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Table of Contents

Reexamining the Economic Growth – Education Inequality – Income Distribution Nexus in Indonesia

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Abstract:

This paper examines the determinants of economic growth, income inequality, and their relationship in the context of education inequality. The results indicate that the relative dispersion of human capital has a disequalizing relationship with income distribution while the absolute dispersion has the opposite effect. This study also shows that economic growth has a significantly disequalizing effect on the income distribution and there is a quadratic relationship between income per capita and inequality (Kuznets' curve). Finally, human capital investment is positively related to the growth of the economy. Therefore, economic policies should be targeted on equal access to education.

Keywords: education; growth; inequality; Indonesia

JEL Classification: C3; I24; O47

Introduction

The goal of development is to reduce poverty, which can be achieved by economic growth, income redistribution and other development aspects such as health and education equality (Bigstein and Levin 2001). A pro-poor growth strategy not only focused on economic growth but could also be combined with an active policy of income redistribution. However, distributional policies take on greater priority if more rapid reduction in poverty can be achieved through reduction in inequalities. On the other hand, if greater levels of inequality appear to secure rapid growth that leads to faster poverty reduction, then there may be greater tolerance of distributional inequalities. Therefore, the relationship between economic growth and inequality has been highly controversial since 1950s (Bigsten and Levin 2001).

In recent years, the debates have focused on one channel which examines the impacts of economic growth on income inequality (see Ravallion 2001 and Quah 2001). However, some studies investigate the role of education in relation between economic growth and income inequality (see Checchi 2000 and Park 1996). They basically use either enrollment ratio or average years of schooling, which indicate the improvement in education level. But such indicators cannot clearly reflect the dispersion of human capital in terms of absolute and relative, respectively. Standard deviations of schooling have recently been used to measure such dispersion in absolute terms. However to measure the dispersion of schooling distribution in relative terms, education Gini seems to be an appropriate measure.

In this paper, I use the framework of Thomas *et al*. (2000) to investigate if there is a significant relationship of changes in the education Gini and standard deviation of schooling on income inequality. Then, I establish hyphothesis that economic growth is associated with income inequality and its distribution, and that there is a link of education variables on economic growth. I also disentangle whether income inequality and its distribution are correlated with economic growth.

1. Literature review

In the case of growth – inequality nexus, Kuznets (1955) postulates an inverted-U pattern where inequality first increases and then falls, as per capita income rises. The driving force was assumed to be structural change in a dual-economy setting, in which labor was shifted from a less productive (low wage) and undifferentiated traditional sector in relatively equal (rural) area, to a more productive (high wage) and differentiated modern sector in relatively unequal (urban) area.

Many researchers have doubted the Kuznets' inverted-U relationship. Fields (1989) finds that, even with more rapid growth, inequality is less likely to increase and there is no tendency for inequality to increase more in early stages of economic development (traditional society) than in latter stages (high mass consumption). In line

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with this argument, Bruno *et al.* (1996) believe that the effect of growth on inequality can go either way and depends on number of factors, but the evidence that growth changes distribution in a systematic way is very doubtful.

Deininger and Squire (1998) reveal that it was impossible to find any significant change in income distribution during recent decades and they did not find any robust evidence of an association between growth and inequality. Neither Ravallion and Chen (1997) nor Rehme (2007) find any sturdy relationship between the rate of growth and inequality. Goudie and Ladd (1999) conclude that the effect can go either way, contingent on a number of factors, and that there is little convincing evidence that growth alters distribution in a systematic way.

While the Harrod-Domar model predicts that greater inequality would create higher growth rates, there is a shift in focus from inequality to growth (Goudie and Ladd 1999). On the one side, this model proposes a strong argument that a positive link between inequality and economic growth could arise because a larger share of income is on the hand of the rich who mostly use for saving and investment purpose, instead of the poor who have high interest in consumption. On the other side, empirical evidence from both industrialized and less-developed countries has tended to confirm the negative relationship between inequality and growth.

Overall, there are five mechanisms that explain the link between inequality and growth, as follows:

First, political-economy models by Persson and Tabellini (1994). As the median voter's distance from the average capital endowment in the economy increases, reflecting a rise in income inequality, the median voter will push for high taxes, which discourage investments, and finally lower growth. In contrary, Aghion and Bolton (1990) believe that higher income inequality will produce higher rates of taxation, which increase expenditure on public education programs, leading to higher public investment in human capital, which boosts economic growth.

