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Analysis of Causality Interactions Between Education, Inequality, and Unemployment Toward Poverty in East Java: Empirical Evidence from Dynamic Panel Co-integration Model

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Abstract: The issue of poverty has been faced for a long time. In Indonesia today, East Java is the most significant contributor to the poor people. With various policies that the government has implemented, the issue of poverty remains unsolved. This study, therefore, discusses the causality relationship between education, inequality, and unemployment toward poverty in East Java. Using secondary data from the Statistics Indonesia (BPS), we estimated dynamic panel data of cities and regencies in East Java from 2012 to 2017. Employing the Granger causality approach, it was found that education has a one-way relationship with inequality and a two-way relationship with unemployment. In addition, poverty has a one-way relationship with all the variables used. In the long term, education has a negative correlation with poverty. According to our findings, both the government and the private sector need to expand more job opportunities and improve education for the poor as both sectors significantly reduce poverty in the long term.

Keywords: Education; Inequality; Unemployment; Poverty; Granger Causality

JEL Classification: D63, E24, I24, I32

Introduction

In the present day, poverty is one of the biggest problems confronting many countries throughout the world, including Indonesia. Poverty has the same effect on all countries, such as welfare for low-income families (clothing, food, housing), low level of education, and limited access to health facilities (Dewi & Rachmawatie, 2020). In 2016, 6.80% of the total Indonesian population, or around 17,951,413 people, lived on an income of less than US$2 per day (Statistics Indonesia, 2018). Specifically, one of the most significant contributors to poverty in Indonesia is East Java Province.

At the end of March 2019, more than 4 million people in East Java lived below the poverty line. With this number, East Java Province is said to be the province with the most significant number of poor people in Indonesia.

However, this figure has been much lower since 2013 and continues to decline from year to year. In 2013, the number of poor people in East Java reached 4,893,000 people.
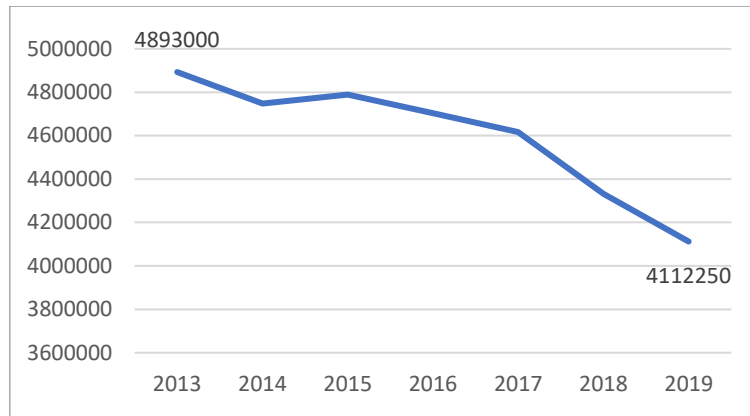
Figure 1 Total of Poor People in East Java Province
Source: Statistics Indonesia (2019a)

Although the level of decline has a relatively large number throughout the year, the ratio between the population and the number of poor people across the years reveals that the change percentage is relatively minor. Therefore, the poverty reduction rate in East Java tends to be very small. In 2013, the proportion of poor people was 12.73%, and after six years in 2019, the percentage only decreased by 2.36%.
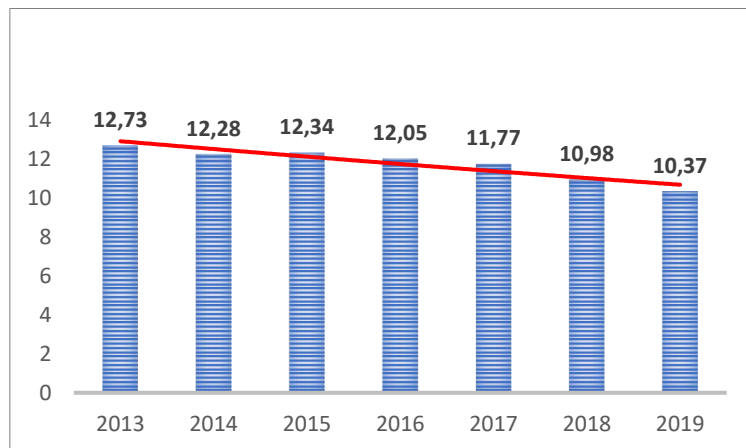
Figure 2 Poverty Percentage in East Java Province
Source: Statistics Indonesia (2019b)

