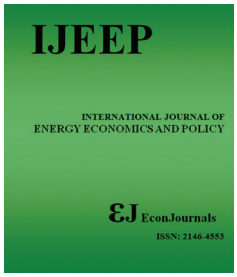

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The Effect of Crude Oil Prices on Economic Growth in South East Sulawesi, Indonesia: An Application of Autoregressive Distributed Lag Model

La Ode Saidi[1]*, Pasrun Adam[1], Manat Rahim[2], Rosnawintang[2]

[1]Department of Mathematics, Faculty of Maths and Science, Universitas Halu Oleo, Kampus Bumi Tridhamma Anduonohu 93232, Kendari, Indonesia, [2]Faculty of Economics and Business, Universitas Halu Oleo, Kampus Bumi Tridhamma Anduonohu 93232 Kendari, Indonesia. *Email: lm.saidi@yahoo.co.id

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ABSTRACT

This research aims to examine the effect of crude oil prices on economic growth in South East Sulawesi, Indonesia. Data on crude oil prices and economic growth are annual time series data stretching from 1987 to 2016. The results of co-integration tests show that there is no long-term relationship between crude oil prices and economic growth. However, the estimation of the autoregressive distributed lag (5.0) model shows that in the short term, there is the influence of crude oil prices toward economic growth.

Keywords: Crude oil price, economic growth, Autoregressive distributed lag bound co-integration test, Autoregressive distributed lag model
JEL Classifications: C120, C320, E300, O470

1. INTRODUCTION

Crude oil is one of the important commodities which is needed by all countries, so crude oil becomes a product that is traded on international markets. Excessive crude oil producing countries supply crude oil to some countries. In contrast, non-crude oil countries import crude oil from oil producing countries. The import of oil is carried out by a country, because crude oil is a vital need for the industry to produce goods, run transportation equipment, and produce electrical energy (Adam et al., 2015; Adam, 2016; Muthalib et al., 2018). Therefore, changes in oil prices can also cause changes in production costs: Goods, transportation and electricity. Changes to future production costs can cause changes the price of products.

Crude oil prices can affect economic growth through changes in prices of production. The increase in crude oil prices can cause inflation. The government of a country will conduct monetary policy by raising interest rates to reduce inflation. An increase in interest rates can then reduce the value of investment which ultimately affects GDP or economic growth.

The study about the influence of crude oil prices toward economic growth has been carried out by researchers in various countries. There is no consensus regarding the results of their research. For example, Berument et al. (2010) investigated the effect of oil prices on economic growth in MENA countries (Algeria, Iran, Iraq, Kuwait, Libya, Oman, Qatar, Syria, and the United Arab Emirates). They found that there was no influence of oil prices on economic growth in each MENA member country. Mendosa and Vera (2010) investigated the effect of oil prices on economic growth in Venezuela, and found that there was an influence of oil prices on economic growth. Jiménez-Rodríguez and Sánchez (2004) examined the effect of oil prices on economic growth in countries that belonged to members of the Organization for Economic Co-operation and Development (OECD) organization, and found that there was an influence of oil prices on economic growth. Nevertheless, this influence showed

positive effect in one country, while in other OECD countries, the influence of oil on economic growth was negative. Their differences in findings could be caused by: (1) The time period for research data collection; and (2) cultural, socio-political and economic conditions in countries where research is conducted.

South East Sulawesi is one of the provinces in Indonesia where cultural conditions, socio-political and economic conditions are different from other countries, so that the effect of crude oil prices on economic growth can be the same or different from the findings of the researchers as mentioned above. According to our best knowledge, this study is the first study which is ever conducted, because the study of the effect of crude oil prices on economic growth in South East Sulawesi has not been carried out yet. This study aims to examine the effect of crude oil prices on economic growth in South East Sulawesi, Indonesia. The data used is annual time series data that stretches from 1987 to 2016. Autoregressive distributed lag (ARDL) model is used to test the effects.

This paper is organized according to the structure, as follows. Section 1 is the introduction that includes a research gap, objectives, and a summary of the research methodology. Part 2 is the literature review on empirical studies. Part 3 is the data and methodology that explains the steps of data analysis. Part 4 is the results and discussion, and finally part 5 is the conclusion.

