Measuring gini coefficient of education: the Indonesian cases

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I. INTRODUCTION

While income inequality in third world countries has aggressively been commented and studied extensively, little analysis is relatively available on measuring inequality in other dimensions of human development. After some decade of structural adjustment and reform without any major changing in the welfare of the majority people of third world countries, the emphases of economic policy have shifted toward and tackled poverty itself (Appiah-Kubi, 2002). In the era of economic reforms, as the foundations of education have changed, so has the distribution of illiteracy. Between rural and urban areas, male and female, inequality on education has risen substantially since the reforms began (Appiah-Kubi, 2002). In order to find a measurement of this inequality, a new indicator for the distribution of human capital and welfare have come up with an education Gini index that also facilitates comparison of education inequality across countries and over time (Thomas *et al*, 2000).

Education has a major role in the accumulation of human capital (Galor and Moav, 2004). In order to gain socio-economic equilibrium, government should invest a huge amount of money in public education. Easterly (2004) found that inequality in education is positively correlated with income inequality, however, there is a weak association between education attainment and output per worker. In the basis of economic logic, education enhances social and political mobility. Educated people are better to speak up their rights, to organize themselves, and to bargain in the political process where a substantial share of national resources is redistributed. In other words, if education is distributed unequally, income would be distributed unequally.

To reach equality on education, government must have a proper policy on demand and supply of education. There are four factors affecting individual demand of education (Tesfeye, 2002). Firstly, household characteristics.[1] Secondly, children characteristics.[2] Thirdly, quality of schooling.[3] Lastly,

[1] For example, income, wealth, family size, and level education of the parents
[2] For instance, innate ability, health, nutrition, cognitive growth, and gender
[3] For example, teaching quality, pupil/teacher ratio, class size, teacher qualifications, quality of classrooms and reading writing equipments, curriculum, school infrastructure and regular maintenance, electric supply, drinking water facilities and toilets

return from schooling. Meanwhile, quantitative factor[4] is one factor affecting individual supply of education (Tesfeye, 2002). It is undeniable that a good policy on demand and supply of education by the government may achieve equality on education in all levels of income, particularly the poorer.

Prior to determining education inequality in Indonesia, the author firstly ascertain at which level of education people attaining school. There are four indicators, recently used by the government, to measure education level in Indonesia. Firstly, school enrollment ratio or called *Angka Partispasi Sekolah* (APS), which is the number of Indonesian who attained three levels of education from the 7-to-12-year-old age group, represents primary school, to the 16-to-18-year-old age group, represents senior secondary school. Secondly, net enrollment ratio or called *Angka Partisipasi Murni* (APM), which is the number of Indonesian who are still schooling in three levels of education from primary school to senior secondary school. Thirdly, educational attainment, which is the number of Indonesian who completed six levels of education attainment from people who never been attended to school to people who completed university. Lastly, literacy rate, which determines the individual ability to read and write. From 1999 to 2005, there was a dramatic increase in APS, APM, educational attainment, and literacy rate respectively (BPS, 1999-2005).[5]

Even though there was a steady increase in APS, APM, educational attainment, and literacy rate in 2005 that gives the indication of the improvement in education gaps among gender and areas, as reflected in productivity and earnings, these indicators do not clearly provide education equality and sufficiently reflect absolute and relative dispersion of human capital (Thomas *et al*, 2000). Hitherto standard deviations of schooling have been used to measure the dispersion of schooling distribution in absolute term, however, to measure the dispersion in schooling distribution in relative term, it appears that education Gini seems to be appropriate measure that reflects the improvement in the distribution of educational opportunities which is crucial for generating income (Thomas *et al*, 2000).[6]

In this paper, I use the existence model of Thomas et al (2000) by using the educational attainment data from National Social Economic Survey (SUSENAS) between 1999 and 2005 in 23 provinces to clarify and compare the pattern of Gini coefficient of education among areas and

