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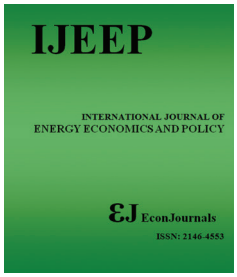

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The Influence of Fuel Prices and Unemployment Rate towards the Poverty Level in Indonesia

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ABSTRACT

The purpose of this study is to examine the influence of fuel prices and unemployment rates toward poverty levels. The data used were yearly time series data consisting of fuel price, unemployment rate, and poverty level that span from 1998 to 2017. To test the influence of fuel price and unemployment rate toward the poverty level, the autoregressive distributed lag model was used. The results of data analysis showed that in the short-term, there is a negative influence of fuel prices toward the level of poverty. Meanwhile, there is a positive influence of unemployment rate on poverty level in the long-term. In this case, every 1% increase (decrease) the unemployment rate, the poverty rate rose (down) by 0.3309%.

Keywords: Fuel Price, Unemployement Rate, Poverty Level, Autoregressive Distributed Lag Model
JEL Calassifications: C220, E310, I32, J64

1. INTRODUCTION

The need of fuel for mankind is vital, because all economic sectors in a country from agriculture, industry, mining, transportation, trade and services need fuel that keeps increasing from year to year along with increasing economic activity of a country. In agriculture, these fuels are needed to move agricultural equipment (Rafiq et al., 2009; Adam, 2016; Adam et al., 2018). In the field of industry, fuel is needed to drive industrial machinery in producing goods. In the field of transportation and trade, fuel is needed to mobilize the means of transportation both for goods and public transportation. In the field of mining, fuel is also required to move mining equipment in producing minerals. In addition, consumer households also need large amounts of fuel as the population and households increase. Therefore, every policy, especially the policy of fuel price increase, will have an impact on all sectors of the economy in a country and no exception to the household sector as a consumer.

Empirical facts show that any increase in international oil prices is always followed by the policy of fuel price increase in the country by the government. This fuel price increase always has an impact on the increase in production costs (Sugden, 2009, Baumeister and Killian, 2014, Adam et al., 2016) and transportation costs. The increase in production costs will affect the price increase of goods or inflation in the country. So, in the next turn, it can reduce the purchasing power of the community that is resulting in poverty and unemployment increase. Wirjodirjo and Ummatin (2017) in their study found that the impact of rising fuel prices started from the fraction of the fuel price increase that affected the amount of inflation. The increase in inflation will also cause a decline in the purchasing power of companies to buy fuel as industrial raw materials, so the production capacity will also decrease. This production capacity decrease affects employment and welfare levels. Inflation also causes the real income received to be reduced.

Poverty is a problem faced by all countries in the world, especially in developing countries. Therefore, poverty should be solved immediately so it does not become a big problem in economic development. Thus, in the international scope, poverty has become the agenda set forth in the millennium development goals.

Research on the influence of fuel prices on poverty levels and also the effect of unemployment on poverty rates are still rarely done by researchers. The influence of fuel prices on poverty levels has been studied by previous researchers such as Pradhan and Sahoo (2002) and Oluwatayo and Alagbe (2015). There were different findings in their research. Pradhan and Sahoo (2002) found that rising fuel prices lowered the poverty level, while Oluwatayo and Alagbe (2015) found that rising fuel prices raised poverty levels. Furthermore, research on the influence of the unemployment rate on poverty level has also been studied by previous researchers such as De-Fina (2004) where she found that unemployment rates did not significantly affect poverty levels.

In accordance with the literature search, it is found that research on the influence of fuel prices and unemployment rate in Indonesia has not been reported, so the research on the influence of fuel prices and unemployment rate on poverty level in Indonesia is important in order to provide information about it. Therefore, this study aims to examine the effect of fuel prices and unemployment rates on poverty levels in Indonesia. The econometric model used to test the effect is the autoregressive distributed lag (ARDL) model.

2. LITERATURE REVIEW

In this section, the researchers would like to present the results of previous research, both theoretical research and empirical research. From the literature search results, the literature review is grouped into four research groups: (1) The relationship between fuel prices and poverty rates, (2) the relationship between fuel prices and other macroeconomic variables (including poverty levels), (3) the relationship between unemployment rate and poverty levels, and (4) the relationship between unemployment rates and other macroeconomic variables (including poverty levels).