Second, the relationship can be explained through investments in physical and human capital. Kaldor (1956) proposes an argument that higher income inequality spurs physical capital (material resources) accumulation because rich agents have a higher marginal propensity to save than the poor. In contrary, Galor and Moav (2004) insist that during the early stages of economic development, accumulation in physical capital drives economic growth. At initial level, high income inequality stimulates aggregate saving that in turn, increases physical capital accumulation, which engineers the process of economic development. During this process, the increased physical capital stimulates return on human capital (education) investment. Thus, in the later stages of economic development, human capital accumulation wholly substitutes physical capital accumulation as an activator of economic growth, because of capital-skill complementarity.

A third channel between inequality and growth is via social-political conflicts. Alesina and Perotti (1996) argue that inequality creates social-political unrest, which tends to reduce efficiency and investment levels, and then growth. It has also been argued that if income is distributed unequally, it will bring instability to society which lessens the ability of governments to respond to external shocks, leading to a high frequency of government changes (Rodrik 1997).

Fourth, economic incentives can determine the growth – inequality nexus. Voitchovsky (2005) confirms that in a high income inequality country where skill is fully rewarded, productivity increases due to a strong incentive to invest either in physical or in human capital, which generates higher growth rates. Moreover, Champernowe and Cowell (1998) endorse the minimal role of government in open economy where income inequality is fundamentally good for incentives, which then increase growth.

Last, De La Croix and Doepke (2003) argue that a higher fertility rate will lower the relative income for the poor, which in turn enlarges the income inequality. The poor tend to have more children and thus invest less in education. In addition, there is tendency that children of poor people will likely still be poor in the future due to poverty trap. A larger proportion of population will come from the poor if fertility rate increases. As a result, a rise in inequality lowers average education and therefore, growth.

Moving to the relationship between education inequality and economic growth, such nexus can be explained by three mechanisms as follows. First, in a life expectancy model by De La Croix and Licandro (1999), investment in human capital is assumed to depend on the parental level of human capital, the number of children born by their parents, and the individual's life expectancy, which then depends on the environment where individuals grow up. An individual's level of human capital is a positive function of life expectancy and hence, the positive effect of a longer life on growth can be offset by decreasing the participation rate.

A second possible channel can be explained through technological progress. The growth process may increase the rate of adoption of new technologies. More specifically, as the investment in human capital of the highly-educated people increases, the accumulated knowledge trickles down to the less-educated people via a technological progress in production, known as the global production externality (Galor and Tsiddon 1997).

Last, this relationship can be determined by incentives that should be taken into account as growth-enhancing (Aghion *et al.* 1998). Educational inequality could be good for incentives, meaning that the greater the educational inequality, the greater the incentive for an individual to attain a higher educational level and training.

Most empirical studies use the international data on education attainment to explain this relationship. Barro (2001) reveals that growth is positively related to the initial level of average years of school attainment of adult males at the secondary and higher levels, and it is insignificantly correlated to years of school attainment of females at the secondary and higher levels and male at the primary level. Moreover, the quantity of schooling is positively associated to the economic growth. However, the effect of school quality is found more important for economic growth.

In contrast, Birdsall and Londono (1997) explore the impact of the distribution of assets on growth by emphasis on human capital accumulation via basic education and health. The results indicate a significant negative correlation between education dispersion and economic growth. Lopez *et al.* (1998) prove that the distribution of education is very important to describe income levels and economic growth, and if it is distributed unequally, it would lower income levels and economic growth. The impact of education on growth is also affected by good macroeconomic policy such that policy reforms can rise the average years of schooling and enhance the productivity of human capital in growth models.

Meanwhile, Lin (2007) investigates on how income inequality responds to changes in the average level of schooling and educational inequality in Taiwan. In addition, two control variables, fertility rate and the ratio of high-tech products on total exports, were used in OLS regressions. The finding suggests that average years of schooling are negatively associated with income inequality, and education inequality is positively correlated with income inequality. However, the estimated coefficients of the log of per capita GDP and its square are opposing with the Kuznets inverted U-shaped hypothesis. Moreover, the model can lead to reverse causation in a sense that income inequality also has an impact on economic growth and thus, OLS regression has a problem in simultaneity.

In attempt to re-establish the effects of education variables on income distribution, Park (1996) examines cross-section data in 59 countries with careful choice of the schooling variables. In a significant result, average years of schooling have an equalizing outcome on the income distribution while the standard deviation of schooling has a disequalizing yield on the income distribution. Nevertheless, as Park explicitly recognizes, a multicollinearity problem arises because the variable chosen as a proxy for educational inequality contains the average level of schooling. In addition, this study does not solve the simultaneity problem between economic growth and distribution and hence OLS regression results will be biased.