2. LITERATURE REVIEW

Study on influence of crude oil prices toward economic growth has been carried out by many researchers. Chai et al. (2015) investigated the influence of oil prices toward economic growth in countries: China, US and Japan. They used the asymmetric co-integration model to analyze quarterly data stretching from 1992 to 2013. Test results showed that oil prices only affected economic growth in China and Japan. Yussof and Latif (2013) examined the effect of oil prices on economic growth in Malaysia using data that extended from 1966 to 2006. The ARDL model was used to test these effects. The test results showed that oil prices affected the economic growth in the short term. Using the ARX-MA model, Maheu et al. (2018) examined the effect of oil prices on economic growth in the United States. The test results showed that the oil price shock affected the economic growth through the conditional variance of economic growth.

Hanabusa (2009) examined the relationship between oil prices and economic growth in Japan. To test this relationship, they used an exponential generalized of autoregressive conditional heteroscedasticity (EGARCH) model and data stretching from 2000 to 2008. EGARCH test results showed that there was a two-way relationship between oil prices and economic growth. Besso and Pamen (2017) evaluated the relationship between crude oil prices and economic growth in CEMAC countries (Cameroon, Central Africa Republic, Chad, Congo, Equatorial Guinea and Gabon) using data from 2000 to 2015. The VAR test results showed that oil prices affected the economic growth in CEMAC countries negatively. Ftiti et al. (2016) examined the independency between crude oil prices and economic growth in countries: The United Arab Emirates, Kuwait, Saudi Arabia, and Venezuela using data that stretches from 2000 to 2010. Granger causality test results showed that oil prices affected the economic growth.

Malik (2010) examined the effect of oil prices, deficit expenditures, real exchange rates, stock prices, interest rates (domestic and world), inflation, real total debt, and capital investment on economic growth in Pakistan. The results of multiple regression tests on quarterly time series data that span 1979Q1-2007Q2 indicated that oil prices did not affect economic growth. Meanwhile, a decrease in the value of other macroeconomic variables caused economic growth (output) to rise. Yoshino and Taghizadeh-Hesary (2014) examined the effect of oil price movements on economic growth and inflation in countries: US, Japan, and China using monthly time series data stretching from January 2000 to December 2013. Estimation results of VAR structures indicated that there was influence of oil price fluctuations toward economic growth, and the influence of oil price fluctuations toward inflation. Using multiple regression model, Mhamad and Saeed (2016) examined the effect of oil prices, exchange rates, and exports on economic growth in Iraq. They used time series data that stretched from 2000 to 2015. Test results showed that oil and export prices affected the economic growth, and the exchange rate did not affect the economic growth.

Qianqian (2011) examined the relationship between oil prices, inflation, exchange rates, money supply, net-exports and economic growth in China using monthly time series data stretching from October 1999 to October 2008. The estimation of VAR model showed that there was a long-term relationship between prices oil, inflation, net-export economic growth, and money supply. Gummi et al. (2017) examined the relationship between oil prices, human capital, exports, and economic growth in Nigeria using annual time series data stretching from 1974 to 2014. The Granger causality test results showed that there was no long-term relationship between the three variables. The only relationships found were short-term relationships such as: (1) There was a relationship between oil prices and economic growth; (2) there was a positive relationship from human capital to economic growth; and (3) there was a positive relationship between oil prices to exports. Kurihara (2015) examined the relationship between oil prices, exchange rates and economic growth in developing or developed countries (United States, European Union, and Japan) using quarterly data spanning 1990Q1-2015Q1. The VAR test results showed that oil price increase positively affected the economic growth. Also, he found that exchange rate appreciation influenced economic growth. The effect of oil prices and exchange rates on economic growth was a long-term influence.

3. DATA AND METHODOLOGY

3.1. Data

This study uses annual time series data in the period 1987 to 2016. Time series data consists of Dubai crude oil prices, and gross domestic regional product per capita (GDRP) in South East Sulawesi Province, Indonesia. GDRP is a proxy of economic growth. The price unit of crude oil is USD/barrel, while the GDRP unit is IDR.

Dubai's oil price data source is the United States Bank St. Louis. The GDRP data source is the South East Sulawesi Statistical Center. Furthermore, Dubai crude oil prices are stated with OIL, while economic growth is stated with GRO. OIL and GRO are natural logarithms.

