Education inequality, economic growth, and income inequality: Evidence from Indonesia, 1996-2005

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I. INTRODUCTION

The main goal of development is to reduce poverty, which can be achieved by economic growth, income distribution and other development aspects such as health and education equality. A pro-poor growth strategy is not only focus on economic growth but could also be combined with an active policy of income redistribution (Bigsten and Levin, 2000). 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, 2000).

In recent years, the debate has focused on one channel which examines the impacts of economic growth on income inequality. The first argument is that inadequate redistributive policies and the increase in inequality that accompany economic growth lessen the potential benefits of economic growth to the poor (Ravallion, 2001). Another side argues that despite increased inequality in the liberal economic policies, open markets raise income of each people in societies, which reduce the poverty incidence proportionally (Quah, 2001).

However, some research investigates the role of education in relation between economic growth and income inequality. Checchi (2000) analyzes the relationship between economic growth, income inequality and educational achievements in terms of both the average attainments and its concentration. Park (1996) considers the income Gini ratio and the income shares in the context of educational attainment and economic growth. In a similar approach, Ram (1984) proposed some variables such as population increase, education level and inequality, and

economic structure in attempt to explain the relationship between income distribution and economic growth.

A steady increase in enrollment ratio, educational attainment, average years of schooling, and the literacy rate in Indonesia indicates the improvement in education level. But these indicators do not sufficiently reflect absolute and relative dispersion of human capital (Thomas *et al.*, 2000). Standard deviations of schooling have recently been used to measure the dispersion of schooling distribution in absolute terms, however, to measure the dispersion in schooling distribution in relative terms, it appears that education Gini seems to be an appropriate measure (Thomas *et al.*, 2000).

In this paper, I use the model of Thomas *et al*. (2000) to investigate if there is a significant effect of changes in the education Gini and average years of schooling on income inequality. I establish that economic growth has a systematic impact on income inequality and its distribution, and that there is an impact of education variables on economic growth. I disentangle the effect of income inequality and its distribution on economic growth.

The paper is organized as follows: Section II provides literature review on economic growth, education inequality, income inequality, and income distribution. Section III describes research methodology. Section IV implies an empirical result about the relationship among variables. Section V explains conclusion and policy recommendations.

II. LITERATURE REVIEW

2.1 Economic Growth and Income Inequality

Kuznets (1955) investigated the relationship between per capita income and inequality in a cross-section of countries. He found an inverted-U pattern where inequality first increased and then fell, as per capita income rose. 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 than in latter stages. In line 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 is impossible to find any significant change in income distribution during recent decades and they do not find any systematic evidence of a relationship between growth and inequality. Nor do Ravallion and Chen (1997) or Rehme (2007) find any systematic 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. In the absence of a clear relationship, there is a case for pursuing a policy aimed at rapid growth.

While the Harrod-Domar model predicts that greater inequality would lead to higher growth rates, there is a shift in focus towards the opposite effect from inequality to growth. On the one side, this model proposes a strong argument that a positive relationship between inequality and economic growth could arise because a larger share of income is being hands 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 impact of inequality on growth.

Such a relationship was found in six channels 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. 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 investment. Thus, in the later stages of

economic development, human capital accumulation wholly substitutes physical capital accumulation. However, credit market imperfections that arise from asymmetric information prevent the poor to gain productive investment in human capital (Benabou, 2002). Therefore, equality may promote growth via human capital investment and may alleviate the adverse effect of credit constraint on human capital accumulation (Easterly, 2001).

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). Thus, when the gap between the rich and poor widens, the poor may engage in disruptive activities that are usually at the cost of the rich (Benabou, 1996).

Fourth, the relationship between economic growth and income inequality is determined by economic incentives. 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. However, Champernowe and Cowell (1998) endorse the minimal role of government where income inequality is fundamentally good for incentives, which then increase growth.

Fifth, 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. A mean-preserving spread in the income distribution spurs the fertility differential between the rich and the poor, implying that more weight gets placed on families who provide little education. As a result, a rise in inequality lowers average education and therefore, growth.

Last, income inequality and economic growth are closely related with habits. Champernowne and Cowell (1998) prove that once people accustom to a degree of comfort, they will find it hard to return to an earlier and lower standard of living. This means that a rapid reduction in income inequality is likely to slow down or even halt economic progress, highlighting the difficulty of the adjustment process.