In a late study, Park (1998) presents an endogenous growth model to examine the determinants of economic growth and income distribution and their relationship. By using a simultaneous equation model, a higher level of educational attainment of the labor force has an equalizing outcome on the income distribution, while a larger dispersion of schooling among the labor force adds to income inequality. Moreover, both human and physical capital investments are significant factors in boosting economic growth, and income inequality negatively related with economic growth. However, this model only provides a partial explanation of changes in economic growth and the income distribution, given other factors such as technology and learning by doing.

2. Methodology

I take Core SUSENAS by using 1996, 1999, 2002, 2005, 2008, 2011, and 2014 as its series with section of 23 provinces in Indonesia. Five provinces such as Banten, Gorontalo, Bangka Belitung, Riau Islands, and North Maluku are a newly-autonomous-region from the previous provinces such as West Java in 2000, North Celebes in 2000, South Sumatra in 2000, Riau in 2004, and Maluku in 1999, respectively, and thus I do not include from the analysis. I also exclude the other provinces such as Maluku, Nangroe Aceh Darussalam, and Papua due to various factors (*e.g.* political turbulence and natural disaster) which make the data cannot be obtained sequentially in the period of 1999 – 2002 and 2005 – 2014.

Instead of using average consumption per capita taken from household survey, economic growth data used in this paper are real income per capita based on 2000 and 2010 constant market prices in terms of Rupiah. Bhalla (cited in Adams 2004) proves that the use of the former will underestimate income inequality and elasticity of poverty on economic growth. To measure inequality on income distribution I use the BPS Gini index based on expenditure data. As a note, a Gini index based on expenditure data tends to be lower than one resulted from income data as it only describes income shares of the bottom and the middle.

In estimating education inequality in Indonesia, I use education Gini coefficient, average years of schooling, and standard deviations of schooling. Thomas *et al.* (2000) develop education Gini formula, which is shown in eq. (1).

$$E_L = \left(\frac{1}{\mu}\right) \sum_{i=2}^{n} \sum_{j=1}^{i-1} p_i \left| y_i - y_j \right| p_j$$

(1)

where: E_L is the education Gini that takes into account the distribution of educational attainment; μ is the average years of schooling for the targeted population; p_i and p_j is the proportions of population with certain levels of schooling; y_i and y_j are the years of schooling at different educational attainment levels; n is the number of levels in attainment data.

Meanwhile, on measuring average years of schooling and its standard of deviation, Barro (1991) categorize the population that include no schooling or illiterate, partial primary, complete primary, partial secondary, complete secondary, partial tertiary, and complete tertiary. However, BPS shares the population into six categories attainment include never been to school, not complete primary school, complete primary school, complete junior secondary school, complete senior secondary school, complete tertiary school or university. Thus, those measurements can be estimated in formula 2 and 3 respectively.

$$\mu = AYS = \sum_{i=1}^{n} p_i y_i$$

(2)

$$\sigma = SDS = \sqrt{\sum_{i=1}^{n} p_i (y_i - \mu)^2}$$

(3)

Since this study's focus is the effects of education variables on economic growth and income inequality as well as its distribution, I specify the following simultaneous equation model, given other variables that may effect on economic growth, income inequality as well as its distribution.

$LYINEQ = \alpha_0 + \alpha_1 SDS + \alpha_2 LEG + \alpha_3 LY + \alpha_4 LY^2 + \alpha_5 TFR + \alpha_6 LYINEQ_{-1} + \mu_1$ (4)

$LY = \beta_0 + \beta_1 SDS + \beta_2 LEG + \beta_3 LYINEQ + \beta_4 LPopGR + \beta_5 LiExp + \beta_6 LY_{-1} + \mu_2$ (5)

where: LYINEQ is is the natural logarithm of income inequality and is proxied by the income share of bottom 40%, middle 40%, top 20% of population, and the income Gini; SDS is standard deviation of schooling based on the dispersion of education attainment; LY is the natural logarithm of real per capita GDP; LY^2 is the squared of natural logarithm of real per capita GDP; TFR is total fertility rate; PopGR is natural logarithm of population growth rate; LiExp is life expectancy; μ is error term.