[4] The availability facilities of school, access to schooling, school location and distance that influence travel cost in education, and size and quantity of the school

[5] For further information please contact the author at kumbadigdo@yahoo.com

[6] Both income gini and the wealth gini coefficients have been widely used in studies of growth, poverty and inequality. For example, Deininger and Squire (1996) found that a systematic link between growth and inequality, and a strong positive relationship between growth and reduction of poverty. Liberia, Squire and Zou (1998) alleged that higher concentration of land contributed to higher income inequality. On the other hand, the Inter-American Development Bank (1999) de-emphasized the significance of land concentration with respect to income inequality. Lundberg, and Squire (1999) came with two strong conclusions. First, growth is much more sensitive to policy intervention than to inequality. Second, even a moderate change in inequality coupled certain growth is of tremendous impact on alleviating poverty. This footnote was drawn from Thomas *et.al.* (2000)

gender. In addition, I investigate if education Gini positively influences the difference of illiteracy rate among gender and standard deviations of schooling respectively. Moreover, I resolve if education Gini negatively associates with average years of schooling. Lastly, I settle if the relationship between average years of schooling and standard deviations of schooling forms education Kuznets curve.

The main findings suggest that inequality in education as measured by education Gini is negatively associated with average years schooling, implying that higher education attainments are more likely to achieve equality in education. Moreover, a clear pattern on an education Kuznets curve exists if standard deviation of schooling is used. Furthermore, gender gaps are related to education inequality and the relation between these variables become stronger over time.

The paper is organized as follows. Section II provides literature review on the role and distribution of schooling and indicator of measuring education inequality. Section III describes research methodology in which I use both direct and indirect method. Section IV implies an empirical result about the relationship among variables. Section V explains conclusion and policy recommendations.

II. LITERATURE REVIEW

1. Empirical Studies on the Role and Distribution of Schooling

Mass and Criel (1982) examined the distribution of primary school enrollment and asserted that enrollment Gini is very enormously changed across countries. They describes a negative relation between the average enrollment and its distribution where the higher the average enrollment, the lower the Gini coefficient. On the other hand, Ram (1990) applied income Kuznets curve to form educational Kuznets curve. The finding confirms that as the average level of schooling rises, educational inequality first increases, then after reaching a peak, educational inequality starts to decline. The turning point of this declining is about seven years of education.

O'Neill (1995) argued that the stock of human capital is the accumulation of the past education and not sensitive to the current income level. The finding proves that among the developing countries, convergence in education levels has resulted in a reduction in income dispersion. Yet, incomes have diverged globally despite substantial convergence in education levels. In contrast, Birdsall and Londono (1997) used cross-country analysis to form a traditional growth model and put forward initial levels of educational inequality and land Gini have strongly negative impacts on economic growth and growth of the poorest income.

Lopez *et al* (1998) constructed the asset allocation model and Gini coefficient of educational attainment and investigated the linkage between distribution of education and growth. Their major findings are the following: Firstly, the distribution of education is very important to describe

income levels and economic growth, and if it is distributed unequally, it would bring negative impacts on income levels and economic growth. Lastly, economic reforms improved the productivity of human capital in growth models. By controlling the distribution of education, which is one of the economic reforms agenda, the government can rise the average years of schooling.

Gregorio and Lee (1999) presented the empirical evidence on how education and income have related to income distribution. They validate higher attainment and distribution of education as a means of changing income distribution. In this case, the Kuznets inverted-U curve takes into account. In addition, government social expenditure contributes to the more equal distribution of income. Yet, the growth of income and education could not make income and education inequality decline substantially in a short and long period. Meanwhile, Inter-American Development Bank (1999) examined standard deviation of education to measure education inequality and claimed that there is a positive association between standard deviations of education and education inequality in the sense that the higher standard deviations of education, the greater education inequality measured by Gini coefficient education.