To sum up, the effect of inequality on economic growth can be generalized as follows (Goudie and Ladd, 1999): Firstly, countries with early severe inequality of consumption and

land are less likely to be successful in reducing poverty due to slower economic growth and poverty reduction. Secondly, the impact of changing a pattern of distribution on growth may be sensitive to the political and social context and to the method by which the distribution is adjusted. Finally, the key public policy constraint is the choice between expenditures which bear either on distributional aspects or on economic growth or on both simultaneously.

2.2 Economic Growth and Education Inequality

In principle, the relationship between education inequality and economic growth can be explained by three channels as follows. First, in a life expectancy model by De La Croix and Licandro (1999), investment in human capital depends 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 related 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.

2.3 Education Inequality and Income Inequality

Many existing literatures have a different instrument in searching for the relationship between education inequality and income inequality. Deininger and Squire (1998) show that initial land inequality is relevant for predicting income growth and changes in income inequality. By referring to the liquidity constraints on access to education, land inequality reduces average years of education. As a consequence, income inequality and educational attainments are positively correlated because of the presence of wealth inequality.

Meanwhile, Gregorio and Lee (2002) indicate that government social expenditure and education factors, reflected by higher education attainment and more equal distribution of education, play a significant role in making equitable of income inequality. The results also confirm that the Kuznets' inverted-U curve exists when explaining the relationship between income level and its inequality.

In another study, Gylfason and Zoega (2003) prove that gross secondary-school enrolment and public expenditure on education are directly related to income equality. Also, better education appears to directly encourage economic growth through increased social equality. Moreover, better education financed by public expenditure reduces inequality in the distribution of income.

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, are used in OLS regressions. The finding suggests that a higher level of average years of schooling will generate a lower income inequality, and a lower education inequality will also cause a lower 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 contrast, Rehme (2007) highlights the dual role of education in explanations of how income inequality and economic growth are associated. The study concludes that education simultaneously affects growth and income inequality, however, more education does not

necessarily decrease inequality when the latter is assessed by the Lorenz dominance criterion. Increases in education first increase growth and then, decrease growth and income inequality.

There are numerous cross-sectional studies which emphasize on the effect of education inequality on income distribution in an attempt to prove Kuznets' inverted-U curve hypothesis. Winegarden (1979) makes regression the income share of the bottom 80% on the mean and variance of schooling along with many other explanatory variables and concludes that higher average levels of schooling are an equalizer on income distribution, while educational inequality tends to generate income disparities to a considerable degree.

Ram (1984) criticizes Winegarden's method of calculating the mean and variance of schooling from straight years instead of natural logarithm, leading to a statistically insignificant in the estimated coefficient of educational inequality. He then shows the impact of educational inequality on the income shares of the bottom 80% and 40% in which higher level of schooling exerts mild equalizing effect, whereas a larger educational variance contributes to more equality in income distribution. But the estimated coefficients of the educational inequality variable for both full sample and LDCs are statistically insignificant.

Bourguignon and Morrisson (1990) use the rate of secondary education enrollments as a proxy for schooling level and find a positive and significant effect of education on the income share of the bottom 40%. However, the use of the variance of the dichotomous variable as an instrument for measuring educational inequality makes the presence of strong collinearity with schooling variable. 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 effect on the income distribution while the standard deviation of schooling has a disequalizing effect 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 effect 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 contributing to economic growth, and income inequality has a negative effect on 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.

III. DATA, METHODOLOGY, AND MODEL

3.1 Data

This research uses National Social Economic Survey (SUSENAS) data conducted by Bureau Statistics Indonesia (BPS). SUSENAS is a repeated cross-section and nationally representative household survey that has two main components. The first one is Core SUSENAS, which collects basic socio-demographic information on households and individuals and is conducted annually. The second component, Module SUSENAS, gathers detailed information on households. There are three different modules (consumption, health, and education) and each module is conducted triennially.

The Core covers about 200,000 households and 800,000 individuals, while the Module entails a sub-sample of about 65,000 households. I take Core SUSENAS by using 1996, 1999, 2002, and 2005 as its series with section of 23 provinces in Indonesia because five provinces such as Banten, Gorontalo, Bangka Belitung, Riau Islands, and North Maluku are an extension of 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. The other provinces such as Maluku, Nangroe Aceh Darussalam, and Papua still flared up between 2000 and 2002, made the data unstable.

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 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 lower than one resulted from income data as it only describes income shares of the bottom and the middle.

3.2 Methodology

On the purpose of estimating education inequality in Indonesia, I use a direct method to calculate education Gini coefficient, average years of schooling, and standard deviations of education. The direct method states that the education Gini is defined as "the ratio to the mean (average years of schooling) of half of the average over all pairs of absolute deviations between all possible pairs of people" (Deaton 1997). Thomas *et al.* (2000) developed Deaton's formula, which is shown in equation 1.