In addition, the first-period-lag of LY and LYINEQ are added into economic growth and income inequality equation respectively as these variables are one of the main determinants. Overall, Table 1 provides summary of statistic of variable that its are used in this paper.

Table 1. Summary of Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
lowest	161	21.547550	2.001988	15.355	26.200
middle	161	37.625930	2.515397	32.605	48.091
highest	161	40.872450	3.727162	31.440	51.935
ays	161	6.878882	.9651651	4.430	9.820
hdi	161	69.834660	4.555598	54.200	78.590
PopGR	161	.1691787	.0889946	-.050404	.400101
ig	161	.3248571	.04623	.241	.44
eg	161	.31	.0515752	.19	.47
sde	161	3.923665	.2858555	3.38	4.66
growth	161	55195.57	72453.24	31.44	35.3723
LiExp	161	69.34534	4.176915	57.8	79.7
TFR	161	2.711056	.4697707	1.8	4.2
Year	161	2005	6.018721	1996	2014

LY |	161	10.31626	1.036457	8.053251	12.77627
------------+--					
LY2 |	161	107.4928	22.08791	64.85486	163.233
lowest_lag |	138	21.70681	2.015718	15.355	26.2
middle_lag |	138	37.64275	2.40378	32.605	48.091
highest_lag |	138	40.67797	3.636964	31.44	51.93
LY_lag |	138	10.31648	1.095641	8.053251	12.77627
------------+--					
ig_lag |	138	.3161014	.0421376	.241	.44
lPopGR |	159	-1.907262	.6009101	-4.169852	-.9160383

In addition, the expected sign of independent variables in each equation can be summarized in Table 2. In equation (4), a higher level of educational attainment is expected to contribute to a decrease in income inequality and thus, α_1 will be negative. In addition, the coefficient of α_2 will be positive as there is a direct relationship between educational inequality and income inequality in essence of human capital theory. Also, an association between growth and income inequality is expected to test Kuznets' hyphothesis so α_3 is positive and α_4 is negative. Moreover, since income inequality will rise as the fertility rate goes up, α_5 will be positive. Lastly, the coefficient of α_6 will be positive since level of previous inequality determines that of current inequality.

Table 2. The expected sign

	$\alpha_1 SDS$	$\alpha_2 LEG$	$\alpha_3 LY$	$\alpha_4 LY^2$	$\alpha_5 TFR$	$\alpha_6 LYINEQ_{-1}$
Income Inequality (L*YINEQ*) equation	(-)	(+)	(+)	(-)	(+)	(+)
	$\beta_1 SDS$	$\beta_2 LEG$	$\beta_3 LYINEQ$	$\beta_4 LPopGR$	$\beta_5 LiExp$	$\beta_6 LY_{-1}$
Economic Growth (*LY*) equation	(+)	(-)	(-)	(-)	(+)	(+)

The theoretical framework explains that greater inequality in income and education distribution is detrimental factor to economic growth. Therefore, in equation (5), the coefficient of β_1 will be positive while β_2, β_3 and β_4 will be negative. Also, the coefficient of β_5 will be positive since a rise of economic growth will increase life expectancy. Finally, the coefficient of β_6 will be positive as the current growth is determined by the previous growth.

3. Results

Preliminary estimations are done separately for each equation, (4) and (5), by using the ordinary least squares (OLS) method. The model is then re-estimated using two-stage least squares (2SLS) method.

Table 3 presents the OLS estimation results of equation (4). The standard deviation of schooling (SDS) serve as an absolute dispersion of human capital while education Gini (LEG) measures the relative dispersion of human capital. Both variables show a significant relationship with income distribution, except for the income share of the middle population (Middle40) for SDS and top population (Top20) for LEG. In addition, SDS shows a considerable disequalizing link with income inequality, reflected by a positive sign on income Gini and the Top20 as well as a negative sign on the income share of the bottom population (Bottom40). On the other hand, EG shows equalizing on income distribution, reflected by a negative sign on income Gini and positive sign on Bottom40.

