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The Impact of Mining Sector on Economic Growth and Unemployment in East Kalimantan, Indonesia: A Simultaneous Panel Data Analysis using EC2SLS

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Abstract:

Over decades, East Kalimantan Province is the region with the highest GRDP and unemployment rate among the other provinces in Kalimantan Island, even the unemployment rate is higher than the national rate. The economy of East Kalimantan is supported by the mining sector with an average contribution is 49.6 percent in the 2010-2019 period. Therefore, this study aims to examine the relationship between economic growth and unemployment, and the effect of the mining sector on both. This study uses panel data simultaneous equation model with the EC2SLS estimation method with 10 regencies/municipalities in East Kalimantan as the unit of analysis, from 2015 to 2019. The results are there is a simultaneous relationship between economic growth and unemployment, but it is positive; the economic growth is influenced by domestic investment, education, and the mining sector in general, while land opening for coal mining activities doesn't affect; unemployment is influenced by coal mining area, minimum wage, and population density, while the mining sector labor doesn't affect. The land opening of coal mining is mostly brought in a lot of workers from outside the region so that population density increased and employment opportunities decreased.

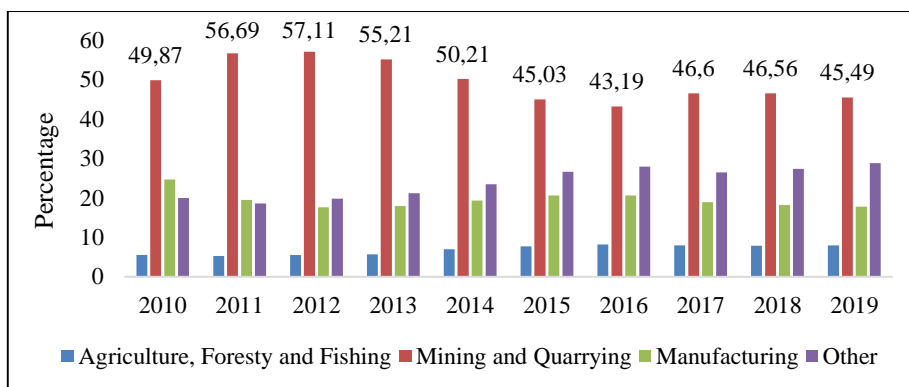
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Mining Sector, Unemployment, Economic Growth, EC2SLS

1. Introduction

The theory of the relationship between economic growth and unemployment has been explained in Okun's Law, where a three percent change in output is associated with a one percent change in the unemployment rate (Okun, 1962). Mankiw (2015) also explains the Solow-Swan economic growth theory, which is that economic growth depends on the production factors such as labor, capital, and technology. The existence of unemployment shows that part of the production factor, namely labor, is not being utilized so that it will result in not optimal for economic growth. Therefore, it can be concluded that the relationship between economic growth and unemployment is negative.

One of the regions in Indonesia which has problems with the relationship between economic growth and unemployment is East Kalimantan Province. Based on the Central Bureau Statistics (BPS), East Kalimantan Province is the region with the highest GRDP and unemployment rate among the other provinces in Kalimantan Island, even the unemployment rate is higher than the national rate. The relationship between both indicators indicates that economic growth in East Kalimantan has not inclusive because it has not able to absorb labor properly. Inclusive economic growth according to McKinley (2010) is comprehensive and sustainable economic growth so that every member of society can participate as well as benefit from this economic growth. In addition, this situation is also inconsistent with Sustainable Development Goal 8, which is "promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all". Based on the distribution of the East Kalimantan economy, the mining and quarrying sector has an average contribution of 49.6 percent during 2010-2019. It means that almost half of East Kalimantan's economy is supported by the mining and quarrying sector, as shown in Figure 1.



Source: Central Bureau of Statistics (BPS)

Figure 1. Distribution of GRDP in East Kalimantan at 2010-2019

The less inclusive economic growth of East Kalimantan is suspected to be unsustainable, which is the mining sector dominates the economy of East Kalimantan. Mining activities have several impacts on the environment that increase greenhouse gas (GHG) emissions, depletion of fossil fuels (DFF), and reduce the amount of water that can be consumed (Aguirre-Villegas & Benson, 2017). The condition of coal mine holes in Indonesia is increasingly expanding with 3,092 holes still open in 2018, which has the potential to damage the environment (Mining Advocacy Network, 2020). The expansion of coal mining is also following the Dimethyl Ether (DME) project as a substitute for Liquefied Petroleum Gas (LPG), where the material from DME comes from coal (Ministry of Energy and Mineral Resources, 2020). In addition, the issue of electric car production provides a positive signal for Indonesia because it has quite high mineral reserves as a material for making batteries (VOI, 2021). Therefore, East Kalimantan has great potential to develop the mining sector, particularly coal and minerals mining.

