca & Long, 1979) running from employment to energy consumption, the employment will increase if the energy conservation policy is implemented. In addition of the other examples in policy implementation, the energy conservation policies may be implemented with little or no effects on growth when there is a unidirection of causal relationship running from income to energy. Lastly, if the findings have found no causality relationship in either directions, or called neutrality hypothesis (Yu & Jin, 1992), they would suggest that the energy conservation policies have no effect on the economic growth.

There are more recent empirical studies regarding energy consumption and economic growth. For instance, Fernandes and Reddy (2020) apply Johansen's cointegration test and Toda Yamamoto causality test to find the long-run relationship between energy used and economic growth of six newly industrialized countries in Asia which are China, India, Indonesia, Malaysia, the Philippines, and Thailand

from 1971 to 2018. The outcomes show long run relationship in China, India, and Indonesia but the energy consumption cannot correct itself to equilibrium when shock is intervened toward real GDP when applying VECM. In addition, when applying Toda Yamamoto causality test, there is a unidirectional running from economic growth to energy consumption in India and Thailand.

Moreover, there are papers that specifically examine the energy-related cointegration tests for individual country. Rafindadi and Ilhann (2017) utilize the trade openness, financial development, and economic growth to examine the energy consumption in South Africa. The methodologies applied here are Bayer-Hank combined cointegration test and Granger causality test, the results show the financial development, which is proxied by the real domestic credit, and trade openness positively influence the energy consumption. Ghosh and Kanjilal (2016) employ nonlinear multivariate model to explore the relationship among oil prices, exchange rate and stock market in India by using threshold cointegration in to define the endogenous structural breaks and Toda Yamamoto Granger causality. The findings show that the stock market has been incorporated since 2009 with the international events while the global oil price is exogenously determined when applying causality test.

The empirical panel cointegration tests and panel causality tests are extensively utilized. For instance, Belke, Drobnik, and Dreyer (2011) who employ panel cointegration and Granger causality to examine the long-run relationship among 25 OECD countries, this research aims to distinguish between the national and international components that drive the long-run energy consumption and economic growth relationship and the results reveal the domination of international developments. Moreover, the findings show price inelasticity of energy consumption and the bi-directional causal relationship of economic growth and energy consumption. Fang and Chang (2016) engage human capital, energy consumption and economic growth to examine the long-term relationship. The outcomes confirm the essential of interdependence across 16 Asia Pacific countries. Regionally, the panel bootstrap Granger causality test exposes the economic growth is causing the energy consumption, but the relationship of energy used and GDP is differed for different countries during 1970-2011. Similarly, Bilgili, Ozturk, Kocak, and Bulut (2017) investigate the connection of energy consumption and youth unemployment in 20 European countries during 1990-2011. The results from employing panel fully modified ordinary least squares and panel dynamic ordinary least squares show that the energy consumption is negatively impacted the youth unemployment rates. Also, there is a unidirectional causality running from energy used to youth unemployment rates. The research suggests that the

policymakers should encourage energy consumption to promote the youth employment. Syzdykova, Azretbergenova, Massadikov, Kalymbetova, and Sultanov (2020) explore the energy consumption and economic growth relationship by using panel cointegration and panel causality test for Commonwealth of Independent States during 1992-2018. The findings reveal bidirectional causality between energy used and economic growth which can be interpreted that the higher energy used results in higher income and vice versa. Therefore, the renewable energy should be promoted (Pirlogea & Cicea, 2012).

Methodology

Economic and energy use profiles

Table 1 describes the economic and energy used profile in year 2018. The six countries that we investigated are heavily populated with the total of 3.2 billion people. Out of the six, India is the least wealthy on a per capita income with a GDP per capita of US$1,981.27. The others have per capita income over US$3,000 where Malaysia has the highest GDP per capita over US$10,000. The highest growth rate for manufacturing value added in 2018 is India which is 5.93%. Malaysia, the Philippines, and Indonesia have the manufacturing growth rate over 4% whereas Thailand where it can perform only 2.99%. Unfortunately, the data for China manufacturing growth rate is available up to year 2014 which is 6.93%. For energy consumption, the country that consumed the most is China at 13,524.98 barrel per day followed by India, Indonesia and Thailand respectively. The countries that consume energy less than a thousand barrel a day are Malaysia and the Philippines.