The relationship between fuel prices and poverty levels was examined by previous researchers as follows; Pradhan and Sahoo (2002) built a mathematical model of the relationship between international oil prices and poverty levels. To test this relationship, they performed a model simulation using data in India. Model simulation results showed that the production of fuel in the country could reduce oil imports, so the effect of international oil prices on the level of poverty was negative. Chitiga and Fofana (2012) examined the influence of fuel prices toward poverty level in South Africa. They found that the price of fuel positively affected the poverty level.

Naranpanawa and Bandara (2012) and Reyes et al. (2009) examined the effect of fuel prices on poverty levels and other macroeconomic variables. Naranpanawa and Bandara (2012) examined the effect of rising fuel prices on economic growth and poverty levels in Sri Lanka. Their findings suggested that rising fuel prices were affecting economic growth and poverty levels. Reyes et al. (2009) examined the effects of rising rice prices and fuel prices on poverty levels in the Philippines. Their findings suggested that there was an effect of rising rice prices and fuel prices on poverty levels. The magnitude of this influence differed among the locations of poverty.

Yao (2004), and Sackey and Osey (2006) conducted a research of the relationship between unemployment rate and poverty level. Yao (2004) built a mathematical model that linked between variables of unemployment and poverty level. In this model, the poverty level was the dependent variable, while the unemployment rate was the independent variable. The model built was then tested empirically using data in China. Empirical test results showed that unemployment rate affected poverty level. Sackey and Osey (2006) examined the relationship between unemployment and poverty level in Ghana. Their results showed that there was a relationship between unemployment and poverty level.

Blank and Blinder (1985) conducted a research of the influence of macroeconomic variables (inflation, unemployment rate and tax policy) toward poverty level. The results of data analysis showed that inflation, unemployment and tax rates had an effect on poverty level. The effect of unemployment rate on poverty level was negative. Haveman and Schwabish (2000) examined the relationship between unemployment, economic growth and poverty level. They found that the unemployment rate positively affected the poverty level, and there was a strong relationship between economic growth and poverty level. Martinez et al. (2001) examined the relationship between unemployment rate, income distribution and poverty levels. They found that there was an influence of the unemployment rate on the distribution of income and poverty levels. Xue and Zhong (2003) conducted a research of the issue of unemployment and poverty level in China. He found that the unemployment rate and migration from rural to urban areas were the main causes of rising poverty levels in the city. Freeman (2003) investigated the relationship between unemployment rates, poverty level, and income growth rates. Based on data analysis, he found that the poverty level and income growth rate were sensitive to the unemployment rate.

3. DATA AND METHODOLOGY

3.1. Data

The data of this study were the price of fuel, the unemployment rate, and the poverty level. The data used was an annual time series that spans from 1998 to 2017. The price of fuel was proxied with the fuel price index. The both unit measurements of the annual time unemployment rate and the poverty level were %.

The time series of the fuel price index was obtained from Index Mundi. Meanwhile, both time series of unemployment and poverty level were obtained from the Indonesian Central Bureau of Statistics.

3.2. Methodology

The analytical tool used to test the influence of fuel prices and the unemployment rate on poverty levels was the ARDL model. The ARDL model included time lag elements for the dependent variable and independent variables in the equation. The dependent variable in this research was the poverty levels (POV), and the independent variables were fuel price index (FUE) and unemployment rate (UNE). These three variables were natural logarithms. In the model equation formulation, the time lag for the POV variable was p, whereas the time lags for the FUE and

UNE variables were q and r. Thus, the ARDL model that linked the relationship between UNE, FUE and POV was represented by the ARDL (p, q, r) model.

The variables involved in the ARDL (p, q, r) model should be stationary or integrated of order d, I (d). The order of integration could be different (Pesaran and Shin, 1999). Therefore, to examine the effect of fuel prices and unemployment rates on poverty levels, the first step was to examine the order of integration or stationarity of variable (or time series). The stationary test used was Augmented Dickey-Fuller (ADF) test and Phillips-Perron test. The ADF test was developed by Dickey and Fuller (1981), while the PP test was developed by Phillips and Perron (1988). The test criteria used was P-value criteria in which time series was said to be stationary or integrated of order d, I(d), if P-value was less than a certain level of significance (1%, 5% or 10%).