Moreover, poverty is the primary constraint in economic development; those who live in a cycle of poverty have a tiny probability of getting economic opportunities. The weak capability of the poor puts them at a disadvantage position compared to those who are not poor. The poor also have many obstacles in accessing essential life services, such as schools and health facilities (Suryahadi et al., 2011). Indeed, the difficulty of accessing

economic opportunities is one of the reasons that can increase the level of poverty experienced by individuals and households (Ogbeide & Agu, 2015). Most economists consider that solving the problem of poverty requires appropriate policies; besides that, the poor in the population must be able to get the benefits from the implemented policies.

Government efforts to tackle and reduce poverty, thus, continue to be implemented. Anti-poverty programs launched by the government, such as direct cash transfer, credit business for society, and some other programs, have a massive impact on poverty alleviation. However, when the alleviation program was implemented, many poor people were left behind because of administrative problems or the inaccurate object of the targeted programs. As poverty conditions are increasingly complex, poverty alleviation will become more challenging.

Nowadays, poverty has become a multidimensional problem. With the unresolved poverty problem, it is estimated that there are problems in the formulation and implementation of improper policy in poverty alleviation. Most poverty cases are more linked and measured by the economic dimension, where the lack of money is the leading cause of poverty. In another perspective, poverty is limited to fulfilling material and daily needs. However, poverty always has various dimensions: health, social, education, and politics. In this regard, education is an essential element in alleviating poverty. Education has emerged as an almost undeniable strategy for economic development in overcoming social, political, and economic problems in developing countries (Datzberger, 2018). However, in Indonesia, there is a polemic where education has not effectively alleviated poverty. Both come from the supply side, where the quantity of infrastructure and the quality of teachers is inadequate; there are also problems on the demand side, where financial capacity is a significant problem for poor households accessing education (Suryahadi et al., 2011). In some cases, one of the reasons parents do not enroll their children in school is because the opportunity cost of enrolling their children in school is higher than sending them as child workers and earning money to ease the burden on the poor at home.

Poverty and education are two things that have been widely discussed in research in recent years. This thinking begins with the belief that high education and human resources are essential for economic growth. Most of the literature on poverty and education concludes that the two are inversely related—the higher the education level, the lower the poverty rate, vice versa. The relationship between poverty and education can also be seen as two perspectives. First, investment in education increases the skills and productivity of poor households, increasing income levels and improving living standards in the long term. Second, although education positively influences poverty alleviation, a complicated problem is identified; poverty itself is a significant obstacle to educational attainment for the poor (Awan et al., 2011). In addition, poverty has a considerable effect on education, divided into three dimensions. First are resources, especially from the financial side. Second, mental pressure, especially social pressure, mutilates the mindsets of non-poor students at their schools, causing poor students to be

reluctant to go to school. Third, distortions in institutions affect the quality and standards of teaching (Bramley & Karley, 2007).

On the other hand, some literature states that poverty and inequality are likened to two sides of one coin. Poverty and inequality are also often found simultaneously in a region with acute poverty. The assumption often mentioned, either explicitly or implicitly, argues that where there is an increase in poverty, it is assumed that inequality will also increase, and vice versa (Beteille, 2003). In addition, poverty and inequality have an indirect relationship with economic growth. According to Adams (2004), a gradual increase in economic growth will reduce poverty, but the increase will have a different response to inequality; the changes in inequality are tiny compared to the decrease in poverty. Within a specific area, poverty levels are also often linked to inequality, as previous research has shown. Inequality is said to be vital in its contribution to reducing or increasing poverty in an area (Adams, 2004; Bourguignon, 2003). Aigbokhan (2000) asserted that the polarization of inequality contributes to increased poverty. Inequality is indirectly related to the unequal distribution of labor so that the income received by the community tends to be different.