Based on economic problems in East Kalimantan, this study aims to examine the relationship between economic growth and unemployment in East Kalimantan, as well as the influence of the mining sector on these two indicators. This study only focuses on the influence of the mining sector on the economic side, not on environmental issues.

2. Methodology

The data used in this study comes from the Central Bureau of Statistics (BPS), Department of Energy and Mineral Resources (ESDM) East Kalimantan Province, and Capital Investment Coordinating Board (BKPM). This study uses panel data regencies/municipalities as a cross-section and the time series 2015-2019. According to Baltagi (2005), panel data has advantage that can control heterogeneity of individuals that can't be captured by cross-section data. In addition, panel data provide more informative, more varied data, with low collinearity among variables, to produce more reliable and efficient estimates.

A simultaneous equations model is used to explain the relationship between variables that influence each other. There are two types of variables, endogenous variable and predetermined variable. The endogenous variable that becomes the explanatory variable will be stochastic so it is usually correlated with the error term in the equation. This condition is called the endogeneity problem, which violates the OLS assumption, so it causes the parameter estimation by OLS to be (Gujarati & Porter, 2009). Therefore, an estimation method is needed that uses instrument variables such as two-stage least square or 2SLS (Baltagi, 2005). In order to the simultaneity test, Hausman's Specification Test is used as explained by (Baltagi, 2005).

In order to estimate, the structural equations in the model must be identified (just identified or overidentified). The model identification can be determined by "order condition" as a necessary and a "rank condition" as a condition of sufficiency. In the order condition, structural equations can be identified if they meet the following conditions (Gujarati & Porter, 2009):

$$K - k \geq m - 1 \tag{1}$$

with K is the number of exogenous variables in the system, k is the number of exogenous variables in the equation, and m is the number of endogenous variables in the equation.

In this study, the 2SLS random effect was chosen as the best model. There are two types of 2SLS random effects, Generalized 2SLS (G2SLS) and error component 2SLS (EC2SLS). EC2SLS produces a smaller standard error than G2SLS, making it more efficient (Han, 2016). The structural equation in this study is as follows:

$$\ln GDRP_{it} = \beta_{10} + \beta_{11} \ln UNEM_{it} + \gamma_{11} \ln GDRP_mining_{it} + \gamma_{12} \ln RSF_NR_{it} \tag{2}$$

$$+ \gamma_{13} \ln DI_{it} + \gamma_{14} \ln Coal_land_{it} + \gamma_{15} \ln MYS_{it} + u_{1it}$$

$$\ln UNEM_{it} = \beta_{20} + \beta_{21} \ln GDRP_{it} + \gamma_{21} \%EM_mining_{it} + \gamma_{22} \ln Coal_land_{it} \tag{3}$$

$$+ \gamma_{23} \ln Min_wage_{it} + \gamma_{24} \ln Density_{it} + u_{2it}$$

with $\ln GDRP$ is economic growth, $\ln UNEM$ is unemployment, $\ln GDRP_mining$ is GRDP of the mining sector, $\ln RSF_NR$ is Revenue Sharing Fund of Natural Resources, $\ln DI$ is Direct Investment, $\ln Coal_land$ is a land area of coal mining, $\ln MYS$ is Mean Year School, $\ln EM_mining$ is the employment of mining sector, $\ln Min_wage$ is minimum wage, $\ln Density$ is population density, u_1 and u_2 is an error term.

3. Result

Simultaneity Test and Model Identification

Based on Hausman's Specification Test, it is concluded that there is a simultaneous relationship between economic growth and unemployment in 10 regencies/municipalities in East Kalimantan, which is indicated by the error term which is the estimation result of each reduced form equation, has a significant effect on other endogenous variables. Furthermore, the model identification uses the order condition which concludes that both equations are identified as overidentified, which is indicated by $K - k > m - 1$, so the appropriate estimation method is 2SLS.

