Energy Subsidy and Economic Production: The Evidence from Malaysia and Indonesia

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Abstract
Energy subsidy policy is one of the most favorable policies implemented by many oil producer countries in improving their economic development. However, the economic outcome is still debatable due to the implications on economic efficiency, fiscal policy and et cetera. As two main oil producer countries in ASEAN 5, both Malaysia and Indonesia had allocated 5% of energy subsidy (% of GDP) averagely throughout the period of 1990-2014. This paper is intended to study the impact of energy subsidy on economic production in Malaysia and Indonesia by employing a dynamic panel data analysis. Our finding suggests that the energy subsidy affects the growth output positively in the long run. We conclude that energy subsidy is significant to promote economic growth in both countries. The absence of energy subsidy will bring harm to the economic growth. However, if a reduction of energy subsidy is essential to improve efficiency and fiscal pressure, we suggest the policymaker to implement some offsetting policies to cushion the economy from any shocks.

Keywords: Energy; subsidy; output; panel data analysis

1. Introduction

Malaysia and Indonesia are the net oil exporting countries in ASEAN 5. Accumulatively, they have recorded -117 average value of net energy import throughout 2010-2013. As part of the oil production countries in the world, Malaysia and Indonesia earned averagely 5.8% and 2.4% of oil rent (% of GDP) throughout 2010-2014. Tellingly, their revenue was contributed much by oil production. With the combination of GDP, they have contributed about 52% share of GDP in ASEAN 5 economies for the year 2014. In addition, both Malaysia and Indonesia have achieved the highest economic growth in ASEAN 5 economies which is about 6% and 5% in the year 2014, respectively. Malaysia and Indonesia have allocated a huge amount of subsidy, about 74% share of total subsidies in ASEAN 5 economies were contributed by Malaysia and Indonesia in 2014. Out of this value, 74% were allocated for energy subsidy[2]. In general, as the oil producer countries in the world, it gives them many advantages to invest much on energy subsidy to drive a good performance of their macroeconomics and to increase the economic welfare.

There are many arguments on the role of subsidy in promoting economic growth recently. In one side, it is believed that the subsidy can give a cost advantage to the producer and increase the economic welfare of a society in the market (Van Beers and Van den Bergh, 2001). Consequently, it forms a conducive economic environment to promote a rapid national growth. On the other side, the subsidy program is believed not to form a conducive economic environment derived from the existence of the death weight loss in the market and fiscal pressure problem. Thus, it brings to a situation of where the economic system is unproductive to encourage a rapid national growth (Isaak, 2015; Arzedel Granado et al, 2012). In respect to

[2] All numbers and percentage quoted are retrieved from World Bank Development Indicator (WDI), Bank Negara Malaysia and *Bank* Sentral Republik *Indonesia.*

this matter, the government has initiated to rationalize its subsidy policy to ensure that the subsidy becomes a productive tool to promote growth and reduce its fiscal pressure, concurrently. One aggressive action that has been taken is that to reduce significant amount to be allocated for energy subsidy. To date, Indonesia had managed to reduce its subsidy growth about -85% derived from its initiatives to reduce 148% growths for energy subsidy in 2015. Same as Malaysia, it managed to reduce 16% of its subsidy growth derived from a reduction of 9% growth for energy subsidy in 2014. As both economies are highly dependent on subsidy, specifically energy subsidy, this policy will definitely affect their economic activity as a whole via various channels.

In regards to this matter, we argue that it is important for the current literature to discover the impact of economic shock derives from the absence of energy subsidy in an economy toward the sustainable growth of macroeconomic performance. Thus, this paper is intended to explore the long run impact of energy subsidy on economic output by employing the dynamic panel data analysis. The objective of this paper is to determine the long-run impact of energy subsidy on economic output and its magnitude impact on economic output.

This paper is structured as follows. Next section is the literature review. Section 3 explains the data and methodology employed in this study. The last two sections discuss the empirical result, conclusion and policy implication.