Furthermore, increasing unemployment is often considered another indicator of a country's economic decline. It will create a multiplier effect; there will be widespread poverty when a country's economy goes down. In recent years, the relationship between poverty and unemployment has not been clear. However, unemployment usually lowers a person's standard of living due to the absence of income received, causing a person to become poor (Mohammad & David, 2019). Besides, although many poverty alleviation and unemployment reduction policies are often carried out in developing countries on a large scale, both issues are still tricky problems to solve (Agénor, 2004).

While many studies have discussed the factors that may influence poverty in society, the question of possible causal relationships between phenomena or variables that correlate with poverty has not been given much attention, especially implementation in the case of poverty in East Java Province. The importance of understanding the causal relationship to the phenomenon of poverty can assist policymakers in developing and formulating more appropriate policies for the ongoing poverty problem. Hence, the policymaking can lead to the main problem that caused the phenomenon to begin.

To bridge the gap, we analyzed the causal relationships between education, inequality, unemployment, and poverty in East Java Province. The rest of this paper is organized as follows: Section 2 describes the methodology used in this study. Section 3 shows the results and discussion. In the end, it closes with the conclusions and recommendations of this study.

Research Method

This quantitative study aims to analyze the causal relationship between education, inequality, and unemployment on poverty in East Java Province. The research began with

data searching, data input, and data processing following the research model used; the analysis results ended with conclusions and suggestions for policymakers. The data used in this study were secondary in the form of panel data obtained from the Statistics Indonesia (BPS). The data used were annual data at the regency and city levels from 2012 to 2017.

The Granger causality panel model was employed to analyze the causal relationship between education, inequality, and unemployment on poverty in East Java Province. In this case, Granger has a strong advantage in analyzing and forecasting two variables that may have correlated. Since it formulates a test statistic to test whether movements in one variable systematically precede movements in another variable (Hacker & Hatemi, 2006), the Granger causality analysis used in this study was based on the following regression equation:

$$[Educ]_{i,t}= \alpha + \sum_{k=0}^{p} \gamma^{(k)} [Educ]_{i,t-k} + \sum_{k=0}^{p} \beta_i^{(k)} \begin{bmatrix} Pov \\ Ineq \\ Unemp \end{bmatrix}_{i,t-k} + \vartheta_{i,t} \qquad (1)$$

Educ is education measured using school expectations. Pov is poverty gauged based on the percentage of poverty occurring in regencies and cities in East Java Province. Ineq is inequality determined using a score from the GINI index. Meanwhile, Unemp is the open unemployment rate. In addition, Equation 1 shows a regression model to see the causal relationships between education and poverty, inequality and unemployment, respectively.

$$[Ineq]_{i,t}= \alpha + \sum_{k=0}^{p} \gamma^{(k)} [Ineq]_{i,t-k} + \sum_{k=0}^{p} \beta_i^{(k)} \begin{bmatrix} Pov \\ Educ \\ Unemp \end{bmatrix}_{i,t-k} + \vartheta_{i,t} \qquad (2)$$

Equation 2 depicts a model to sequentially test the causal relationships between inequality and poverty, education and unemployment, respectively.

$$[Unemp]_{i,t}= \alpha + \sum_{k=0}^{p} \gamma^{(k)} [Unemp]_{i,t-k} + \sum_{k=0}^{p} \beta_i^{(k)} \begin{bmatrix} Pov \\ Educ \\ Ineq \end{bmatrix}_{i,t-k} + \vartheta_{i,t} \qquad (3)$$

Equation 3 illustrates a test model to sequentially see the causal relationships between unemployment and poverty, education and inequality, respectively.

$$[Pov]_{i,t}= \alpha + \sum_{k=0}^{p} \gamma^{(k)} [Pov]_{i,t-k} + \sum_{k=0}^{p} \beta_i^{(k)} \begin{bmatrix} Unemp \\ Educ \\ Ineq \end{bmatrix}_{i,t-k} + \vartheta_{i,t} \qquad (4)$$

In the last model test, Equation 4 displays the model to examine the causal relationships between poverty and unemployment, education and inequality, respectively. In this research, the strategy was divided into four main stages. First, the stationarity test used a unit root test on the panel series. Second, a cointegration test was performed to see a

long-term relationship between variables. Third, if it was found that the variable was cointegrated, it was necessary to estimate the long-term relationship using the fully modified ordinary least square (FMOLS) method. Since OLS requires that each variable used is exogenous, we needed to test the variables using FMOLS in panel cointegration estimates; using simple OLS in long-term estimation relationships may cause bias in the estimates. In the last stage, the Granger causality panel test was then carried out.

