The Nexus Between Poverty, Education and Economic Growth in Indonesia

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Article Information	Abstract
	_____ The causal relationship between poverty, education and economic growth has been widely studied in many countries, however, the results of a lot of studies demonstrate a controversial point of view and diverse conclusions which may be caused by differences in methodologies and development policies. The purpose of this study is firstly, to investigate the dynamic causality relationship between education, poverty, and economic growth both in the short and long-run, secondly, to analyze the dynamic response of poverty to shocks of education and economic growth. This study applied the quantitative method approach by using Panel Error Error Correction Model (PVECM). All secondary data was taken from BPS, in the form of panel data of 33 provinces in Indonesia during the period 2010-2018. This study found strong evidence that there was a long-run feedback causality linkage between poverty, education, and economic growth, while in the short-run, only found a bi-directional causality relationship between education and economic growth. The shocks of education and economic growth were responded negatively by the poverty variable, indicating that improving the quality of education and economic growth plays a vital role or has an impact on poverty reduction.

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INTRODUCTION

In the las few decades, economic growth (per capita income) has been considered as a key indicator of the success of economic development in many countries. However, the failure of economic development in developing countries, especially in reducing poverty levels, raises serious attention from economists, academics, policymakers, and the government especially in Indonesia to review the relationship between economic growth, poverty, and other macro variables. Development policy strategies that rely solely on economic growth do not have much of a trickle-down effect on improving the welfare of the population. Therefore, nowadays, a review of development planning oriented to quality growth without compromising the aspect of equity becomes a top priority in improving the quality of economic development in Indonesia. One important issue that has attracted much attention from researchers is whether economic growth can be a powerful instrument for reducing poverty and how the impact of education on economic growth and poverty. Another question is what is the pattern and direction of the causal relationship between poverty, education and economic growth.

The dynamics of economic growth in Indonesia have fluctuated due to shocks from internal and external factors. For the period 2010-2014, Indonesia's economic growth experienced a downward trend from 6.81% to 5.02%. In 2018, Indonesia's economic growth could grow by 5.17%, with an average economic growth in 2015-2018 of 5.01%., meanwhile, poverty reduction showed a decline. In 2010, the poverty rate in Indonesia was 13.33 % then decreased in 2018 to 9.66 % or an average of 11.28 % per year while the quality of education as measured by the mean years of schooling showed an increasing trend from year to year with an average of 7.77 % annually. Regionally, in 2018, the distribution of poverty rates shows inequality with the highest poverty rates in Papua and West Papua Provinces of 27.4 % and 22.7 %, respectively. Furthermore, DKI Jakarta Province has the lowest poverty rate of 3.55 % in line with the significant average economic growth and education quality (mean years of schooling) of 6.17 % and 11.05 years, respectively.

In the perspective of empirical studies, research that highlights the causal relationship between poverty, education and economic growth has been widely studied in many countries both developed and developing countries. However, the results of a lot of studies demonstrate a controversial point of view and diverse conclusions which may be caused by differences in methodologies and development policies between countries. Several researchers have found that economic growth has a significant impact on poverty reduction. In other words, there is a unidirectional causality running from economic growth to poverty reduction (McKay, 2013; Odhiambo, 2009); (Renggo, 2017; Ginting & Dewi, 2013). Meanwhile, Nyasha, Gwenhure & Odhiambo (2017) and Nuruddeen & Ibrahim (2014) have found a unidirectional causality running from poverty reduction to economic growth. Other studies have revealed that the nexus between poverty and economic growth has a long-run bi-directional causality (Afzal et.al, 2012; Garza-Rodriguez, 2018 ; Dewi et al., 2018) while in the case of Nigeria, Okoroafor and Chinweoke (2013); Nindi & Odhiambo (2015) have argued that there is no relationship between economic growth and poverty.