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

Where: E_L is the education Gini based on educational attainment distribution; μ is the average years of schooling for the concerned population; p_i and p_j stand for 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.

Barro (1991) divides the population into seven categories including 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 including never been to school, not complete primary school, complete primary school, complete junior secondary school, complete senior secondary school, complete tertiary school or university.

The average years of schooling and standard deviations of schooling can be calculated in formula 2 and 3 respectively.

$$\mu = AYS = \sum_{i=1}^{n} p_i y_i \tag{2}$$

$$\sigma = SDS = \sqrt{\sum_{i=1}^{n} p_i (y_i - \mu)^2} \tag{3}$$

3.3 Model Specification

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.

$$YINEQ = \alpha_0 + \alpha_1 AYS + \alpha_2 EG + \alpha_3 LY + \alpha_4 TFR + \alpha_5 YINEQ_{-1} + \mu_1 \quad (4)$$

$$LY = \beta_0 + \beta_1 AYS + \beta_2 EG + \beta_3 YINEQ + \beta_4 LiExp + \beta_5 LY_{-1} + \mu_2 \quad (5)$$

Where YINEQ is a measure of income inequality and is proxied by the income share of bottom 40%, middle 40%, top 20% of population, and the income Gini. AYS is average years of schooling based on the distribution of education attainment. LY is the natural logarithm of real per capita GDP, TFR is total fertility rate, LiExp is life expectancy, and μ is error term. In addition, the first-period-lag of LY and YINEQ are added into economic growth and income inequality equation respectively as these variables are one of the main determinants. Therefore, the expected sign of independent variables in each equation can be summarized in table 1.

Table 1: The Expected Sign

Income Inequality (*YINEQ*) equation	$\alpha_1 AYS$	$\alpha_2 EG$	$\alpha_3 LY$	$\alpha_4 TFR$	$\alpha_5 YINEQ_{-1}$
	(-)	(+)	(-)	(+)	(+)
Economic Growth (*LY*) equation	$\beta_1 AYS$	$\beta_2 EG$	$\beta_3 YINEQ$	$\beta_4 LiExp$	$\beta_5 LY_{-1}$
	(+)	(-)	(-)	(+)	(+)

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, a negative association between growth and income inequality is expected so α_3 is negative. Moreover, since income inequality will rise as the fertility rate goes up, α_4 will be positive. Lastly, the coefficient of α_5 will be positive since level of previous inequality determines that of current inequality.

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 and β_3 will be negative. Also, the coefficient of β_4 will be positive since a rise of economic growth will increase life expectancy. Finally, the coefficient of β_5 will be positive as the current growth is determined by the previous growth.

IV. EMPIRICAL 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 with insignificant variables from early estimations being deleted.

Table 2 presents the OLS estimation results of equation 4. The average years of schooling serve as a proxy for the level of human capital skills while education Gini measures the relative dispersion of human capital. Both variables show a significant impact on income distribution, except on the income share of the middle population (Middle40). In addition, both variables show a considerable disequalizing effect on income inequality, reflected by a positive sign on income Gini and the income share of the top population (Top20) and a negative sign on the income share of the bottom population (Bottom40).

As expected, TFR also exerts a disequalizing effect on income inequality, but its coefficient is not statistically significant. Moreover, there is a systematic and significant relationship between growth and income distribution, except for Bottom40. Finally, adding lag variables of income inequality and its distribution into this equation provide a positive and significant effect, excluding for Bottom40. The explanatory power of the model measured by the adjusted R^2 is relatively small. This is partly due to the nature of heterogeneity cross-section data, besides the possibility of some important explanatory variables missing from the model specification.

Table 2: OLS Regressions of Income Inequality

	Bottom40	**Middle40**	**Top20**	**Income Gini**
Intercept	31.70106* (10.30074)	8.558719 (10.36684)	26.86015** (16.21106)	0.1092164 (0.1547359)
AYS	-2.185992* (0.5163894)	-0.1371916 (0.5003319)	2.222144* (0.9043669)	0.0308374* (0.009223)
EG	-22.93054* (8.548254)	-9.310733 (8.293287)	30.64107* (15.0079)	0.3683319* (0.1545131)
LY	0.5891059 (0.4521611)	0.884679** (0.4862148)	-1.576015** (0.8185818)	-0.014941** (0.0082816)
TFR	-0.5255206 (0.4497116)	0.1033585 (0.5188491)	0.1985889 (0.8680864)	0.0058428 (0.0084631)
$Bottom40_{-1}$	0.2102513 (0.149302)			
$Middle40_{-1}$		0.5242643* (0.1835608)		
$Top20_{-1}$			0.310889** (0.1829208)	
IG_{-1}				0.2791844** (0.1627686)
Adjusted R^2	0.2893	0.2616	0.1607	0.2009
F-Value	0.0001	0.0002	0.0063	0.0016