Result and Discussion

East Java is a province with various characteristics of cities and regencies. The characteristics of education, inequality, the total percentage of poverty, and the unemployment rate are different in each region. Table 1 shows the average of the various variables used in this study for 2012 to 2017. The average in each regency and city in East Java Province indicates that 12.20% were classified as poor. The average education taken by people in East Java was 12.59 years, meaning that people in East Java could complete their education up to the high school level. In addition, in East Java, about 4.2% of the total available workforce was still unemployed.

Table 1 Descriptive statistic

Variables	Mean	St. Dev
Poverty percentage	12.20529	5.018401
School expectations	12.59789	0.969096
Inequality rate	0.327763	0.042487
Unemployment rate	4.232158	1.595788

Stationarity Test

A stationarity test was carried out using the unit test root panel. To investigate stationarity in the series, we used a unit root test on the data panel using the methods of Levin, Lin, and Chu, Augmented Dickey-Fuller–Fisher Chi-Square, and Phillips-Perron–Fisher Chi-Square. The results of the estimated stationarity test are presented in Table 2.

Table 2 The Results of Unit Root Panel Test

Null: No Unit Root				
Method		Levin Lin and Chu	ADF-Fisher Chi-Square	PP- Fisher Chi-square
	Variables			
Level	Poverty percentage	-9.00268*** (0.0000)	100.155** (0.0332)	169.517*** (0.0000)
	School expectations	-66.9514*** (0.0000)	170.298*** (0.0000)	242.882*** (0.0000)
	Inequality rate	-11.4810*** (0.0000)	104.949** (0.0156)	140.241*** (0.0000)
	Unemployment rate	-27.6698*** (0.0000)	177.344*** (0.0000)	181.682*** (0.0000)

* indicates significant at *10%, **5%, ***1% level respectively.

Table 2 displays that the results found that all variables were stationary at the level, even most of them were statistically significant at the 1% level. However, it was different in the variables of inequality and poverty; in the ADF-Fisher method, the two variables were statistically significant at the 5% level. At this point, the unit root panel test revealed that data were stationer. Since data were stationer, we could proceed to the cointegration panel test to analyze the existence of a long-term relationship between poverty, education, inequality, and unemployment.

Cointegration Panel Test

The cointegration test requires that all variables are integrated in the same order. The unit root test in the previous section showed poverty, education, inequality, and stationary unemployment at the order level so that the researcher could proceed to the cointegration test. Using the Kao residual cointegration test (Engle-Granger Based) approach, we tested cointegration.

Table 3 Cointegration Panel Test Results

Null: No Cointegration		
	t-statistic	Prob
ADF	-7.231066	0.0000
Residual variance	0.105109	
HAC variance	0.112355	

Table 3 presents that the t-statistic value of the ADF outcome was -7.231066 with a probability of 0.0000. As the probability value was <5%, we could reject the null hypothesis (Ho). Thus, it can be said that the variables of poverty, education, inequality, and unemployment used in this study had a long-term relationship or were cointegrated.

FMOLS Estimation

After confirming the cointegration relationship between variables, we should follow the long-term analysis estimation. We estimated the long-term effects of education, inequality, and unemployment on poverty. The estimation results of the panel FMOLS method are shown in Table 4 concerning the effect of the long-term relationship of education, inequality, and unemployment on poverty. All variables were statistically significant at 1% significance, where education significantly affected poverty reduction. When public education increases by one year, it will reduce poverty by 0.7%. Also, inequality had a positive effect on poverty, meaning that when the level of inequality rises 1%, it will increase the level of poverty by 0.29%. The same thing was found in the unemployment rate; when the unemployment rate rises by 1%, it will increase the percentage of poverty by 0.02%.