3.2. Methodology

Oil prices are assumed to be exogenous variables that can affect economic growth in South East Sulawesi. Therefore, the model used to examine the effect is a model of autoregressive distributed lag (ARDL) developed by Pesaran and Shin (1999) and Pesaran et al. (2001). The ARDL model with independent variables is OIL and the dependent variable is GRO, as follows:

$$GRO_t = C_1 + \delta_1 t + \sum_{i=1}^{p} \alpha_{1i} GRO_{t-i} + \sum_{i=1}^{q} \beta_{1j} OIL_{t-j} + \varepsilon_{1t} \quad (1)$$

The notations of C_1, δ_1, α_{1i} (i = 1,2,…,p), (j = 0,1,…,q) are the parameters of the regression equation, and p and q are the length of time lag. ε_{1t} is white noise or residual which has independent distribution, homoscedastic, and normally distributed. The ARDL model (1) is usually written ARDL (p, q) where the independent variable OIL and GRO dependent variable are assumed to be stationary at the level. The term of stationary is often called as integrated of order d, $I(d)$, $d \geq 0$.

If the variables of oil prices and economic growth is integrated of order 1, I (1) or one of these variables are I (1) or I (0), and also co-integrated, then the effect of oil prices on economic growth must be tested with error correction models, as follows:

$$D(GRO_t) = C_2 + \delta_2 t + \theta EC_{t-1} + \sum_{i=1}^{p-1} \alpha_{2i} D(GRO_{t-i}) + \sum_{j=0}^{q-1} \beta_{2j} D(OIL_{t-j}) + \varepsilon_{2t} \quad (2)$$

In which C_2, δ_2, θ, α_{2i} (i = 1,2,...,p-1), β_{2j} (j = 0,1,…,q-1) are the parameters of the regression equation while ε_{2t} is white noise. EC_{t-1} is an error correction variable, and $D(GRO)$ is the first difference form of the GRO variable where $D(GRO)=D(GRO_t)=GRO_t-GRO_{t-1}=GRO—GRO\ (-1)$

Based on the requirements of the ARDL (p, q) model, there are several testing steps that must be taken to examine the effect of crude oil prices on economic growth. The first step is to test the order of variables integration. The integration order test used is the Augmented Dickey-Fuller (ADF) test, and the Phillips-Perron (PP) test. The ADF test was developed by Dickey and Fuller (1979), and the PP test was developed by Phillips and Perron (1988). The ADF test uses a t-ratio statistic, and the PP test uses PP-statistics. The formulation of the ADF test hypothesis and the PP test are H_0: The variable is stationary against. H_1: The variable is stationary.

The second step is to test the co-integration between crude oil prices and economic growth. This step is carried out if the price of crude oil or economic growth are integrated at the same order I(0) or I(1) or both variables are different from the order of integration. The co-integration test used is the ARDL bound co-integration test, with the equation:

$$D(GRO_t) = C_3 + \delta_3 t + \sum_{i=1}^{p-1} \alpha_{3i} D(GRO_{t-i}) + \sum_{j=0}^{q-1} \beta_{3j} D(OIL_{t-j}) + \phi_1 GRO_{t-1} + \phi_2 OIL_{t-1} + \varepsilon_{3t} \quad (3)$$

In which C_3, δ_3, α_{3i} (i = 1,2,...,p-1), β_{3j} (j = 0,1,…,q-1), ϕ_k (k = 1, 2) are the parameters of the regression equation, and ε_{3t} is white noise. ARDL bound co-integration test with co-integration equation in (3) requires that no one of the variables is process I(2), and does not require an integration order test. However, in this analysis, the integration order test remains in place in the first step to ensure that one of the crude oil prices or economic growth does not belong to process I(2). Next, the ARDL bound co-integration test uses F-statistics or Wald-statistics. The hypothesis formula is H_0: $\phi_1 = \phi_2 = 0$ (there is no co-integration) against H_1: $\phi_1 \neq \phi_2 \neq 0$ (there is co-integration). The test criteria is H_1 accepted if the value of statistic test is higher than the critics value of upper bound I (1), and H_0 is accepted if the statistic value test is lower than the critics value of lower bound I (0).

The third step is to estimate the ARDL model. The estimation step of the ARDL model begins with the determination of the length of the time lag p and q based on the information criteria. Independency checking (autocorrelation), homoscedastic, and normality of residuals are also carried out. Independent test uses LM test, homoscedastic test uses ARCH test, and normality test uses Jarque Berra test.

4. RESULTS AND DISCUSSION

4.1. Research Results

At first a data unit root test or integration order test I(d) was first performed. The values of the ADF test statistics and the PP test are summarized in Table 1. The stationary test results from both tests show that the price of crude oil (OIL) is stationary at the first difference, or integrated of order 1, I (1). Meanwhile, economic growth (GRO) is stationary at the level. So, the time series of crude oil prices is I (1) process, while the time series of economic growth is I(0) process.