In the case of the relationship between education and economic growth, several researchers have found that education has a significant impact on economic growth. In other words, there is a unidirectional causality running from education to economic growth (Mercan & Sezer, 2014; Baldacci, et.al, 2008; Dănăcică, 2011; Sandar & MacDonald, 2009). Meanwhile, Bakar, Haseeb, & Azam (2014) and Pegkas (2014) have found a bi-directional causality running from education to economic growth and running from economic growth to education. Furthermore, educational institutions, investments in education, quality of education and equal access to education have been found playing a vital role in the alleviation of poverty

and enhancing economic growth (Chaudhry & Rahman, 2009; Pervez, 2014).

This study aims 1) to investigate the dynamic causality relationship between education, poverty, and economic growth both in the short and long-run during the period 2010-2018, 2) to analyze the dynamic response of poverty to shocks of education and economic growth. The rest of this paper proceeds as follows: Section 2 presents a review of relevant literature. Section 3 describes the research method consisting of an explanation of the data and variables used, specifications of the econometric model, testing data and PVECM analysis. Section 4 explains the results and discussion. Section 5 is the final section that contains conclusions and recommendations.

RESEARCH METHODS

The type of data used in this study is secondary data in the form of panel data during the period 2010-2018. Panel data consit of 33 provinces in Indonesia namely 1) Aceh, 2) North Sumatera, 3) West Sumatera, 4) Riau, 5) Jambi, 5) South Sumatera, 6) Bengkulu, 7) Lampung, 8) Bangka, 9) Bangka Belitung, 10) Riau Island, 11) DKI Jakarta, 12) West Jawa, 13) Central Jawa, 14) DI Jogyakarta, 15) East Jawa, 16) Banten, 17) Bali, 18) West Kalimantan, 19) Central Kalimantan, 20) South Kalimantan, 21) East Kalimantan, 22) West Nusa Tenggara, 23) East Nusa Tenggara, 24) North Sulawesi, 25) Central Sulawesi, 26) South Sulawesi, 27) Southeast Sulawesi, 28) Gorontalo, 29) West Sulawesi, 30) Maluku, 31) North Maluku, 32) West Papua, 33) Papua.

All data was taken from the Central Statistics Agency (BPS) and relevant government institutions. The research data in this study consists of 3 (three) variables, namely: 1) Economic growth variable (EG), measured by the natural logarithm of Gross Regional Domestic Product per capita (unit: IDR thousand), 2) Education variable (EDU), measured by the natural logarithm of the mean years of schooling (unit: year), 3) Poverty variable (POV), measured by the percentage of

the number of poor people representing the rate of poverty (unit: percent).

This study applied the quantitative method approach by using Panel Error Error Correction Model (PVECM). It was employed to 1) Investigate the short-run and long-run causality linkage between education, poverty and economic growth. 2) Determine the direction of causal relationship between education, poverty and economic growth both in the short and long-run. Panel Vector correction Model (PVECM) is a restricted PVAR (panel vector auto-regression) designed for use with non-stationary series that are known to be cointegrated. The PVECM has cointegration relations built into the specification so that it restricts the long-run behavior of the endogenous variables to converge their cointegrating relationships while allowing for short-run adjustment dynamics (Engle and Granger, 1987). The cointegration term is known as the error correction term because a series of partial short-run adjustments make corrections to deviations to achieve long-run equilibrium gradually.

When the variables are cointegrated of the same order, then the valid error correction model exists between the three variables. The determination of a cointegration relationship (cointegrated vector) shows the presence of the long-term relationship between variables, causality (Rachev et.al, 2007; Gujarati and Porter, 2009). PVECM treats the three observed variables (POV, EDU and EG) as endogenous variables and includes the lag value of each variable on the right-hand side of the equation. In the panel data, the VECM model used is written as follows:

$$\Delta POV_{it} = \alpha_1 + \sum_{i=1}^{p} \beta_1 \Delta POV_{it-1} + \sum_{i=1}^{q} \beta_1 \Delta EDU_{it-1} + \sum_{i=1}^{r} \beta_1 \Delta EG_{it-1} + \lambda_1 ECT + \mu_{1it} \quad\quad (1)$$