Table 1 Economics and energy consumption profiles as of 2018 [a]

Country/ indicator	Population (millions)	GDP per capita (US$)	Annual growth rate for manufacturing value (%)	Energy consumption (barrel/day)
India	1,352.61	1,981.27	5.93	5,155.75
Indonesia	267.66	3,893.60	4.27	1,785.14
Malaysia	31.53	11,373.23	4.95	813.79
Philippines	106.65	3,102.71	4.93	465.97
Thailand	69.43	7,273.56	2.99	1,477.83
China	1,392.73	9,770.85	6.93	13,524.98

[a] Source: CEIC

Data

Annual time series data are employed in this study. The data cover period 1965-2018 for all countries. The data were acquired from CEIC.

en: energy use refers to oil consumption in barrel per day.

y: real income, defined as GDP Data are in constant local currency.

p: prices. Since energy prices were not available, this variable was proxied by the consumer price index (CPI), 2010 = 100.

This study employed the model based on ler-Granger methodology (see Granger and Newbold, 1974; Engle and Granger, 1981). Stationarity for time series data is tested by Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) methodology (see Dickey and Fuller, 1981; Phillips and Perron, 1988). Following the unit root, the long run relationship is estimated by using Johansen cointegration (1991) test by first formulating vector autoregression (VAR):

$$y_t = \mu + A_t y_{t-1} + \ldots\ldots + A_n y_{t-n} + \varepsilon_t \quad (1)$$

Where y_t is denoted by $nx1$ integrated of I(1) variables vector of variables and ε_t is an $nx1$ innovations vectors. It can be written as:

$$\Delta y_t = \mu + \Pi y_{t-1} + \sum_{i=1}^{n-1} \Gamma_i \Delta y_{t-i} + \varepsilon_t \quad (2)$$

Note that:

$$\Pi = \sum_{i=1}^{n} A_i - I \text{ and } \Gamma_i = -\sum_{j=i+1}^{n} A_j \quad (3)$$

Where Π is the coefficient matrix and it is a reduced rank $r < n$. r is the cointegration relationships number. We then estimate the error correction model:

$$Dy_t = A_{21}(L)D_{y-1} + A_{22}(L)Den_{t-1} + A_{23}(L)Dp_{t-1} + \lambda_y ECT_{t-1} + u_{2t} \quad (4)$$

$$Den_t = A_{11}(L)D_{y-1} + A_{12}(L)Den_{t-1} + A_{13}(L)Dp_{t-1} + \lambda_{en} ECT_{t-1} + u_{1t} \quad (5)$$

$$Dp_t = A_{31}(L)D_{y-1} + A_{32}(L)Den_{t-1} + A_{32}(L)Dp_{t-1} + \lambda_p ECT_{t-1} + u_{3t} \quad (6)$$

Where $[y_t, en_t, p_t]$ are real income, energy used (consumption) and prices, respectively. D is a difference operator; $A_{ij}(L)$ are polynomials in the lag operator L; ECT is the lagged error-correction term(s) derived from the long-run cointegrating relationship; and the u_{it}s are error correction terms assumed to be uncorrelated and random with mean zero. The coefficients, λ_i (i = en, y, p), of the ECTs represent the deviation of the dependent variables from the long-run equilibrium.

The ECM (error correction model) enables an additional causality channel which is unnoticed by standard Granger (1969) and Sims (1972) testing procedures. In the Granger sense a variable X causes another variable Y if the current value of Y can better be predicted by using past values of X than by not doing so. The Granger causality testing procedure involves testing the significant of the A_{ij}s conditional on the optimum lags. Through the ECT, an error correction model offers an alternative test of causality (or weak exogeneity of the dependent variable). If λ_{en} is zero, it means that the change in en_t does not respond to deviation in long-run equilibrium in period t-1. Moreover, if λ_{en} is zero; both A_{11} and A_{13} are zero, it implies that income and prices do not Granger cause energy consumption. The non-significance of both t and Wald F-statistics in the ECM will imply that the dependent variable is weakly exogeneous.

If the variables, $y_t, en_t, and\ p_t$, are cointegrated, then it is expected that at least one or all of the ECTs should be significantly non-zero. Granger causality of the dependent variables is tested as follows: firstly, by a simple t-test of the λ_is; secondly, by a joint Wald F-test of the significance of the sum of the lags of each of the explanatory variables in turn; thirdly, by a joint Wald F-test of the following interactive terms: equation 1 --- (λ_y and A_{22}), (λ_y and A_{23}); equation 2 --- (λ_{en} and A_{11}), (λ_{en} and A_{13}); and equation 3 --- (λ_p and A_{31}), (λ_p and A_{32}).

Empirical results and discussion

Table 2 shows the results of stationary test. We conducted both Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) to test for unit root. The empirical results show that energy variable has a unit root when testing at level for all countries when we test for both ADF and PP. Moreover, the energy variable becomes stationary when we take the first difference except India which becomes stationary at second difference. Similarly, the income variable is not stationary at level for all countries and it becomes stationary at first difference for most of the countries except for India, the Philippines and China where the null hypothesis of having a unit root is rejected. For the price variable the data is stationary at level with the exception in China where the null hypothesis is rejected at 10% level. These can be concluded that most of the variables has unit root at level, but they become stationary after first and second difference.