The second step is to test the co-integration between the price of crude oil and economic growth using the ARDL bound co-integration test. The statistical values of the co-integration test are given in Table 2. By comparing test statistic values (2.307) and the values of lower critics bound I(0) and upper bound I(1), it is concluded that the price of crude oil and growth economy is not co-integrated. That is, the price of crude oil and economic growth do not have a long-term relationship in the period 1987 to 2016.

Since the price of crude oil and economic growth are not co-integrated, the third step is to estimate the ARDL model in the first difference. This step begins with determining the time lag. Based on the AIC information criteria, it was found that the time lag for oil price is 0, and the time lag for economic growth is 5. So, the estimated ARDL model is the ARDL (5.0) model in the first difference. The estimation results of the ARDL (5.0) model are given in Table 3. All variables involved in the ARDL (5.0) model including the constant and trends are 1% significant. Therefore, in the short term, there is the influence of crude oil prices on economic growth. This conclusion is valid, because the classical assumption requirements of the ARDL (5.0) model in the form of normality, independence (autocorrelation), and homoscedastic are fulfilled.

4.2. Discussion

The finding in this study is that there is a short-term effect of crude oil prices on economic growth. This finding is in line with

Table 1: Unit root test

Variable	ADF test statistics		PP test statistics	
	Constant without trends	Constant and trends	Constant without trends	Constant and trends
OIL	−1.2583	−2.3374	−1.2705	−1.4653
D (*OIL*)	−4.9117*	−4.8611*	−4.9226*	−4.8720*
GRO	−0.1602	−6.3398*	−3.5231**	−1.5911
D (*GRO*)	−5.8992*	−3.1151	−5.5289*	−10.6470*

*, ** are significant at 1%, 5%. Source: Own processing

Table 2: ARDL bounds test

Number of sample (T)	Number of explanatory variable (k)	F-statistics	Critical value					
			I (0)			I (1)		
			1%	5%	10%	1%	5%	10%
30	1	2.3017	10.615	7.36	6.01	11.65	8.265	6.78

Critical values are extracted from Table in Appendix of Narayan (2005). ARDL: Autoregressive distributed lag

Table 3: The estimation of ARDL (5.0) model

Constant and variable independent	Coefficient	t-Statistics	P-value
C	1.0812	6.7800	0.0000
@Trend	−0.0359	−5.2768	0.0001
D (*GRO*(−1))	−0.0957	−3.7817	0.0015
D (*GRO*(−2))	−0.1078	−4.3392	0.0004
D (*GRO*(−3))	−0.1348	−5.7041	0.0000
D (*GRO*(−4))	−0.0926	−3.9554	0.0010
D (*GRO*(−5))	−0.0685	−2.9793	0.0084
D (*OIL*)	−0.5235	−4.1541	0.0007

Jarque Bera test (normality), LM test (independence), and ARCH (homoscedastic) test values are 0.663; 0.766, and 0.629

the findings of Mendosa and Vera (2010), Jiménez-Rodríguez and Sánchez (2004), Chai et al. (2015), Yussof and Latif (2013), Maheu et al. (2018), Hanabusa (2009), Besso and Pamen (2017), Ftiti et al. (2016), Malik (2010) Yoshino and Taghizadeh-Hesary (2014), Mhamad and Saeed (2016), Qianqian (2011), Gummi et al. (2017), and Kurihara (2015).

The finding of this study is not in line with the findings of Berument et al. (2010). The difference between the results of this study and the findings of Berument et al. (2010) can be caused by differences in cultural, socio-political and economic conditions in which Berument et al. (2010) conducted research in Venezuela, while this study is carried out in South East Sulawesi, Indonesia.

Since the economic growth of South East Sulawesi is affected by the price of crude oil, the South East Sulawesi government needs to utilize the energy sources of crude oil owned as efficiently as possible. Thus, the procurement and utilization of oil cannot cause inflation as a barrier to economic growth.

5. CONCLUSION

The purpose of this study is to examine the effect of crude oil prices on economic growth in South East Sulawesi, Indonesia. The data used are annual time series data consisting of: World crude oil prices and gross domestic regional product per capita that range from 1987 to 2016. Gross domestic regional product per capita is a proxy of economic growth.

The stationary test results show that the price of crude oil is I(1) process, while gross regional domestic product per capita is I(0) process. The co-integration test results show that in the period 1987 to 2016, crude oil prices and economic growth were not co-integrated. That is, in the long run, there is no relationship between crude oil prices and economic growth. Furthermore, based on the estimation results of the ARDL(5.0) model it was found that, in the short term, there was an influence of crude oil prices on economic growth.