N= 69

Note: The first entry for each predictor is the coefficient estimate and the second in parentheses is the standard error of the coefficient. *Significant at the 5% level, **Significant at the 10% level, and ***Significant at the 15% level.

Table 3 reports the OLS estimation results of equation 5. Surprisingly, there is a significant and positive effect of income inequality on economic growth, endorsing Harrod-Domar model. A similar effect also takes place in the relation of human capital investment (AYS) and economic growth, however this assumption does not prevail in model 1 and 4 in which Bottom40 and income Gini are included, respectively.

Furthermore, higher education Gini index has adverse impact on economic growth although its coefficient in all models is statistically insignificant. Also, in insignificant and unexpected results life expectancy is a decreasing function of economic growth, except for Middle40. As predicted, the lag variable of growth is positively and significantly related to economic growth, indicating that current growth links to the previous growth. Lastly, replacing income Gini index with income share has small effect on the regression results in terms of both the significance of the coefficients and the explanatory power of the model.

Table 3: OLS Regressions of Economic Growth

	Model 1	**Model 2**	**Model 3**	**Model 4**
Intercept	1.483158* (0.4869427)	0.878303** (0.4610271)	0.777793* (0.3837835)	0.8769399* (0.3796413)
AYS	0.0248518 (0.026872)	0.045053** (0.0262246)	0.03972*** (0.0260657)	0.033383 (0.0262831)
EG	-0.309115 (0.3727526)	-0.0357491 (0.3669602)	-0.1806797 (0.37647)	-0.2595098 (0.3764482)
LiExp	-0.0023953 (0.0045539)	0.0013678 (0.0045231)	-0.0009202 (0.0046902)	-0.0018837 (0.004644)
LY_{-1}	0.9339189* (0.0201151)	0.9255537* (0.0209043)	0.9317929* (0.0208602)	0.9339108* (0.0205489)
Bottom 40	-0.0138618* (0.0065043)			
Middle 40		-0.0013597 (0.0057373)		
Top 20			0.004748 (0.0036961)	
Income Gini				0.63684** (0.3615439)
Adjusted R^2	0.9851	0.9840	0.9844	0.9848
F-Value	0.0000	0.0000	0.0000	0.0000

N= 69

Note: The first entry for each predictor is the coefficient estimate and the second in parentheses is the standard error of the coefficient. *Significant at the 5% level, **Significant at the 10% level, and ***Significant at the 15% level.

Based on the preliminary results, three statistically insignificant variables (TFR from equation 4, LiExp and EG from equation 5) are dropped. Thus, the following equation is chosen for the final 2SLS model.

$$YINEQ = \alpha_0 + \alpha_1 AYS + \alpha_2 EG + \alpha_3 LY + \alpha_4 YINEQ_{-1} + \mu_1 \quad (6)$$

$$LY = \beta_0 + \beta_1 AYS + \beta_2 YINEQ + \beta_3 LY_{-1} + \mu_2 \quad (7)$$

Table 4 describes the 2SLS regression results of equation 6. The finding confirms the OLS results that the level of human capital and the relative dispersion of human capital have a disequalizing effect on income and its distribution in which a positive sign on income Gini and Top20, and a negative sign on Bottom40 occur. Moreover, the significance of these variables resembles the initial estimation where Middle40 is still insignificant. Unlike the previous result, economic growth on one hand has strongly and significantly equalizing effect on income inequality, reflected by a negative sign on Top20 and Income Gini, and a positive sign on Bottom40. On the other hand, all lag variables of YINEQ have a positive effect but the income Gini lag decreases its significant. Overall, the 2SLS estimation provides a clear description of whole model reflected by its F-value. One possible explanation is because TFR and LiExp have been dropped from the equation.