2. Literature Review

Three main conclusions have been made by the previous studies related to the study of energy subsidy and its impact on an economy. First, it has a strong evidence to support that energy subsidy removal will eventually reflect adverse performance on the macro economy and economic welfare (Jiang and Lin, 2014; Lin and Jiang, 2011; Liu and Li, 2011 and Plate, 2014; and Solaymani and Kari, 2014). Jiang and Lin (2014) and Lin and Jiang (2011) have clearly documented their result which shows that the GDP is expected to decrease affected by energy subsidy removal in China. It is also supported by Plate (2014) where it is expected to have the same experience in the net oil importer and net oil exporter countries. Apart of that, energy subsidy removal also reduces the employment rate (Jiang and Lin, 2014; Lin and Jiang, 2011). Basically, an absent of energy subsidy will eventually increase the inflation as the price level increase reflect the increase of production cost (The International Institute of Sustainable Development, 2012). This hypothesis is supported by Manzoor et al, (2009), Jiang and Tan (2013) and Solaymani and Kari (2014).

Second, it has a strong evidence to prove that the energy subsidy removal will eventually improve economic efficiency and reduce fiscal pressure (Jiang and Tan, 2013; Jiang and Lin, 2014; Lin and Jiang, 2011). This evident is clearly stated in Jiang and Tan (2013), Jiang and Lin and Solaymani and Kari (2014). In China, it is expected to increase national saving up to 30% and improve its energy intensity simultaneously due to the execution of energy subsidy removal (Jiang and Lin , 2014; Jiang and Tan, 2013). This empirical result also supported by Solaymani and Kari (2014) where the energy subsidy removal is expected to improve Malaysian fiscal pressure and also economic efficiency.

Third, it has a positive impact on the environment as it is expected to reduce the carbon emission by removing energy subsidy in an economy. Lin and Jiang (2011), Liu and Li (2011), Solaymani and Kari (2014) and Jiang and Lin (2014) have empirically proved that the energy subsidy removal is significant to reduce the carbon emission. It is because the energy subsidy removal reflects a reduction in energy demand as the price of energy become expensive.

All studies above employed an input-output analysis. To the best of our knowledge, there is no study employs panel econometric method in exploring the relationship between energy subsidy and output. To fill the gap in the current literature, this paper employs a dynamic panel data analysis to contribute a new empirical finding on this issue. Since the time series data for energy subsidy is limited for both sample countries, we employ a dynamic panel data analysis in respect to its advantage to treat large sample size derive from a combination of two time series dataset for two sample countries.

3. Data and Methodology

This study employs neo-classical production function. We take into account the factors of labor and capital as control variables in the model. The suggested model is as follows:

$$GDP_{it} = ES_{it} + K_{it} + L_{it} + \varepsilon_{it} \quad (1)$$

where,
Y- Gross Domestic Product (USD constant 2005)
ES – Energy Subsidy (USD constant 2005)
K – Gross Capital Formation (USD constant 2005)
L – Number of Total Employment

A panel data of Malaysia and Indonesia from 1990 to 2014 are employed in this study. The data for all series are taken from World Bank database, Department of Statistics of Malaysia and Indonesia and the central bank of Malaysia and Indonesia.

The panel econometric methods that are employed in this study are as follows:

3.1 The Panel Unit Root Test

The Im, Pesaran and Shin (IPS) unit root test is employed to examine the stationary process of all series in the model. It is based on the heterogeneous panel assumption that allows heterogeneity of the autoregressive coefficient (Im, Pesaran and Shin, 2003). The equation for IPS test is as follows:

$$Y_{it} = \alpha_i + \beta_i Y_{i,t-k} + \sum \varphi_k Y_{i,t-k} + \delta_{it} + \mu_{it} \quad (2)$$

The null hypothesis is expressed as follows:

$H_0 : \beta_i = 0$ For all i

$H_1 : \beta_i < 0$ For at least one i

In a normal practice, if all series are found to be I(1), it allows us to execute the cointegration test for long run cointegration. However, there are some methods that allows us to regress the long run estimator regardless all series are I(1).