$$\Delta EDU_{it} = \alpha_2 + \sum_{i=1}^{p} \beta_2 \Delta EDU_{it-1} + \sum_{i=1}^{q} \beta_2 \Delta POV_{it-1} + \sum_{i=1}^{r} \beta_2 \Delta EG_{it-1} + \lambda_2 ECT + \mu_{2it} \quad\quad (2)$$

$$\Delta EG_{it} = \alpha_3 + \sum_{i=1}^{p} \beta_3 \Delta EG_{it-1} + \sum_{i=1}^{q} \beta_3 \Delta POV_{it-1} + \sum_{i=1}^{r} \beta_3 \Delta EDU_{it-1} + \lambda_3 ECT + \mu_{3it} \quad\quad (3)$$

Where ECT is expressed as follows:

$$ECT_{it} = POV_{it} - \beta_0 - \beta_1 EDU_{it} - \beta_2 EG_{it}.$$

EG is the economic growth variable, measured by the natural logarithm of the Gross Regional Domestic Product (million IDR). POV

is the poverty variable, measured by the percentage of the number of poor people representing the rate of poverty (unit: percent). EDU is the education variable, measured by the natural logarithm of the mean years of schooling. ECT is an error correction term, t is time (the year 2010-2017) and i is cross-section data (33 provinces in Indonesia).

In this model, the error correction term is placed on the right hand side. In the long-run equilibrium, this term is equal to zero. However, if POV, EDU and EG deviate from the long-run equilibrium, the error correction term will not be equal to zero and each variable adjusts to partially restore the equilibrium relation. The coefficient of ECT measures the speed of adjustment of the ith endogenous variable towards the equilibrium. PVECM analysis must go through the following stages / procedures:

Firstly, the unit root (stationarity) test. It is used to test whether panel data is stationary or not stationary.

Stationary data will tend to approach the average value and fluctuate around the average value. Panel data is a combination of times series data and cross-section, so the stationary test phase needs to be done to see whether there is a unit root contained between variables, so that the relationship between variables becomes valid. If the panel data has a unit root, it is said that the data moves randomly (random walk). If the absolute value of statistics is greater than the critical value, the observed data shows stationary or reject the null hypothesis. In this study, the method of panel data unit root tests is Levin, Lin & Chu t-test, ADF (Augmented Dicky Fuller)-Fisher test and Philips-Perron (PP)-Fisher test. Levin, Lin & Chu (2002) in Baltagi (2005) used the panel data unit root test by considering the following ADF specifications:

$$DY_{it} = \alpha Y_{it-1} + \sum_{j=1}^{p} \beta_{it} DY_{it-j} + X_{it}\delta + \varepsilon_{it} \quad ....(4)$$

Where Y_{it} = panel data. DY_{it} = difference form of Y_{it}, $\alpha = p-1$, pi = number of lags adjusted for first difference. ε_{it} = error term. Secondly, the panel cointegration test. The presence of cointegration relationship indicates the existence

of the causal relationship but does not show the direction of causality between the variables. Cointegration is a long-term relationship between variables, although not individually stationary, but the linear combination between these variables becomes stationary. The use of Panel VECM requires that there be at least 2 cointegrated variables. The method that can be used to test the cointegration is Kao Residual Cointegration Test (Engle-Granger Based). Kao (1999) in Baltagi (2005) proposed an Augmented Dickey-Fuller (ADF) panel cointegration test in which cointegrating vectors are assumed to be homogeneous. Let $\hat{e}_{it}$ be the estimated residual from the following regression:

$$y_{it} = \alpha_i + \beta x_{it} + \varepsilon_{it} \quad ....,...... \quad (5)$$

The Kao test is based on a version of the ADF test on the residual (ε_{it}) of the auxiliary regression $\varepsilon_{it} = \rho \varepsilon_{it-1} + v_{it}$, or on the augmented version of the pooled specification:

$$\quad .... \quad (6)$$
$$\varepsilon_{it} = \rho \varepsilon_{it-1} + \sum_{j=1}^{p} \lambda_j \Delta \varepsilon_{it-j} + v_{it}$$