Table 3. OLS Regressions of Income Inequality

	LBottom40	LMiddle40	LTop20	Log Income Gini
SDS	-0.13* (0.03)	-0.02 (0.01)	2.67* (0.92)	0.18* (0.04)
LEG	0.12* (0.03)	-0.05** (0.02)	0.69 (1.34)	-0.24* (0.06)
LY	0.05 (0.12)	-0.09 (0.09)	3.51 (5.41)	0.31*** (0.18)
LY²	-0.002 (0.006)	0.004 (0.004)	-0.18 (0.25)	-0.01*** (0.008)
TFR	-0.02 (0.01)	-0.005 (0.007)	0.63 (0.52)	0.003 (0.02)
LBottom40-1	0.56* (0.09)			
LMiddle40-1		0.83* (0.05)		

	LBottom40	LMiddle40	LTop20	Log Income Gini
LTop20$_{-1}$			0.74* (0.06)	
LogIG$_{-1}$				0.49* (0.07)
R^2	0.63	0.76	0.67	0.54

Note: N= 138; The first entry for each predictor is the coefficient estimate and the second in parentheses is the robust standard error of the coefficient. *Significant at the 0.01 level, **Significant at the 0.05 level, and ***Significant at the 0.10 level.

As expected, total fertility rate (TFR) also exerts a equalizing yield with income inequality, but the coefficient is not statistically significant. Moreover, there is a quadratic relationship between income per capita and inequality (Kuznets' curve) where the estimated coefficient is about 0.31 on the linear term and -0.01 on the squared term. Finally, adding lag variables of income inequality and its distribution (LYINEQ) into this equation provides a positive and significant association. The explanatory power of the model measured by the R^2 is relatively good though the possibility of some important explanatory variables missing from the model specification.

Table 4 reports the OLS estimation results of equation 5. First, in the long-term, there is a negative association between income inequality and economic growth. In contrast, SDS is positively associated with economic growth while higher education Gini (LEG) index has adverse relationship with economic growth and the coefficient of LEG in all models is statistically significant. Also, in insignificant and unexpected results, life expectancy (LiExp) and population growth (LPopGr) is a decreasing function of economic growth. As predicted, the lag variable of growth is positively and significantly related to economic growth, indicating that current growth links to the previous growth.

Table 4. OLS regressions of economic growth

	Model 1	Model 2	Model 3	Model 4
SDS	0.20 (0.17)	0.22 (0.16)	0.22 (0.17)	0.32*** (0.18)
LEG	-0.72*** (0.39)	-0.70*** (0.37)	-0.72** (0.38)	-0.71** (0.37)
LiExp	-0.02 (0.02)	-0.02 (0.01)	-0.02 (0.01)	-0.004 (0.01)
LPopGr	-0.05 (0.06)	-0.05 (0.06)	-0.05 (0.06)	-0.06 (0.06)
LY$_{-1}$	0.82* (0.06)	0.82* (0.06)	0.82* (0.06)	0.82* (0.05)
LBottom 40	-0.14 (0.49)			
LMiddle 40		-0.07 (0.65)		
LTop 20			-0.004 (0.51)	
Log income Gini				-0.75*** (0.45)
R^2	0.84	0.84	0.84	0.84

Note: N= 136; The first entry for each predictor is the coefficient estimate and the second in parentheses is the robust standard error of the coefficient. *Significant at the 0.01 level, **Significant at the 0.05 level, and ***Significant at the 0.10 level.

Table 5 describes the 2SLS regression results of income inequality equation. The finding confirms the OLS results that the absolute dispersion of human capital (SDS) have a disequalizing link with income distribution in which a positive sign on income Gini and Top20, and a negative sign on Bottom40 occur. Meanwhile, the relative dispersion of human capital (LEG) have a equalizing effect on income inequality, reflected by a negative sign on income Gini, and a positive sign on Bottom 40. Moreover, economic growth (LY) has a significantly disequalizing effect on income inequality, reflected by a positive sign on Top20 and Income Gini, and a negative sign on Bottom40.

Also, like OLS result, there is a quadratic relationship between income per capita and inequality (Kuznets' curve) where the estimated coefficient is about 2.64 on the linear term and -0.12 on the squared term. Finally, all lag variables of inequality are positively correlated with current inequality and total fertility rate has negative and

insignificant relationship with Bottom40 and Middle, except for Top20 and income Gini. Overall, under null hyphothesis that LY are exogenous, Hausman test result suggests that we should reject the null hyphothesis, meaning that my OLS result are significantly different from instrumental variable approach and thus, LY are endogenous because μ_1 in equation 4 are correlated with μ_2 in equation 5. In addition, under null hyphothesis that all instruments are uncorrelated with error term, overidentifying test result suggests that overidentification restrictions are valid and we should not cast a doubt on the suitability of instruments set.