Thomas *et al* (2000) constructed Gini coefficient to find educational attainment inequality. The finding establishes that the inequality in educational attainment declined over three decades of 1960-1990 and it is negatively associated with the average years of schooling. Furthermore, the educational Kuznets curve exists when standard deviations of schooling are used and gender-gaps are closely associated to the education inequality where the connection between two variables boil down to stronger over time. Lastly, per capita PPP GDP increments are positively correlated with the labor force's average years of schooling. In contrast, Siddhanta and Nandy (2003) maintained that education inequality, gender gaps of educational attainment, average years of schooling, standard deviations of schooling, and illiteracy rate in rural area are higher than urban area. In addition, prosperity and gender gap of education in urban area is negatively associated, while in rural area, this correlation turns to be positive.

2. Indicators of Measuring Education Inequality

2.1 Enrollment Ratios

The enrollment ratio for different levels of schooling was used as indicators of human development at the initial stage (Levine and Zervos, 1993). The most commonly used are the primary enrollment ratio, the junior secondary enrollment ratio, and the senior secondary enrollment ratio. Of all measurement of equality education, Bureau Statistic Indonesia is not only estimating school enrollment ratio but also appraising net enrollment ratio. However, enrollment ratio only measures the access of people's education and it does not show the cumulated

educational attainment. Thus, it is inappropriate to use these enrollment ratios in growth models. In addition, enrollment ratio does not reflect the stock of human capital (Thomas *et al*, 2000).

To counter the disadvantages of these indicators, there is a grade enrollment ratio based on the percentage distribution of pupils among grades in a particular schooling system (UNESCO, 1996). The advantages of the grade enrollment ratio as follows (Castello and Domenech, 2002): Firstly, the grade enrollment ratio captures more detail on student performances. Secondly, average attainment levels did not influence the grade enrollment ratio. However, the data do not reflect working age population so that is a time lag where student in primary grades will enter into the labor force after a lag of approximately 5 to 15 years (Frankema and Bolt, 2006).

2.2 Average Years of Schooling

Psacharopoulos and Arriagada (1986) suggested that the proper indicator of human development level is the stock of educational attainment defined as average years of schooling. They collected the information about each country's schooling distribution and calculated educational attainment whereas Barro and Lee (1991) formalized the use of educational attainment for growth regressions. Nehru *et al* (1994) created a cross-country database for educational attainment, through evaluating the schooling distributions over time for various countries. Yet, this indicator does not describe the characteristic of human capital gap in terms of absolute and relative (Thomas *et al*, 2000).

2.3 The Quality of Schooling

Behrman and Birdsall (1983) believed that the quality of schooling should be taken into consideration when measuring the level of human development instead of using the quantity of schooling. There are two typical approaches used to measure the quality of education. The first approach is the input. It is very relevant to see which country provides more resources to education than other sectors. Pupil-teacher ratio, expenditures on teacher's wage, books, and other reading materials can measure the inputted resources into education (Thomas et al, 2000). However, the high volume of input does not make the yield of schooling quality improve. Moreover, the inputs for schooling depend on the income level. Based on those matters, Hanushek and Kim (1995) refuted a limited feasibility of using input of schooling as the proxies for education equality.

The last approach is the output that directly measures the achievement of schooling by comparing the scores of cognitive performance. The students of the same-age group of various countries are obtained by the same international test on the same subject including mathematics and science (Thomas *et al*, 2000). The assessment of student achievement was conducted both by the International Association for Evaluation of Educational Achievement (IEA) and by

International Assessment of Education Progress (IEAP) (Hanushek and Kim, 1995). Yet, Barro and Lee (1997) found that these measurements could only be explained in the Industrial Countries and could not comparable over time.

2.4 Standard Deviations of Schooling

Standard deviation has been used to measure the absolute dispersion of assets distribution. Ram (1990) used standard deviations of schooling to illustrate the existence of the education Kuznets curve. Birdsall and Londono (1997) investigated the impact of initial asset distribution on growth and poverty reduction and found a significant negative correlation between education dispersion, measured by standard deviations of schooling, and income growth. Inter-American Development Bank (1999) took standard deviations of schooling to measure education inequality.