The ADF test is applied to the estimated residual: where p is chosen so that the residual v_{it} are serially uncorrelated. The ADF test statistic is the usual t-statistic of in the previous equation. The null hypothesis of no cointegration, the ADF test statistics can be written as:

$$ADF = \frac{t_{ADF} + (\frac{\sqrt{6N\hat{\sigma}v}}{2\hat{\sigma}0v}}{\sqrt{(\frac{\hat{\sigma}_{0v}^2}{2\hat{\sigma}_v^2} + (10\hat{\sigma}_{0v}^2)}} \quad .... \quad (7)$$

Where $\hat{\sigma}_v^2 = \Sigma_{\mu\varepsilon} - \Sigma_{\mu\varepsilon}\Sigma_{\varepsilon,}^1 \hat{\sigma}_{0v}^2 = \Omega_{\mu\varepsilon} - \Omega_{\mu\varepsilon}\Omega_{\varepsilon,}^1 \Omega$ is the long-run covariance matrix and t_{ADF} is the t-statistic of in the ADF regression. Kao shows that the ADF test converges to a standard normal distribution N (0,1). The statistical value of Kao panel data cointegration test (ADF), then compared with the t-statistic value at 5% or the Probability value. If the statistical value is greater than the critical value or the probability value is less than 0.05, there is a long-run relationships in the variables.

Thirdly, the Wald test. The short-run causality is also tested using Wald test. The Wald test computes a test statistic based on the unrestricted regression. The Wald statistic measures how close the unrestricted estimates come to satisfy the restrictions under the null

Based on the research objective that has been stated previously namely: to investigate the dynamic causality relationship between education, poverty, and economic growth both in the short and long-run during the period 2010-2018. To answer the main objective, this study employs Panel Error Error Correction Model (PVECM). A description of the panel data containing the average, median, maximum value, lowest value (minimum) and number of observations, is available in Table 1. On average, the poverty rate (POV) during the period 2010-2018 in 33 provinces of Indonesia is 12.19 percent, with maximum and minimum values of

hypothesis. If the restrictions are in fact true, then the unrestricted estimates should come close to satisfy the restrictions.

RESULTS AND DISCUSSION

36.80 percent and 3.48 percent, respectively. Table 1 also explains that education (EDU), as measured by the mean years of schooling (MYS) experienced a significant increase. The mean years of schooling in 33 provinces of Indonesia for the period 2010-2018 is 7.94 years, with a maximum of 11.05 years and a minimum value of 5.6 years. During the period 2010-2018, the average achievement of Gross Regional Domestic Product per capita in 33 Indonesian provinces was 35,757 thousand, with a maximum and minimum value of 165,863 thousand and 9,317 thousand, respectively.

Table 1. Description of data

Statistics	POV	EDU	EG
Mean	12.18923	7.940471	35757.06
Median	10.66000	7.920000	26815.36
Maximum	36.80000	11.05000	165863.3
Minimum	3.480000	5.590000	9316.790
Std. Dev.	6.568512	0.997577	28488.44
Kurtosis	3.983013	3.355400	9.269098
Jarque-Bera	67.76515	8.330747	808.8254
Probability	0.000000	0.015524	0.000000
Sum	3620.200	2358.320	10619847
Sum Sq. Dev.	12771.02	294.5671	2.40E+11
Observations	297	297	297

Source: Data processed

Table 1 explains that data are normally distributed with the statistical significance indicator Jarque-Bera statistically significant at alpha of 5%. The number of cross-section units is 33 provinces in Indonesia and the total time-series is 9 years (2010-2018) so that a total of 297 panel data observations are obtained.