Table 5. 2SLS regressions of income inequality and its distribution

	LBottom40	LMiddle40	LTop20	Log Income Gini
SDS	-0.11* (0.03)	-0.01 (0.01)	0.05** (0.02)	0.16** (0.07)
LEG	0.07 (0.05)	-0.07* (0.03)	0.06 (0.04)	-0.14 (0.12)
TFR	-0.02 (0.01)	-0.005 (0.008)	0.02 (0.01)	0.009 (0.04)
LY	-0.64** (0.29)	-0.39** (0.18)	0.71* (0.29)	2.64* (0.77)
LY2	0.03** (0.01)	0.02** (0.008)	-0.03* (0.01)	-0.12* (0.04)
LBottom40$_{-1}$	0.57* (0.10)			
LMiddle40$_{-1}$		0.79* (0.06)		
LTop20$_{-1}$			0.69* (0.07)	
Log IG$_{-1}$				0.35* (0.13)
R^2	0.50	0.71	0.54	0.14
Hausman Test	0.004*	0.03**	0.004*	0.000*
Overidentification test	0.11	0.04**	0.06***	0.69

Note: N= 136; The first entry for each predictor is the coefficient estimate and the second in parentheses is the robust standard error of the coefficient. *Significant at the 0.01level, **Significant at the 0.05 level, and ***Significant at the 0.10 level.

Table 6 expresses the 2SLS regression results of growth equation. SDS is statistically insignificant in all models, except for model 4 where one additional unit of SDS will increase economic growth by 0.73%, holding other variables fixed. Similar with OLS result, the relative dispersion of human capital (LEG) have adverse impact on growth in all models and the coefficients are statistically significant. In addition, LiExp are a positive function of economic growth and the coefficients are statistically significant in model 4, except for LiExp in Model 1, 2 and 3.

Also, the coefficient of income Gini is statistically significant and negatively correlated with growth where one percent increase in income Gini will decrease growth by 3.79 %, holding other variables fixed. Overall, under null hyphothesis that LYINEQ are exogenous, Hausman test result suggests that we should reject the null hyphothesis, meaning that my OLS result are significantly different from instrumental variable approach and thus, LYINEQ especially income Gini is endogenous because μ_2 in equation 5 are correlated with μ_1 in eq. (4). In addition, under null hyphothesis that all instruments are uncorrelated with error term, overidentifying test result suggests that overidentification restrictions are not valid and we should cast a doubt on the suitability of instruments set.

Table 6. 2SLS regressions of economic growth

	Model 1	Model 2	Model 3	Model 4
SDS	0.12 (0.17)	0.21 (0.16)	0.22 (0.16)	0.73* (0.29)
LEG	-0.72*** (0.38)	-0.66*** (0.39)	-0.70*** (0.40)	-0.67*** (0.41)
LiExp	-0.03 (0.02)	-0.02 (0.01)	-0.02 (0.02)	0.06** (0.03)
LPopGr	-0.06 (0.05)	-0.05 (0.06)	-0.05 (0.06)	-0.10 (0.07)
LY$_{-1}$	0.83* (0.05)	0.82* (0.05)	0.82* (0.06)	0.81* (0.05)

	Model 1	Model 2	Model 3	Model 4
LBottom 40	-0.70 (0.75)			
LMiddle 40		0.20 (0.80)		
LTop 20			-0.05 (0.67)	
LIncome Gini				-3.79* (1.27)
R^2	0.84	0.84	0.84	0.75
Hausman Test	0.28	0.74	0.88	0.001*
Overidentification Test	0.000	0.000	0.000	0.000

Note: N= 136; The first entry for each predictor is the coefficient estimate and the second in parentheses is the robust standard error of the coefficient. *Significant at the 0.01 level, **Significant at the 0.05 level, and ***Significant at the 0.10 level

Conclusion

There are many comprehensive studies investigating the relationship between economic growth, education inequality, income inequality, and income distribution. A relationship between economic growth and income inequality and vice versa is still major issue among the economist and researchers. In addition, there is an indication of systematic relationship between economic growth and education inequality, between education inequality and income inequality as well as income distribution. One major shortcoming of the literature on the link among these variables is that the simultaneous and the direction of causal relationship have often been neglected. Thus, an establishment of linkage and direction of causality will have major impacts on the relevance of results.

The econometric results from a cross-section analysis of 23 provinces in the period of 1996-2014 indicate that the absolute dispersion of human capital has an equalizing effect onthe income distribution while the relative dispersion of human capital has the opposite effect. This study also indicates that economic growth has a significantly disequalizing effect on the income distribution and there is a quadratic relationship between income per capita and inequality (Kuznets' curve). In addition, the current level of inequality and growth is positively associated with the previous level of inequality and growth. Moreover, standar deviation of schooling and and life expectancy is positively related with the growth of economy while both income and education Gini are negatively correlated with growth. However, there is little convincing evidence that changes in population have a link with economic growth and that alteration in total fertility rate has a relationship with income distribution.