3.2 Cointegration Test

We employ Pedroni (1999) cointegration test to analyze the cointegration relationship in eq. (1). It allows heterogeneity of the autoregressive coefficient in panel data model. There are seven different cointegration statistics used to capture the pooled effect and group mean effect.

3.3 Long Run Estimator

We carry out the Pooled Mean Group (PMG) regression to estimate the long-run equation. The PMG regression is a combination of pooling and calculating the average means (Pesaran et. al., 1999). Assuming ARDL (1,1,1,1) equation:

$$Y_{it} = \alpha_i + \beta_{10i}ES_{it} + \beta_{11i}ES_{it-1} + \beta_{20i}K_{it} + \beta_{21i}K_{it-1} + \beta_{30i}L_{it} + \beta_{31i}L_{it-1} + \tau_i Y_{it} + \varphi_{it}$$
(3)

Thus, the error correction equation is as follows:

$$Y_{it} = \omega_i[Y_{it-1} - \rho_{0i} - \rho_{1i}ES_{it} - \rho_{2i}K_{it} - \rho_{3i}L_{it}] - \beta_{11i}ES_{it-1} - \beta_{21i}K_{it-1} - \beta_{31i}L_{it-1} + \varphi_{it}$$
(4)

where

$$\rho_{0i} = \frac{\alpha_i}{1-\tau_i}, \quad \rho_{1i} = \frac{\beta_{10i} + \beta_{11i}}{1-\tau_i}, \quad \rho_{2i} = \frac{\beta_{20i} + \beta_{21i}}{1-\tau_i},$$

$$\rho_{3i} = \frac{\beta_{30i} + \beta_{31i}}{1-\tau_i}, \quad \omega_i = -(1-\tau_i)$$

As a robustness check, we re-estimate the model using pooled OLS, dynamics OLS (DOLS) and fully modified OLS (FMOLS) estimations. Pooled OLS is static model estimation, while DOLS, FMOLS and PMG are dynamic model estimation. The lag length selection for DOLS, FMOLS and PMG are determined by Akaike's Information Criterion (AIC).

4. Empirical Results

Table 1: IPS Test Results

Variable	I(0)		I(1)	
	Constant	Trend	Constant	Trend
LES	0.3362	-3.0815*	-9.3126*	-7.9185*
LK	-0.2388	-0.2468	-4.3603*	-3.439*
LL	-1.2598	-0.1805	-4.6812*	-4.4763
LY	0.6716	-0.6072	-3.7531*	-2.9817*

***, ** and * indicates significant at 1%, 5% and 10% level

The results of panel unit root tests are presented in Table 1. In summary, all panel unit root tests tend to conclude that all series are I(1). Thus, we can proceed to execute the cointegration test.

Table 2: Pedroni Cointegration Test Results

Cointegration Test	No Time Effect	Time Effect
Panel v-Statistic	-0.0038	20.7022*
Panel rho-Statistic	-1.4109***	1.331
Panel PP-Statistic	-3.8733*	0.361
Panel ADF-Statistic	-2.6804*	1.6507
Group rho-Statistic	-0.9471	0.9487
Group PP-Statistic	-4.8483*	0.6234
Group ADF-Statistic	-2.4848*	0.9443
Panel v-Statistic (Weighted Statistic)	-0.0961	22.9694*
Panel rho-Statistic (Weighted Statistic)	-1.3984***	1.2973
Panel PP-Statistic (Weighted Statistic)	-3.727*	0.2963
Panel ADF-Statistic (Weighted Statistic)	-2.7784*	1.3614

***, ** and * indicates significant at 1%, 5% ans 10% level

The results for cointegration test are presented in Table 2. The result for Pedroni (1999) cointegration tests with no time effect indicates that eight out of eleven tests significant to reject the null hypothesis. For the result of Pedroni (1999) cointegration tests with time effect, two out of eleven tests significant to reject the null hypothesis. Thus, we can conclude that our cointegration tests tend to support that all series are cointegrated in the long run.