The econometric model which used to investigate the causal linkage between poverty, education, and economic growth both in the short-run and long-run, also to analyze the

dynamic response of poverty toward shocks of education and economic growth variables in Indonesia is the Panel Vector Error Correction Model (PVECM). The first requirement in using PVECM analysis is that the data used should be stationary and integrated. Therefore, in this section, the first step is testing data stationarity by employing the methods of Levin, Lin & Chu (LLC), and Augmented Dickey-Fuller (ADF) - Fisher and Philip-Perron (PP) -Fisher as shown in Table 2.

Table 2. Unit root test

Variables	Level			First difference		
	LLC	ADF-Fisher	PP-Fisher	LLC	ADF-Fisher	PP-Fisher
POV	-3.21445	64.9885	61.9209	-20.2285	342.022	367.417
	(0.001)***	(0.5121)	(0.6195)*	(0.000)*	(0.000)***	(0.000)***
EDU	-1.49491	47.2822	58.1757	-22.9175	413.783	427.111
	(0.0675)	(0.9604)	(0.7426)	(0.000)***	(0.000)***	(0.000)***
EG	1.62265	39.0857	34.9820	-37.1671	385.685	400.794
	(0.9477)	(0.9966)	(0.9994)	(0.000)***	(0.000)***	(0.000)***

Note: LLC=Levin, Lin & Chu. ADF-Fisher= Augmented Dickey-Fuller-Fisher
PP-Fisher=Philips-Perron-Fisher.
Value in parentheses ( ) is p-value. ***,**, * = Significant at alpha 1 %, 5 %, 10 %.

Table 2 provides important information on unit root test for examining stationarity of panel data by employing several methods namely Levin, Lin & Chu-Fisher, Augmented Dickey Fuller-Fisher and Philips Perron-Fisher. Testing data in level shows that all variables tested (POV, EDU and EG) are not stationary or fail to reject the null hypothesis (there is unit root) so that the differencing process is one of the solutions to make data stationer. In the first difference data, all variables tested are significant at alpha 1 % (p-value < 0.01) or reject the null hypothesis indicate that all first difference variables are stationary or have no unit root in the same order (integrated, I(1)). The next step in using PVECM analysis is to carry out a cointegration test with the aim of identifying the existence of a long-term relationship between variables in the model, using the Kao residual cointegration test method presented in Table 3.

Tabel 3. Kao residual cointegration test

Method	t-statistic	P-value
ADF	-4.149535	0.0000***
Residual Variance	39.43445	
HAC Variance	20.85732	

Source: Data processed

Note: ***, **, * = Significant at alpha 1 %

The cointegration test results in Table 3 provide information that the ADF statistical value of the Kao residual cointegration test is statistically significant at alpha of 1 % or p-value <0.05, indicating there is a long-term relationship between variables in the model. The presence of a cointegration relationship indicates the existence of causal relationship but does not show the direction of causality between the variables. All variables (POV, EDU and EG) have passed the stages of unit root and cointegration testing which is a condition of validity using PVECM analysis. The next step is to estimate PVECM with the aim, firstly, to obtain important information regarding the dynamic pattern of the causal relationship between poverty, education and economic growth both in the short and long term. PVECM estimation results can be seen in Table 4.
Based on the PVECM estimation results summarized in Table 4, demonstrate several important information that the ECT (error correction term) coefficients are negative and show significant statistically at alpha 1 % dan 5 % for all dependent variables or there would be speed of adjustment toward the long-run equilibrium indicating there is a long-term causality running from independent variables

(education and economic growth) to poverty variable (POV), a long-term causality running from independent variables (poverty and economic growth) to education variable (EDU) and also giving a strong evidence of the existence of a long-run causality running from independent variables (education and poverty) to economic growth variable (EG). In the long-run, economic growth and education have an impact on poverty reduction, which in turn reduces poverty significantly to accelerate economic growth and education (feedback causality). The existence of a two-way relationship (bi-directional causality)

is shown by the ECT and long-run coefficient, which are significant at alpha 5% for both variables. The ECT coefficient shows the speed of adjustment or the process of correction from the short-run to lead to equilibrium in the long-run. The speed of adjustment from education (EDU) and economic growth (EG) to poverty variable is 25.8 % meanwhile the speed of adjustment at Model 2 dan 3 is 0.5 % and 7.12 % respectively. The next procedure is to test for a short-run causality using Wald test/VEC Granger causality test as set out in Table 5.