The initial OLS regressions provide only limited support for other explanatory variables such as total fertility ratein a sense that such variables fail to make impacton 2SLS estimations. Furthermore, instrumental variables estimation allows to interpret the results as causal but the need of good and valid instrument is crucial. When the instrument is only weakly correlated with the explanatory variable, the variance of the IV estimator can be high, that is the standard errors will be high and so coefficients may be insignificant. For instance, during first stage regression, the instrument of population growth rate in equation 4 as well as TFR and LY2 in equation 5 tend to be insignificant. In addition, misspecification of the equation tends to be problem in this paper. For example, for model I – IV in equation 5, overidentifying test suggested that instruments are correlated with error term, which means we should put all instrument to the equation as exogenous.

With intrinsic limitations, the need to disentangle the growth – income distribution nexus with other aspects of inequality, such as health and land is considered to be very important in future research. Another item on research agenda is how to take into account the interaction effects between education and income distribution. Finally, this research shows the necessity for more dynamic models in panel dataset.

There are some development policy considerations that can be drawn from this study in a bid to increase the level of human capital. If developing countries such as Indonesia want to achieve an egalitarian society with a more equitable distribution of income, economic policies should be more targeted at educational expansion and equal access to education sector. This can either be accomplished by altering the scholarship scheme to reach children who cannot continue to school after completing primary school. Such action can give positive effect on the demand for education. Or the government can raise the supply for education by building some affordable schools that are closer to the community.

References

[1] Adams, Jr, Richard, H. 2004. Economic Growth, Inequality, and Poverty: Estimating the Growth Elasticity of Poverty, *World Development*, 32(2): 1989-2014. DOI: https://doi.org/10.1016/j.worlddev.2004.08.006

[2] Aghion, P. and Bolton, P. 1990. *Government Domestic Debt and the Risk of Default: A Political Economy Model of the Strategic Role of Debt.* In: Dornbusch, R and Draghi M (eds.), Public Debt Management: Theory and History, Cambridge University Press, Cambridge, London.

[3] Aghion, P., Howitt. P., Brant-Collett, M., and Garcia-Penalosa, C. 1998. *Endogenous Growth Theory*. MIT Press, Cambridge, Massachusetts, ISBN-10: 0262011662, ISBN-13: 9780262011662, 694 pp.

[4] Alesina, A. and Perotti, R. 1996. Income Distribution, Political Instability, and Investment. *European Economic Review*, 40(6): 1203-1228. DOI: https://doi.org/10.1016/0014-2921(95)00030-5

[5] Barro, R.J. 1991. Economic Growth in a Cross Section of Countries. *Quarterly Journal of Economic*, 106(2): 407-443. DOI: https://doi.org/10.2307/2937943

[6] Barro, R.J. 2001. Human Capital and Growth. *The American Economic Review*, 91(2): 12-17. DOI: 10.1257/aer.91.2.12

[7] Bigsten, A. and Levin, J. 2001. *Growth, Income Distribution, and Poverty: A Review*, World Institute for Development Economics Research (WIDER) Discussion Papers 2001(209). Available at: https://www.econstor.eu/bitstream/10419/52902/1/339062169.pdf

[8] Birdsall, N. and Londono, J.L. 1997. Asset Inequality Matters: An Assessment of the World Bank's Approach to Poverty Reduction. *The American Economic Review*, 87(2): 32-37. DOI: http://www.jstor.org/stable/2950879

[9] Bruno, M., Ravallion, M. and Squire, L. 1996. *Equity and Growth in Developing Countries: Old and New Perspective on The Policy Issues,* World Bank Policy Research Working Papers 1563. Available at: http://213.154.74.164/invenio/record/11028/files/bruno.pdf

[10] Champernowne, D. and Cowell, F. 1998. *Economic Inequality and Income Distribution*. Cambridge University Press, New York, ISBN-10: 0521589592, ISBN-13: 9780521589598, 405 pp.