Table 2 Results of unit root test

Country/ Variable	Augmented Dickey-Fuller (ADF)		Phillips-Perron (PP)	
	Levels	First differences	Levels	First differences
India				
y_t	5.6437	7.3922	50.2758	0.4929
en_t	1.6637	0.9774	8.4115	-2.5926
p_t	-4.2542***	-3.1217***	-4.5316***	-12.2566***
Indonesia				
y_t	3.6533	-3.0653**	6.4775	-2.9428**
en_t	1.3488	-2.6229*	1.3391	-6.5199***
p_t	-12.4845***	-6.7513***	-12.4845***	-82.3009***
Malaysia				
y_t	6.6100	2.8532	8.1871	-4.7279***
en_t	0.7517	-7.4932***	0.7890	-7.4895***
p_t	-6.7362***	-5.8947***	-6.7550***	-37.9198***
Philippines				
y_t	3.9511	2.0226	8.2778	-1.1640
en_t	-0.6804	-5.1244***	-0.7160	-5.2941***
p_t	-4.9256***	-5.7730***	-4.9256***	-19.7483***
Thailand				
y_t	3.6507	-4.6626***	3.1088	-4.7069***
en_t	1.3079	-5.0164***	1.7452	-5.0735***
p_t	-4.1554***	-8.2438***	-4.0407***	-20.5428***
China				
y_t	0.0385	1.5727	12.2724	1.2732
en_t	6.9063	0.3390	6.8652	-4.0194***
p_t	-2.6830*	-4.9915***	-2.9171*	-7.7190***

Notes: (*) Significant at the 10%; (**) Significant at the 5%; (***) Significant at the 1%.

After we test for data stationary where they show that most of the variables are I(1), which meet the criteria to for cointegration, Johansen's multivariate maximum likelihood cointegration are estimated as seen in table 3. The cointegrated number is represented by r. As the results show, the null hypothesis of no cointegration relationship is rejected at 5% significant level and 1% significant level for Indonesia and

Thailand respectively, which can be interpreted that there is a long-run relationship among income, energy and price. For India, there exists two long-run relationship among variables. Additionally, the Philippines and Malaysia show three cointegration relationships at 1% significant level. However, the result reveals no long-run relationship in China. Therefore, we disregard China in the next step. The cointegration outcomes indicate that there is at least one direction of Granger causality. In order to enable us to show the temporal causality direction between the variables, ECM is examined. The purpose of employing ECM is to determine the short-run and long-run Granger causality.

Table 3 Results of Johansen's maximum likelihood test for multiple cointegrating relationships (intercept, no trend)

Country/ Null hypothesis	Characteristic roots	Test statistics[a]	5% Critical value
India			
r = 0 r = 1	0.465927	50.92887***	29.79707
r = 1 r = 2	0.295486	18.31328**	15.49471
r = 2 r = 3	0.001930	0.100439	3.841466
Indonesia			
r = 0 r = 1	0.294732	30.01148**	29.79707
r = 1 r = 2	0.193952	11.85425	15.49471
r = 2 r = 3	0.012278	0.642391	3.841466
Malaysia			
r = 0 r = 1	0.580844	70.20105***	29.79707
r = 1 r = 2	0.340871	24.98639***	15.49471
r = 2 r = 3	0.061687	3.310931*	3.841466
Philippines			
r = 0 r = 1	0.363451	46.27477***	29.79707
r = 1 r = 2	0.306830	22.78670***	15.49471
r = 2 r = 3	0.069214	3.729721*	3.841466
Thailand			
r = 0 r = 1	0.339942	36.55016***	29.79707
r = 1 r = 2	0.199257	14.94789	15.49471
r = 2 r = 3	0.063161	3.392699	3.841466
China			
r = 0 r = 1	0.226271	22.03729	29.79707
r = 1 r = 2	0.153118	8.697556	15.49471
r = 2 r = 3	0.001066	0.055450	3.841466

Note: λ_{max} value is the test statistic. Significant at the ***1% level, the **5% level and the *10% level.

The ECM lagged explanatory variables is described in table 4 by joint Wald F-statistics where it shows the short-run causal effects. The ECTs's joint Wald F-statistic is the interactive term that reveals the variables that carry the short-run adjustment for the long-run equilibrium when the shock intervenes the system.