Table 4: 2SLS Regressions of Income Inequality and Its Distribution

	Bottom40	**Middle40**	**Top20**	**Income Gini**
Intercept	25.23566* (9.936793)	7.455846 (10.17855)	33.14461* (13.0071)	0.2120398*** (0.1322274)
AYS	-2.196487* (0.513922)	-0.2299515 (0.4887101)	2.376201* (0.8970826)	0.0317928* (0.0091401)
EG	-20.17733* (8.312938)	-9.811369 (7.871289)	29.86661* (14.64679)	0.3405401* (0.1503796)
LY	0.9103012* (0.4512409)	0.9550783* (0.4704169)	-1.953574* (0.8020726)	-0.0198493* (0.0082151)
$Bottom40_{-1}$	0.177533 (0.1462067)			
$Middle40_{-1}$		0.5367416* (0.1623472)		
$Top20_{-1}$			0.2941935** (0.1656848)	
IG_{-1}				0.2506044*** (0.1541114)
Adjusted R^2	0.2826	0.2717	0.1708	0.2047
F-Value	0.0000	0.000	0.0015	0.0004

N= 69

Note: The first entry for each predictor is the coefficient estimate and the second in parentheses is the standard error of the coefficient. *Significant at the 5% level, **Significant at the 10% level, and ***Significant at the 15% level.

Table 5 expresses the 2SLS regression results of equation 7. The effect of dropping EG from this estimation strengthens the previous result that average years of schooling is statistically significant in all models and it is positively associated with economic growth where one additional year of schooling will increase economic growth by 6.8%, 4.5%, 6.3%, and 6.4% in each model respectively, holding other variables fixed. There is also a positive and significant

relationship between the previous growth and the current growth. The sign of income Gini and Top20 turns to be negative while the others change into the opposite way and apart from Middle40, all coefficients become statistically insignificant. This implication might be due to a biased and inconsistent of OLS estimators resulted from a contemporaneous correlation between endogenous regressors and error terms, and therefore, OLS might not good indicator in measuring the relationship among variables.

Table 5: 2SLS Regressions of Economic Growth

	Model 1	**Model 2**	**Model 3**	**Model 4**
Intercept	0.6526099** (0.3908329)	0.4355147 (0.4003974)	-0.0114563 (0.0083158)	1.2731* (0.4423259)
AYS	0.0676315* (0.0260241)	0.0448836* (0.0181608)	0.0627489* (0.0203672)	0.0644821* (0.021876)
LY_{-1}	0.9136803* (0.0248432)	0.9032054* (0.0260581)	0.9038615* (0.0274456)	0.9097302* (0.0258672)
Bottom 40	0.012935 (0.0143625)			
Middle 40		0.0216242** (0.0129498)		
Top 20			-0.0114563 (0.0083158)	
Income Gini				-0.8386965 (0.7636407)
Adjusted R^2	0.9810	0.9796	0.9790	0.9805
F-Value	0.0000	0.0000	0.0000	0.0000

N= 69

Note: The first entry for each predictor is the coefficient estimate and the second in parentheses is the standard error of the coefficient. *Significant at the 5% level, **Significant at the 10% level, and ***Significant at the 15% level.

V. CONCLUDING REMARKS

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 1996-2005 indicate that a higher level of human capital (AYS) and the relative dispersion of human capital have a disequalizing effect on the income distribution. This study also confirms that

economic growth has strongly and significantly equalizing effect on the income distribution, supporting the complementarity relationship between equity and growth. In addition, it is clear that the current level of inequality and growth is determined by the previous level of inequality and growth. Finally, human capital investment contributes significantly to the growth of economy. However, there is little convincing evidence that changes in inequality will affect economic growth.

The initial OLS regressions provide only limited support for other explanatory variables such as life expectancy and total fertility rate in a sense that such variables fail to make impact for the final 2SLS estimations. Furthermore, the evidence of multicollinearity arises because education Gini contains average years of schooling. Therefore, with intrinsic limitations imposed by the availability and the reliability of the data, the findings in this study are tentative, leaving a challenge for future studies. The need to disentangle the association between economic growth and income inequality and other aspects of development, such as gender gaps, education-related policies, and poverty is essential in any future research. Another item on research agenda is how to account the interaction effects between education and income inequality and economic freedom. Finally, this research shows the necessity for more complex interactions, mechanisms, and dynamic models of all kinds to be considered when studying within-country economic growth, income and education inequality in the future.

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 than what some proponents of Harrod-Domar call direct redistributive policies, which constitute a detrimental factor to economic growth. This can be accomplished by altering the scholarship scheme to reach children who cannot continue to school after completing primary school. In addition, the central government must increase the opportunity cost of not going to school by providing cash subsidies directly to the family.

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