Table 4. Summary of PVECM estimation results

Independent Variables	Dependent Variables		
	ΔPOV	ΔEDU	ΔEG
Long-Run Coefficient			
EDU (-1)	39.81955	-	-
	(7.93766)***		
EG(-1)	11.37917	-	-
	(9.86910]***		
ECT	-0.257703	-0.004561	-0.071211
	(-2.65735)***	(-2.48485)**	(-9.49965)***
Short-Run Coefficient			
ΔPOV(-1)	-0.081158	0.001805	0.043800
	(-0.87281)	(1.02567)	(6.09394)***
ΔPOV(-2)	-0.124876	0.001839	0.041543
	(-1.47885)	(1.15083)	(6.36468)***
ΔEDU(-1)	10.49506	-0.455419	1.371103
	(2.09941)**	(-5.95794)***	(3.54827)***
ΔEDU(-2)	6.513162	0.134482	0.436643
	(1.49202)	(-5.51160)***	(1.29402)
ΔEG(-1)	1.718902	0.055273	0.193925
	(1.69064)*	(2.87207)***	(2.46756)**
ΔEG(-2)	-0.365615	0.064423	0.255016
	(-0.38416)	(3.57609)***	(3.46646)***

Source: Data processed.

Value in parentheses () is t-statistic   ***, **, * = Significant at alpha 1 %, 5 %, 10 %.

Table 5 shows a short-run causality test using a Wald test/VEC Granger causality test. There is no evidence to support the short-run running from economic growth (EG) and education (EDU) to poverty variable (POV) or fail to reject the null hypothesis of the Wald test.

However, the Wald test demonstrates a strong evidence for a short-run bi-directional causality between education and economic growth which corroborates the feedback hypothesis.

Table 5. Wald test/VEC Granger causality test

Dependent variable	Independent variable	Chi-Sq	Df	p-value
1. Poverty (POV)	Education (EDU)	4.575573	2	0.1015
	Economic Growth (EG)	4.171934	2	0.1242
2. Education (EDU)	Poverty (POV)	1.725694	2	0.4220
	Economic Growth (EG)	15.30793	2	0.0005***
3. Economic Growth	Poverty (POV)	13.18924	2	0.0014***
	Education (EDU)	56.18732	2	0.0000***

Note: ***, **, * = Significant at alpha 1 %, 5 %, 10 %.

The last stage of PVECM is analyzing the response of the dependent variable to the shocks of the independent variable, using the Impulse Response Function (IRF). The results of the IRF analysis can be seen in Table 6.

Table 6. Response of poverty and economic growth to shocks of independent variables

Period	Response of POV:		Response of EG	
	EDU	EG	POV	EDU
1	0.000000	0.000000	-0.288026	0.109644
2	-0.106969	-0.515347	-0.203691	-0.121598
3	-0.589970	-1.423289	-0.131531	-0.183654
4	-0.706828	-1.228938	-0.282950	-0.194937
5	-0.136493	-0.966720	-0.275500	-0.137611
6	0.042047	-0.668501	-0.258666	-0.098516
7	-0.194118	-0.595279	-0.225796	-0.075958
8	-0.264277	-0.790249	-0.215617	-0.109132
9	-0.319395	-0.953250	-0.224786	-0.136618
10	-0.330777	-0.946125	-0.241299	-0.137243

Source: data processed

The IRF analysis is very useful to know the dynamic behavior of the three variables so that it can be seen whether the relationship pattern has a positive or negative relationship. Table 6 informs that shocks of one standard deviation of the education and economic growth variables are responded negatively by the poverty variable from the second period to the tenth period, indicating that improving the quality of education and economic growth plays a vital role or has an impact on poverty reduction. Furthermore, Table 6 shows shocks of one standard deviation of the poverty education variable are responded negatively by economic growth variables starting from the 2nd period to the 10th period indicating a negative relationship between the two variables while the educational variable shocks are responded negatively by the economic growth variable, which is not in line with the theory. The relationship between the three variables is shown by the negative response from poverty and economic growth as shown in Figure 1.