If in the first step found that the three variables FUE, UNE and POV stationary at the level or integrated of order zero, I(0), then it was conducted a regression coefficient estimation of ARDL(p, q, r) model at level (Heij et al., 2004); Pesaran and Shin, 1999), as follows:

$$POV_t = \alpha_1 + \beta_t t + \sum_{i=1}^{p} \vartheta_{1i} POV_{t-i} + \sum_{j=0}^{q} \varphi_{1j} FUE_{t-j} + \sum_{k=0}^{r} \phi_{1k} UNE_{t-k} + \varepsilon_{1t} \quad (1)$$

Where, $\alpha_1, \beta_t, \vartheta_{1i}$ (i=1,2,…,p).φ_{1j} (j=0,1,…,q), and ϕ_{1k} (k=0,1,…,r) are the regression parameter. Next, t is trend and ε_{1t} is error term with normal distribution and with constant variance (or homocedastic). The length of time lag p, q, and r is determined using Schwardz criterion. If in the long term, the variables of FUE, UNE and POW are in the stable condition (equilibrium), then the long term relation between FUE, UNE and POW is stated with the equation as follows:

$$EC_t = POV - \frac{\alpha_1}{1-\sum_{i=1}^{p}\vartheta_{1i}} - \frac{\beta_1}{1-\sum_{i=1}^{p}\vartheta_{1i}} t - \frac{\sum_{j=0}^{q}\varphi_{1j}}{1-\sum_{i=1}^{p}\vartheta_{1i}} FUE - \frac{\sum_{k=0}^{r}\phi_{1k}}{1-\sum_{i=1}^{p}\vartheta_{1i}} UNE \quad (2)$$

In the Equation (2), $\varphi = \frac{\sum_{j=0}^{q}\varphi_{1j}}{1-\sum_{i=1}^{p}\vartheta_{1i}}$ and $\phi = \frac{\sum_{k=0}^{r}\phi_{1k}}{1-\sum_{i=1}^{p}\vartheta_{1i}}$ are called the long-term multiplier effect numbers or also called long-term coefficients of FUE and UNE. The positive values of φ and ϕ show that the fuel price and unemployement rate have positive impact toward the poverty level. Similarly, the negative values of φ and ϕ show that the fuel price and unemployement rate have negative impact toward the poverty level (Koop, 2006; Murthy and Okumande, 2016).

However, if in the first step, it is found that the three variables FUE, UNE and POV are stasionary in the first diference or integrated of order one, I(1), then the second step is to test the cointegration relationship of the three variables FUE, UNE and POV. Since the number of samples is small, and Narayan (2005) only set the bound tests critical value for samples ≥30 observations and less or equal to 80 observations, then in this reaserach, the cointegration testing did not use the ARDL bound cointegration test of Pesaran et al. (2001). For the alternative, the cointegration test used was the Engle-Granger cointegration test. This cointegration test can be used if all the time series involved in the ARDL (p, q, r) model are integrated at the same order. The Engle-Granger cointegration test was performed by testing the stationarity of the EC variable in Equation (2). If the EC was stationary at the level or integrated of order zero, I(0), then the three time series FUE, UNE and POV would be cointegrated. Conversely, if the EC variable was not stationary, then the three time series FUE, UNE and POV were not cointegrated. If FUE, UNE and POV were cointegrated, then FUE, UNE and POV had a long-term relationship.

If FUE, UNE and POV were not cointegrated, then the third step was conducted the coefficients estimation of the ARDL model in the first diference. Conversely, if FUE, UNE and POV were cointegrated, then the ARDL model (Heij et al., 2004) was estimated, as follows:

$$D(POV_t) = \alpha_2 + \beta_2 t + \gamma EC_t(-1) + \sum_{i=1}^{p-1} \vartheta_{2i} D(POV_{t-i}) + \sum_{j=0}^{q-1} \varphi_{2j} D(FUE_{t-j}) + \sum_{k=0}^{r-1} \varphi_{2k} D(UNE_{t-k}) + \varepsilon_{2t} \quad (3)$$

Where, $\alpha_2, \beta_t, \vartheta_{2i}$(i=1,2,…,p-1).$\varphi_{2j}$ (j=0,1,…,q-1), and ϕ_{2k} (k=0,1,…,r-1) are the parameter of regression, and ε_{2t} is the error term. The equation (3) is called as error correction model. The time series of EC_t is obtained from the Equation (2). The coefficients of ϑ_{2i} (i=1,2,…,p-1), φ_{2j} (j=0,1,…,q-1) φ_{2j} (j=0,1,…,q-1) and ϕ_{2k} (k=0,1,…,r-1) in the equation (3) is called as short-term coefficients.