Table 3: Long Run Estimator

Variable	Pooled OLS	DOLS	FMOLS	PMG
ES	0.08175*	0.1151*	0.0981*	0.0897*
K	0.6778*	0.6022*	0.6412*	0.9326*
L	-2.6239*	-4.6808*	-4.7661***	-1.8363*

***, ** and * indicates significant at 1%, 5% and 10% level

The result for long-run estimator is presented in Table 3. We use PMG estimator to interpret the long-run coefficients. According to the ceteris paribus assumption, we can say that for every 1% increase of ES leads to 0.09% increase on Y while other factors are constant. 1% increases of K tend to increase 0.93% of Y while other factors are constant. 1% increases of L leads to a decrease of Y about 1.83% while other factors are constant. All in all, ES has the smallest magnitude change respect to a change of the exogenous variable of Y. In general, our robustness checks (pooled OLS, DOLS and FMOLS) support our previous findings with PMG estimation.

5. Conclusion and Policy Implication

In summary, this paper employs dynamic panel data analysis to explore the impact of energy subsidy on economic production in Malaysia and Indonesia. Malaysia and Indonesia are oil net exporter countries in ASEAN 5 while allocate a very high amount of energy subsidy in their economy. We conclude that both countries are highly dependent on energy subsidy to drive their economic growth. Our finding indicates that energy subsidy and capital have a positive relationship with the output. Conversely, labor has a negative impact on output.

The finding that energy subsidy gives a positive impact on output is consistent with Jiang and Lin (2014), Lin and Jiang (2011) and Plate (2014). The International Institute of Sustainable Development (2012) reported that energy subsidy leads to the increase of income directly and indirectly. Energy subsidy is directed to an increase of income when a private sector pays less for energy; its consumer surplus is increased. On the other hand, energy subsidy is indirect causes an increase of income when the price level is low from a cheaper energy cost that reduces the cost of production. However, the cost of energy subsidy may transfer to the other parties through the tax collection and deadweight loss. In the current development, Malaysia and Indonesia are trying to rationalize their subsidy program subject to economic efficiency improvement and to reduce their fiscal pressure. Octavian et al. (2005) and Rosli (2012) suggested that the policymaker needs to introduce some effective offsetting policies to cushion the adverse impact in respect to the absent of energy subsidy. Our empirical result proved that the magnitude impact of energy subsidy is low compared to the other selected factors.

Two types of policies with two different scenarios are recommended. First, the policymaker could concentrate on offsetting policy if a reduction of subsidy is paramount for economic sustainability. Optimizing an occupied labor as a wastage number of labor is expected to increase energy wastage in the production as well. A part of that, a monetary regime needs to be contemporary improved to accumulate enough capital to be invested in an economy to support any progress of economic development. According to the fundamental of the neo-classical production function, the energy input production is absorbed in both labor and capital in the production to produce output (Alam, 2006). In a simple word, the more the number of labor and capital are used in the production, the more the energy is consumed.

Second, if the policymaker would like to continue the energy subsidy program, we recommend to rationalize the subsidy policy so that the subsidy becomes a productive tool to improve economic development. International Institute of Sustainable Development (2013) indicated that a direct energy subsidy distribution is not effective to increase the standard of living of the targeted group. This is because a direct distribution of energy subsidy is enjoyed much by the non-targeted group. The statistics show that 50% of high-income group enjoys about 90% energy subsidy provided by the government in Indonesia (International Institute of Sustainable Development, 2012). The same scenario was happened in Malaysia (The International Institute of Sustainable Development, 2013). Hence, subsidy policy needs to be rationalized to improve the energy subsidy distribution and become more effective to increase the standard of living of a targeted group. Jiang and Lin (2014) suggested that selected subsidy on energy resource or energy commodities should be removed based on its magnitude impact in giving an adverse impact on an economy as a whole. The less the magnitude impact of one subsidy of any energy resource or commodity, the more important it is to be removed. The International Institute of Sustainable Development (2012) suggests the policy maker should introduce an effective subsidy distribution which can exclude the non-targeted group to excess to energy subsidy. Through that, it can be more effective to increase the economic welfare as a whole as the targeted group will be benefited more.