The empirical results in India show the bidirectional short-run causality running between energy and income. Moreover, in the energy equation, there is Granger causality running from price to energy consumption. Also, in the long run, the energy consumption and price cause the real income. Also, this long-run Granger causality test is consistent with Indonesia. Hence, the income for India and Indonesia is depending on the energy consumption. The higher energy price and the quantity these counties consumed, the more income they receive. The short-run effect in table 4 does not exist for Indonesia, Malaysia, the Philippines, and Thailand. However, in the long run, it indicates that the real income and energy consumption cause the price in Malaysia and the Philippines. In Thailand case, the energy consumption causes the price.

The empirical results reveal the country's specific economic background. For instance. The long run causality in India and Indonesia show the energy consumption and price cause income which can be described by the heavily reliance on the countries' energy sector. Whereas Thailand, energy consumption does not cause the real income because the country's economy is more likely to rely on the service sector.

The diagnostic tests that are not shown here which are LM serial correlations, hetoroskedasticity Engle test, and normality tests are examined as well as the ECMs which validate a fair goodness-of-fit on the R^2 and F statistics.

Table 4 Temporal Granger-causality results for India, Indonesia, Malaysia, the Philippines and Thailand

Country/ dependent variable	Short-run effects				Source of causation:		
	Dy_t	Den_t	Dp_t	ECT[a] only	Dy_t, ECT	Den_t, ECT	Dp_t, ECT
	Wald F-statistics			t-Ratio	Wald F-statistics		
India							
Dy_t		7.220115**	1.751255	-1.478230		7.78405***	28.4654***
Den_t	13.12906***		9.702904***	-3.81262***	1.64205		0.22376
Dp_t	3.351515	0.531163		1.750907	1.95184	0.25517	
Indonesia							
Dy_t		0.815916	0.194314	0.582951		2.98598*	3.57444*
Den_t	1.218695		0.043370	0.237865	0.08764		0.02554
Dp_t	0.202631	0.435978		-11.2829***	0.94760	0.22608	
Malaysia							
Dy_t		4.597489	0.314874	-3.60230***		2.33324	0.27555
Den_t	0.493978		1.383026	0.660426	0.15230		0.00090
Dp_t	4.451573	3.694256		-3.30608***	7.02202**	3.05410*	
Philippines							
Dy_t		2.350136	0.316976	-3.22620***		0.04238	13.8282***
Den_t	1.765129		0.902632	-0.792371	2.1E-06		0.63616
Dp_t	2.235899	1.214330		2.190860**	15.3881***	7.48920***	
Thailand							
Dy_t		0.156402	3.473513	-0.987904		1.06893	0.08368
Den_t	3.170932		2.657159	-1.020604	0.00042		1.34247
Dp_t	1.129373	2.354965		5.102906***	1.10696	4.32376**	

[a]ECT-error correction term in the error-correction model. Significant at the ***1% level, the **5% level and the *10% level.

Conclusion

The objective of this study is to test for Granger causality between energy consumption, real income and price for Asian newly industrialized countries. Maximum likelihood techniques were used to analyze the time series properties of the variables and error-correction models were anticipated and employed to test for the Granger causality direction. The concluding results show that the short-run effects only exist in India where there is bidirectional causality between energy consumption and real income whereas there is the energy price cause energy consumption.

We observe the long-run relationship for India, Indonesia, Malaysia, the Philippines, Thailand, and China. The outcomes show no cointegration or long-run relationship among variables in China. However, we find the same outcome for India and Indonesia which indicate that real income is caused by the energy consumption and energy price. In Malaysia and the Philippines, the energy price is coming from the real income and energy consumption. Where, in Thailand, the energy price is caused by the consumption.

The findings can be explained by each country's economic background. India and Indonesia are the world's leading energy producers and consumers according to Energy Information Administration (EIA). Therefore, the falling energy consumption would affect their income since one of the major export earnings in those countries are oil and manufacture. In Malaysia and the Philippines, their main export goods are semiconductors and electronic products. While in Thailand's main export goods are automobiles. The energy production is not a significant component of these three countries' major income, so the energy consumption does not show the significant contribution in the long run relationship.

The energy price has always been one of the main economic indicators when investors evaluating how the economy is doing. It is considered as the main concern for cost of production, hence the profit. Investors perceived the energy price as one of the economic sentiments when looking at the whole market. Stereotyping ideas for developing industrialized countries may be the more energy used, the more production, hence, economic growth. We expect that the countries we studied are sensitive to the oil price shock since they are energy-dependent economies. Surprisingly, there exists short-run relationship between energy and income only in India where the major contributor to GDP is Petroleum sector. For most of the countries, the energy price shock would not severely influence their economies. Therefore, the energy conservation policy would not impact the economic growth and real income.

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