As an additional explanation in this section, we also present homogeneity test, autocorrelation test, and normality test of residual of the ARDL (p, q, r) model. Residual homocedastic (or heterokedastic) test is used ARCH test, residual autocorrelation test is used Breusch-Godfrey Serial Correlation LM (BGSCLM) test, and residual normality test is used Jarque Berra (JB) test. These three tests were absolutely necessary to determine whether the model meets the ARDL model analysis requirements. In addition, stability tests of long-term coefficients were also performed on the regression equation. This stability test was developed by Brown et al. (1975).

4. RESULTS

4.1. Stationary Test and Cointegration Test

The stationary test results using the ADF test and the PP test for the fuel price variables (FUE), the unemployment rate (UNE), and the poverty rate (POV) are summarized in Table 1. It appears in Table 1 that all variables are stationary at the first diference or integrated of order one, I(1). The stasionerity of variable fuel price was significant 1%. Meanwhile, the variables of unemployment rate and poverty level were significant 5%.

The cointegration test results using the Engle-Granger test are summarized in Table 2. It appears in Table 2 that the time series of EC was significant 1%. This indicated that the stationary of EC was at the level, or integrated of order zero, I(0). Thus, the three variables of fuel prices, unemployment rate, and poverty level were cointegrated. This means that these three variables had a long-term relationship.

4.2. Influence Test

Time lag calculations using the Schwardz criterion indicated that the model used to test the effect of fuel prices and unemployment rates on poverty level was the ARDL (1, 1, 0) model. The estimates of short- and long-term coefficients are summarized in Table 3.

Table 1: Unit root test

Variable	ADF test statistics		PP test statistics	
	Without trend	With trend	Without trend	With trend
FUE	−2.838904	−2.347261	−2.838904	−2.347261
D (FUE)	−5.033041*	−5.085931*	−5.033041*	−6.198855*
UNE	−1.104601	−2.276309	−1.348392	−2.353602
D (UNE)	−3.788090**	−4.550405**	−3.810246**	−4.540607**
POV	−1.180639	−2.570170	−1.207744	−2.570170
D (POV)	−4.197434*	−4.236254**	−4.198608*	−4.238352**

*,**are significant 1%, 5%. Resource: Own processing, ADF: Augmented Dickey-Fuller

Table 2: Engle-granger cointegration test

Variable	ADF test statistic	P-value*
EC	−4.375416	0.0038

*MacKinnon (1996) one-sided P values, ADF: Augmented Dickey-Fuller

Table 3: Estimation of the long-run and short-run coefficients

Variable and constant	Coefficient	t-statistics	P-value
A. Short-run coefficient estimation. Dependent variable: D (POV)			
D (UNE)	0.004466	0.029068	0.9773
D (FUE)	−0.055388***	−1.854937	0.0906
EC(−1)	−0.649246**	−3.062380	0.0108
t	−0.018207***	−1.942124	0.0782
B. Long-run coefficient estimation. Dependent variable: POV			
UNE	0.330852***	2.076663	0.0621
FUE	−0.085312	−1.646179	0.1280
C	2.559045*	7.477490	0.0000
t	−0.028044*	−3.504629	0.0049

*,**,*** are significant 1%, 5%, 10%

It is seen in Panel A in Table 3, that the variable coefficient D (FUE) is 10% significant and the variable coefficient D (UNE) is not significant. This means that there is a short-term effect of fuel prices on poverty levels, and in the short run, there is no effect of unemployment rates on poverty levels. Furthermore, the variable coefficients of EC (−1) are significant 1% indicating that the long-term effects of fuel prices and unemployment rates on poverty level are corrected by 64.92%.

In panel B in Table 3, it can also be seen that the UNE variable coefficient is significant 10%, and the FUE variable coefficient is not significant. Therefore, only the unemployment rate has long-term effects on poverty levels. In this case, every 1% increase (decrease) the unemployment rate, then the poverty rate rose (down) by 0.3309%.