The South East Sulawesi government needs to make procurement efficiency policies and use of crude oil to reduce inflation. By suppressing inflation, economic growth is expected to increase.

REFRENCES

Adam, P. (2016), The response of bank of Indonesia's interest rates to the prices of world crude oil and foreign interest rates. International Journal of Energy Economics and Policy, 6(2), 266-272.

Adam, P., Rianse, U., Cahyono, E., Rahim, M. (2015), Modeling of the dynamics relationship between world crude oil prices and the stock market in Indonesia. International Journal of Energy Economics and Policy, 5(2), 550-557.

Berument, M.K., Ceylan, N.B., Dogan, N. (2010), The impact of oil price shocks on the economic growth of selected MENA1 countries. The Energy Journal, 31(1), 149-176.

Besso, C.R., Pamen, E.P. (2017), Oil price shock and economic growth: Experience of CEMAC countries. Theoretical and Practical Research in Economic Fields, 8(1), 5-13.

Chai, J., Yang, Y., Xing, L. (2015), Oil price and economic growth: An improved asymmetric co-integration approach. International Journal of Global Energy Issues, 38(4/5/6), 278-285.

Dickey, D.A., Fuller, W.A. (1979), Distribution of the estimators for autoregressive time series with a unit root. Journal of the American Statistical Association, 74, 427-443.

Ftiti, Z., Guesmi, K., Teulon, F. (2016), Relationship between crude oil prices and economic growth in selected OPEC countries. The Journal of Applied Business Research, 32(1), 11-21.

Gummi, U.M., Buhari, A.I., Muhammad, A. (2017), Oil price fluctuations and economic growth in Nigeria (evidence from granger causality test). Australasian Journal of Social Science, 3(1), 1-16.

Hanabusa, K. (2009), Causality relationship between the price of oil and economic growth in Japan. Energy Policy, 37, 1953-1957.

Jiménez-Rodríguez, R., Sánchez, M. (2004), Oil Price Shocks Empirical

Evidence for Some OECD Countries. ECB Working Paper Series No. 362. p1-63.

Kurihara, Y. (2015), Oil prices and economic growth in developed countries. International Journal of Business and Social Science, 6(11), 40-46.

Maheu, J.M., Song, Y., Yang, Q. (2018), Oil Price Shocks and Economic Growth: The Volatility Link. Shanghai Tech SEM Working Paper No. 2018-004. p1-44.

Malik, A. (2010), Oil prices and economic activity in Pakistan. South Asia Economic Journal, 11(2), 223-244.

Mendosa, O., Vera, D. (2010), The asymmetric effects of oil shocks on an oil-exporting economy. Guardernos De Economia, 47, 3-13.

Mhamad, S.H., Saeed, S.T. (2016), The impact of oil price on economic growth: Empirical evidence from Iraq. Journal of Economics and Sustainable Development, 7(14), 156-161.

Muthalib, A.A., Adam, P., Rostin, R., Saenong, Z., Suriadi, L.O. (2018), The influence of fuel prices and unemployment rate towards the poverty level in Indonesia. International Journal of Energy Economics and Policy, 8(3), 37-42.

Pesaran, M.H., Shin, Y. (1999), An autoregressive distributed-lag modeling approach to co-integration analysis. In: Strom, S, editors. Econometrics and Economic Theory in the 20th Century: The Ragnar Frisch Centennial Symposium. Cambridge: Cambridge University Press. p371-413.

Pesaran, M.H., Shin, Y., Smith, R.J. (2001), Bounds testing approaches to the analysis of level relationships. Journal of Applied Econometrics, 162, 89-326.

Phillips, P.C.B., Perron, P. (1988), Testing for a unit root in time series regression. Biometrika, 75(2), 335-346.

Qianqian, Z. (2011), The impact of international oil price fluctuation on China's economy. Energy Procedia, 5, 1360-1364.

Yoshino, N., Taghizeh-Hesary, F. (2014), Economic impacts of oil price fluctuations in developed and emerging economies. International Electrical Engineering Journal, IEEJ, Oct 2014, 1-17.

Yussof, N.S.B., Latif, N.W.B. (2013), Measuring the effects of world oil price change on economic growth and energy demand in Malaysia: An ARDL bound testing approach. International Journal of Economics, Trade, and Finance, 4(1), 29-35.