Table 4 FMOLS Test

Poverty	FMOLS Estimation
Education	-0.703348***
	(0.0000)
Inequality	0.218789***
	(0.0000)
Unemployment	0.022707***
	(0.0000)

* indicates significant at *10%, **5%, ***1% level respectively.

These findings align with Awan et al. (2011), where education affects poverty by increasing productivity and slowly lifting people out of poverty. In addition, the findings on the effect of inequality and poverty are in line with Beteille (2003) that reducing inequality in the long term will reduce the level of poverty. Meanwhile, the effect of unemployment on poverty is consistent with Mohammad and David (2019) that unemployment will cause individuals not to earn income; moreover, this case will make the individual poorer.

Granger Causality Panel Test

The FMOLS cointegration test carried out implies the effect of a one-way relationship of education, inequality, and unemployment towards poverty. The test also found a long-term relationship between the four variables. We tested to see possible causal relationships between variables for the next stage. Before estimating Granger causality, we needed a lag matching the estimate criteria. The researchers then determined the VAR lag-order selection criteria test to find the lag.

Table 5 VAR Lag Order Selection Criteria results

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-129.3983	NA	0.013161	7.020963	7.193341	7.082294
1	32.11360	280.5207*	6.25e-06*	-0.637558*	0.224329*	-0.330905*
2	47.75026	23.86647	6.57e-06	-0.618435	0.932963	-0.066459
3	59.06420	14.88676	9.09e-06	-0.371800	1.869108	0.425498

*lag order selected based on criteria

According to the results in Table 5, the lag used in our estimation of Granger causality was one year. It means the variables themselves influenced the variables used in this study in the previous year. Furthermore, we continued with the Granger causality test after the lag was confirmed. The results of the Granger causality test are displayed in Table 6.

Table 6 depicts that the relationship between poverty and education was one direction: poverty causes education to increase or decrease. It is in line with Awan et al. (2011) that poverty is a severe obstacle for someone to access education. The same thing may also happen in East Java Province: poverty limits education to be achieved. In contrast to inequality and education in the case of East Java Province, according to the estimation results, education affected the size of inequality in the area. This finding is contrary to the findings of Stiglitz (1973); in his research, he stated that education did not cause

inequality. In East Java, this case may happen due to the indirect effect of education on inequality, where education causes individual productivity to decrease and leads individual income to stagnate so that the distribution of income between individuals is uneven.

Table 6 Granger Causality Test

No	Null Hypothesis	F- Statistic	Probability	Results
1	Poverty does not Granger cause education.	11.9287	0.0007	Rejected***
2	Education does not Granger cause poverty.	0.06269	0.8026	Accepted
3	Inequality does not Granger cause education.	0.39617	0.5298	Accepted
4	Education does not Granger cause inequality.	19.8002	1.E-05	Rejected***
5	Unemployment does not Granger cause education.	6.49889	0.0122	Rejected**
6	Education does not Granger cause unemployment.	3.87871	0.0514	Rejected*
7	Poverty does not Granger cause inequality.	20.2439	1.E-05	Rejected***
8	Inequality does not Granger cause poverty.	0.31332	0.5763	Accepted
9	Inequality does not Granger cause unemployment.	2.62817	0.1078	Accepted
10	Unemployment does not Granger cause inequality.	2.14986	0.1454	Accepted
11	Unemployment does not Granger cause poverty.	1.80707	0.1816	Accepted
12	Poverty does not Granger cause unemployment.	2.97999	0.0871	Rejected*

* indicates significant at *10%, **5%, ***1% level respectively.

In this study, unemployment and education had a two-way relationship, indicating that both increased and decreased levels of unemployment depend on the level of education achieved by people in the whole province. On the other hand, a change in educational level would affect the level of unemployment respectively. These results align with Mincer (1991) that the success or failure of a person in finding a job depends on the high education taken by the individual. In addition, the higher the level of education, the more probability of staying in the current job will be greater than those with low education.