[11] Checchi, D. 2000. *Does Educational Achievement Help to Explain Income Inequality?* World Institute for Development Economics Research (WIDER) Working Papers 208. Available at: https://www.wider.unu.edu/sites/default/files/wp208.pdf

[12] Deininger, K. and Squire, L. 1998. New Ways of Looking at Old Issues: Asset Inequality and Growth. *Journal of Development Economics*, 57(2): 259-287. DOI: https://doi.org/10.1016/S0304-3878(98)00099-6

[13] De La Croix, D. and Licandro, O. 1999. Life Expectancy and Endogenous Growth. *Economics Letters*, 65(2): 255-263. DOI: https://doi.org/10.1016/S0165-1765(99)00139-1

[14] De La Croix, D. and Doepke, M. 2003. Inequality and Growth: Why Differential Fertility Matters. *The American Economic Review*, 93(4): 1091-1113. DOI: 10.1257/000282803769206214

[15] Fields, G. 1989. Changes in Poverty and Inequality in Developing Countries. *World Bank Research Observer*, 4(2): 167-185. DOI: 10.1093/wbro/4.2.167

[16] Galor, O. and Tsiddon, D. 1997. The Distribution of Human Capital and Economic Growth. *Journal of Economic Growth*, 2(1): 93-124. DOI: https://doi.org/10.1023/A:1009785714248

[17] Galor, O. and Moav, O. 2004. From Physical to Human Capital Accumulation: Inequality and the Process of Development. *Review of Economic Studies*, 71(4): 1001-1026. DOI: 10.2139/ssrn.249868

[18] Kaldor, N. 1956. Alternative Theories of Distribution. *Review of Economic Studies*, 23(2): 83-100. DOI: 10.2307/2296292

[19] Kuznets, S. 1955. Economic Growth and Income Inequality. *The American Economic Review*, 45(1): 1-28. DOI: http://www.jstor.org/stable/1811581

[20] Lin, C.H. 2007. Education Expansion, Education Inequality, and Income Inequality: Evidence from Taiwan 1976-2003. *Social Indicators Research,* 80(3): 601-615. DOI: 10.1007/s11205-006-0009-8

[21] López, R., Vinod, T., Wang, Y. 1998. *Addressing the Education Puzzle: The Distribution of Education and Economic Reform,* World Bank Policy Research Working Papers 2031. Available at: https://www.researchgate.net/publication/23549036_Addressing_the_education_puzzle_the_distribution_of_education_and_economic_reform

[22] Park, K.H. 1996. Educational Expansion and Educational Inequality on Income Distribution. *Economics of Education Review*, 15(1): 51-58. DOI: https://doi.org/10.1016/0272-7757(95)00000-3

[23] Park, K.H. 1998. Distribution and Growth: Cross-Country Evidence. *Applied Economics*, 30(7): 943-949. DOI: https://doi.org/10.1080/000368498325372

[24] Persson, T. and Tabellini, G. 1994. Is Inequality Harmful for Growth? *The American Economic Review*, 84(3): 600-621. DOI: http://www.jstor.org/stable/2118070

[25] Quah, D. 2001. *Some Simple Arithmetic on How Income Inequality and Economic Growth Matter*. Paper presented at WIDER Conference on Growth and Poverty, May 25-26, in Helsinki, Finland.

[26] Ravallion, M. and Chen, S. 1997. What Can New Survey Data Tell Us About Recent Changes in Distribution and Poverty? *The World Bank Economic Review*, 11(2): 357-382. DOI: http://www.jstor.org/stable/3990232

[27] Ravallion, M. 2001. Growth, Inequality, and Poverty: Looking Beyond Averages. *World Development*, 29(11): 1803-1815. DOI: https://doi.org/10.1016/S0305-750X(01)00072-9

[28] Rehme, G. 2007. Education, Economic Growth, and Measured Income Inequality. *Economica*, 74(295): 493-514. DOI: https://doi.org/10.1111/j.1468-0335.2006.00555.x

[29] Rodrik, D. 1998. *Where did All the Growth Go? External Shocks, Socialist Conflict, and Growth Collapses*, Mimeo, Harvard University. Available at: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.7.6006&rep=rep1&type=pdf

[30] Thomas, V., Wang, Y. and Fan, X. 2001*. Measuring Education Inequality: Gini Coefficient of Education*, World Bank Policy Research Working Papers 2525. Available at: http://documents.worldbank.org/curated/en/361761468761690314/pdf/multi-page.pdf

[31] Voitchovsky, S. 2005. Does The Profile of Income Inequality Matter for Economic Growth? *Journal of Economic Growth*, 10(3): 273-296. DOI: http://www.jstor.org/stable/40216078