In summary, the case of empirical studies in Indonesia using PVECM found a long-run feedback causality between poverty, education,

and economic growth which are in line with research conducted by several previous studies. Afzal, et.al (2012), Garza-Rodriguez (2018) and Dewi et al. (2018) found a long-run bi-directional causality linkage between poverty and economic growth while Pegkas (2014) and Bakar, Haseeb and Azam (2014) found a long-run bi-directional causality running from education to economic growth and running from economic growth to education. This study also found a short-run bi-directional causality relationship between education and economic growth which corroborates the empirical finding of Hassan and Kalim (2012).
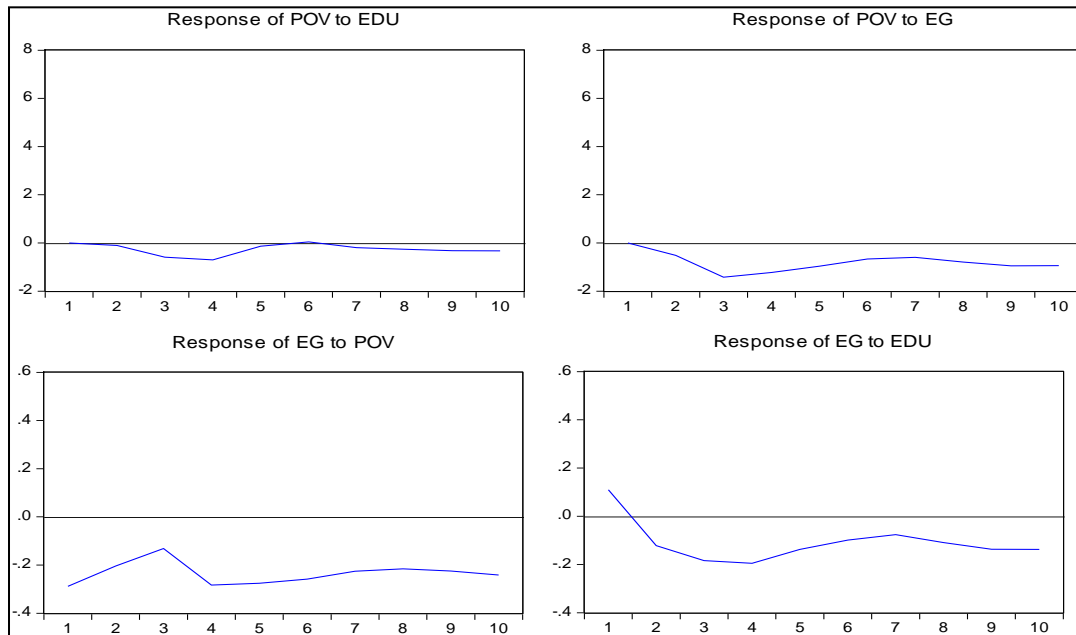

Figure 1. Trend of Impulse Response

CONCLUSIONS

Finally, this empirical study can conclude several important findings related to the pattern of dynamic relationships between poverty, education and economic growth both in the long and short-run by using the Panel VECM. This empirical study found strong evidence that there was a long-run feedback causality linkage between poverty, education, and economic growth while in the short-run, only found a bi-directional causality relationship between education and economic growth. The shocks of education and economic growth were responded negatively by the poverty variable, indicating that improving the quality of education and economic growth plays a vital role or has an impact on poverty reduction. Regional governments in Indonesia should focus on poverty reduction by improvement of

quality of education and economic growth. In further research, it is necessary to add several variables that further strengthen the results of this study, namely government spending on education infrastructure.

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