Then, in this research, poverty and inequality had a one-way relationship, where poverty causes inequality. It denotes that inequality in the area gets more extensive when poverty increases. It corroborates with Beteille (2003) and Nguyen et al. (2020), where poverty will affect the inequality that occurs; thus, when poverty increases, inequality will also increase. On the other hand, when poverty decreases, inequality will decrease. This finding proves that poverty and inequality are natural things to be encountered simultaneously in an area. However, in East Java, there was a one-way relationship; it is likely because inequality from 2012 to 2017 was relatively low, but the number of poor people was still quite large, so poverty has likely caused inequality to arise.

From the estimation results, inequality and unemployment in the case of East Java Province had no relationship at all. In contrast with Morsy (2011), he stated that unemployment is one of the reasons that exacerbates inequality in an area. In the East

Java Province case, the possibility is that the inequality from 2012 to 2017 tended to be low, with an average of 0.2 based on the GINI ratio. Therefore, the estimation results showed that inequality did not cause unemployment or vice versa.

Further, poverty and unemployment had a one-way relationship, where poverty caused unemployment in East Java Province. It agrees with Mohammad and David (2019), who affirmed that unemployment indirectly affects poverty. When individuals are unemployed, their income will stop, while the necessities of their life are not; it is what makes poverty appear due to unemployment. In some cases in other countries with a relatively high level of inequality, Ogbeide and Agu (2015) found that poverty and inequality had an interrelated effect, where poverty caused inequality to rising and vice versa. However, in the case of East Java Province, it can be traced back to the relationship between poverty and education, where poverty affected education. Thus, when education stopped at a low level, indirectly, economic opportunities for work would be closed. In summary, the causal relationship found in cases in East Java in the 2012-2017 period can be explained in Figure 3.
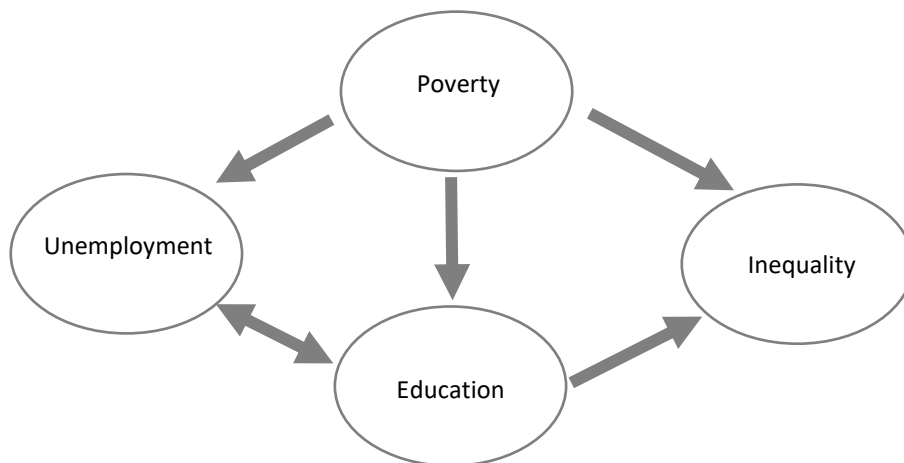
Figure 3 Summary of causality relationship between variables in East Java Province

Conclusion

The results of the Granger causality estimation showed that in this study, education had a one-way relationship to inequality. In addition, education also had a two-way relationship with unemployment. Education, therefore, has a significant role in reducing or increasing unemployment and inequality in East Java Province. In addition, poverty had a one-way relationship to each variable without an inverse relationship. It means that poverty in East Java Province came naturally or most likely came from the previous generation. It makes poverty challenging to solve in a short period.

However, based on long-term estimates using the FMOLS, it was found that poverty can be reduced by increasing education in the East Java Province. This finding indicates that

the government needs to strengthen education in East Java to reduce poverty. In addition to improving education, the government and the private sector need to create as many job opportunities as possible. It is essential because unemployment and education have a relationship with each other. It means that despite education trying to be improved by the government, if individuals do not have wages earned from working to enroll their children to receive education, the efforts to improve education are not effective enough. This study has limitations: data availability with a limited years range. It is hoped that further research will use a more extended range and a narrower level down to the household level so that the issues raised become more detailed and have firm conclusions.

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