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References

Alam, M. S., 2006. Economic Growth with Energy.MPRA Paper, No. 1260.

Arze Del Granado, J. Coady, D. and Gillingham, R., 2012. The unequal benefit of fuel subsidies: are view of evidence for developing countries. *World Development*, 40(11), p.2234-2248.

Im, K. S., Pesaran, M. H. and Shin, Y., 2003. Testing for Unit roots in heteroheneous panels. Journal of Economic, 115, pp.53-74.

Isaak, D., 2015. Oil Security in ASIA and the Pacific. In Lee, M., Park, D. and Saunders, H., 2015. Asia's Energy Challenge: Key Issues and Policy Option, Routledge Taylor and Francis Group, London and New York, pp.33-80.

Jiang, Z. and Lin, B., 2014. The perverse fossil fuel subsidies in china-the scale and effects. *Energy*, 70, pp.411-419.

Jiang, Z. and Tan, J., 2013. How the removal of energy subsidy affects general price in china: a study based on input-output model. *Energy policy*, 63(2013), pp.599-606.

Lin, B. and Jiang, Z., 2011. Estimates of energy subsidies in china and impact of energy subsidy reform. *Energy Economics*, 33(2), pp.273-283.

Liu, W. and Li, H., 2011. Improving energy consumption structure: a comprehensive assesment of fossil energy subsidies reform in china. *Energy policy*, 39(7), pp.4134-4143.

Manzoor, D., Shahmoradi, A. and Haqiqi, I., 2009. An analysis of energy price reform: A CGE Approach. Mimeo, Imam Sadiq University and Ministry of Energy, Iran.

Octavian, R., Hakim, D. B., Sahara, H. and Siregar, S., 2005. The impact of Reducing Oil Subsidy on Indonesian Macroeconomics Performance, Agrecultural Sector and Poverty Incidences. MPIA Working Paper 2007-2008. Manila: Poverty and Econmic Policy (PEP) Research Network.

Pedroni, P., 1999. Critical value for cointegration test in heteroheneous panels with multiple regressors. *Oxford Bulletin Statistics*, 61, pp.653-670.

Pesaran, M. H., Shin, Y. and Smith, R. P., 1999. Pooled Mean Group Estimation of Dynamic Heterogeneous Panels. Journal of the American Statistical Association, 94, pp.621-634.

Plate, M., 2014. The long-run macroeconomic impacts of fuel subsidies. *Journal of Development Economics,* 107, pp.129-143.

Rosli, F., 2012. Malaysian Economy in 2012: Risks and Rewards? Institute of Strategic and International Studies (ISIS) Malaysia, ISIS Praxis Seminar, No. 1/2012.

Solaymani, S. and Kari, F., 2014. Impacts of energy subsidy reform on the malaysian economy and transportation sector. *Energy Policy*, 70 (2014), pp.115-125.

The International Institute for Sustainable Development, 2013. A Citizen's Guide to Energy Subsidies in Malaysia. Manitoba: International Institute for Sustainable Development.

The International Institute for Sustainable Development, 2012. A Citizen's Guide to Energy Subsidies in Indonesia. Manitoba: International Institute for Sustainable Development.

Van Beers, C., Van den Berch, J. C. J. M., 2011. Analysis perseverance of pervese subsidies and their impact on trade and environment. *Ecological Economics*, 36(3), pp.475-486.