Estimation Model

The best model used in this study is the EC2SLS which accommodates homoscedastic and non-autocorrelation assumptions (Baltagi, 2005; Han, 2016). Therefore, assumption testing is carried out to test the normality and non-multicollinearity assumptions, the results is don't violate this assumption. The estimation results of both equations in this study can be seen in the following table.

Table 1. Estimation of Simultaneous Equation with EC2SLS

Eq.	Dependent var.	Independent var.	Coef.	Statistical Result	
1	$\ln GDRP_{it}$	C	7,5661**	R2	0.74
		$\ln UNEM_{it}$	0,1785**	Wald Chi2	47.45
		$\ln GDRP_mining_{it}$	0,1574**	Prob (F-stat)	0.00
		$\ln RSF_NR_{it}$	0,0178		
		$\ln DI_{it}$	0,0061*		
		$\ln Coal_land_{it}$	0,0158		
		$\ln MYS_{it}$	2,2932**		
2	$\ln UNEM_{it}$	C	9,6265**	R2	0.91
		$\ln GDRP_{it}$	0,5343**	Wald Chi2	103.31
		$\%EM_mining_{it}$	-0,0211	Prob (F-stat)	0.00
		$\ln Coal_land_{it}$	0,0425*		
		$\ln Min_wage_{it}$	-0,7328**		
		$\ln Density_{it}$	0,2059**		

**) Significance with alpha 5% and *) Significance with alpha 10%

4. Discussion and Conclusion:

Discussion

Table 1 shows that simultaneously both the economic growth and unemployment equations, the independent variables together have a significant effect on the two dependent variables, with the R-square are 74 percent and 91 percent. There is a two-way influence between economic growth and unemployment which is positive, meaning that when the regencies/municipalities GRDP increases, the number of unemployed will also increase. This is not following Okun's Law and several previous studies

such as Sahnoun & Abdenmadher (2019) and Shina (2016) which conclude that economic growth and unemployment have a negative effect on each other. However, Okun's Law also doesn't occur in Macedonia, which is possible due to the fairly large structural unemployment component and mostly occurs in developing countries (Sadiku et al., 2015).

Economic growth is influenced by the GRDP of the mining sector with a coefficient is 0.15. It means that the overall economy of regencies/municipalities in East Kalimantan is still dependent on the mining sector, but the land opening of coal mining is not significant. Based on the 2018 East Kalimantan economic report, the economic contraction in 2015 and 2016 was due to soaring world coal prices so that demand fell (BPS, 2019). Coal production has increased again in 2017, but it is possible that there will not be much new opening land due to unstable coal trading conditions in the previous year.

Revenue Sharing Fund of Natural Resources (RVSNR) which is a distribution fund from the central government, has no impact on the economic growth of regencies/municipalities in East Kalimantan. The problem of RVSNR is often a delay in giving and a mismatch in the amount expected so that development in the area is less than optimal (Harefa, 2018). In addition, mostly RVSNR is used to improve environmental conditions due to economic activities, such as reforestation and reclamation (Ministry of Finance Indonesia, 2017). The variables of capital, both domestic investment and human capital (education), have a positive effect on economic growth, in line with the research of Bakari and Tiba (2019).

Unemployment is influenced by coal mining land, minimum wages, and population density. The land opening for coal mining has a positive effect on the number of unemployed. This is because the labor absorbed mostly comes from outside the region (Suharto et al., 2017) so that the number of labor in the mining sector also doesn't affect unemployment. The number of labor from outside the region is also indicated by the increasing population density, which causes a decrease in job opportunities and increased unemployment. The Central Bureau of Statistics Indonesia noted that the population growth rate of East Kalimantan is quite high with an average of 2.2% in 2011-2019, where the region with the fastest rate in 2019 is East Kutai due to a large number of mining activities activities (BPS, 2019). Another variable that affects unemployment is the minimum wage, which is in line with the research of Suhendra dan Wicaksono (2016).

Conclusion

In general, mining activities in the regencies/municipalities of East Kalimantan still dominate the economy. However, regional revenues from RVSNR have not been utilized properly to increase economic growth. In addition, land opening for coal mining invites a lot of labor from outside the region, so that local society is less absorbed. As a result, the population increases cause decreasing in employment opportunities and increasing in unemployment. Therefore, the advice given is to provide education and training for local society with a budget from RVSNR, especially the skill for mining activities. Then, the local government should further examine the transmigration policy and the minimum wage to reduce unemployment in East Kalimantan.

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