4.3. Residual Diagnotic and Stability Test of the Regression Equation Coefficients

The results of homogeneity test estimation, autocorrelation test, and normality test showed that the P-value of BGSCLM test, P-value of ARCH test statistic, and P-value of JB test statistic were 0.2578, 0.5378 and 0.2931, respectively. These values were >5%. Thus, the residual of the ARDL (1, 1, 0) model had a constant variance (or homocedastic), had no autocorrelation, and was normally distributed.

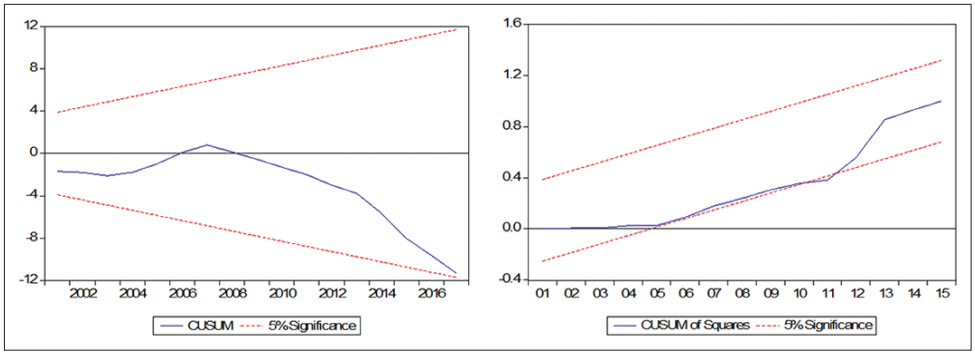
Next, the plot results of long-term coefficients using the CUSUM test and CUSUM Square test are shown in Figure 1.

In Figure 1, it shows that by the CUSUM test, the coefficient graph of the regression equation is within the 5% significance limit. Thus, the long-term coefficients are stable.

5. DISCUSSION

The results of this study found that in the short term, there is a negative influence of fuel prices on the level of poverty, meaning that if the price of fuel increases, the poverty level will decrease, and vice versa. It happens because if there is an increase in the price of fuel, then the government always takes the policy to compensate the poor in the form of direct cash assistance so their

Figure 1: Plot CUSUM (left) dan CUSUM square (right)



income will also increase. In addition, the government also takes an action to subsidize the fuel price increases. The compensation given by the government only takes place in the short term so that the impact of rising fuel prices on poverty reduction is only short-term. Meanwhile, if the price of fuel decreases, the poverty level increases. This is because the proportion of fuel expenditures for the poor is relatively smaller for the total consumption expenditure of poor households. Thus, the fuel prices decrease cannot reduce the poverty level because their purchasing power remains low, so the poverty level increases. The results of this study support the results of Naranpanawa and Bandara (2012) and Reyes et al. (2009) studies that found that the price of fuel affected poverty levels.

The results of this study also found that in the long run there is a positive effect of the unemployment rate on the level of poverty. It means that the higher the unemployment rate, then the poverty level will also be higher. This is in line with the empirical fact that when a person is unemployed, it means that he does not get additional income, so the income received is reduced, and may have implications for increasing poverty levels. The results of this study support the results of Sackey and Osey (2006), Haveman and Schwabish (2000), Xue and Zhong (2003) and Freeman (2003) studies that found an association between unemployment and poverty.

6. CONCLUSION

The purpose of this study is to examine the influence of fuel prices and unemployment rates on poverty levels. The data used to examine these influences are: The fuel price index as a proxy of the price of fuel, the unemployment rate (in %) and the poverty level (in %). Time series data is an annual time series that spans from 1998 to 2017.

The three time series of fuel price, unemployment rate, and poverty level are stationary at first diference level. The result of cointegration test using Engle-Granger cointegration test shows that the three time series are cointegrated. The results of this cointegration test indicate that the three time series has a long-term relationship.

The result of influence test using the ARDL model is obtained that there is a short-run influence of fuel price to poverty level. Meanwhile, in the long-run, there is an effect of unemployment rate on poverty level. In this case, every 1% increase (decrease) of the unemployment rate, poverty level rose (down) by 0.3309%.

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