2.5 Gini Coefficient of Education

As standard deviations of schooling only measures the absolute dispersion of schooling distribution, developing education Gini is very necessary for measuring the inequality of schooling in relative term. Education Gini concept is very similar to income Gini and can be calculated by using enrollment, financing, and attainment data. Rosthal (1978) estimated Gini coefficient using education finance data in several East African Countries. Sheret (1988) utilized enrollment data in Papua New Guinea to reckon Gini index. However, these studies do not emphasize on the distribution of school attainment.

III. DATA and METHODOLOGY

1. Data

This research uses National Social Economic Survey (SUSENAS) data, which have been 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 covers a sub-sample of about 65,000 households. I take Core SUSENAS from 1999 to 2005 in 23 out of 31 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.[7]

2. Methodology

On the purpose of estimating education inequality in Indonesia, I use direct method to capture education Gini coefficient, average years of schooling, and standar deviations of education. In addition, Lorenz curve based on the cumulative proportion of population and that of schooling will be visualized in indirect method.

2.1 Direct Method

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 the absolute deviations between all possible pairs of people" (Deaton 1997). Thomas *et all* (2000) developed Deaton's formula, which is shown in equation 1.

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

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 and Lee (1991) divided the population into seven categories include no schooling or illiterate, partial primary, complete primary, partial secondary, complete secondary, partial tertiary, and complete tertiary. However, BPS shared 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.

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

$$\mu = AYS = \sum_{i=1}^{n} p_i y_i \qquad (2)$$

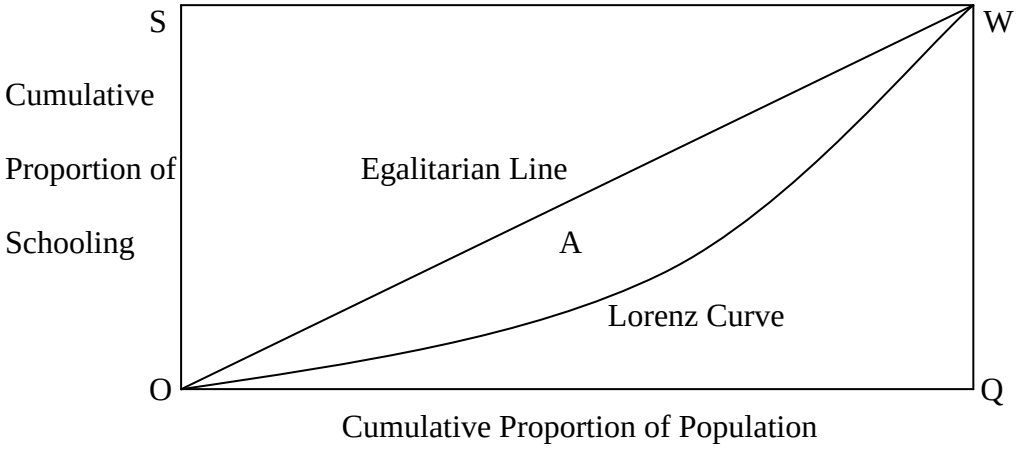
$$\sigma = SDS = \sqrt{\sum_{i=1}^{n} p_i (y_i - \mu)^2} \qquad (3)$$

[7] At that period, there was a revolt that creates political and economic instability in this region

2.2 Indirect Method

The indirect method constructs the education Lorenz curve, shown in figure 1, which is the combination between the cumulative percentage of the schooling years on the vertical axis, shown in S, and the cumulative percentage of the population on the horizontal axis, shown in Q. The forty-five degree line is the education egalitarian line, represents a perfect equality of schooling. Thus, the education Gini is estimated using the indirect method as the ratio between the area of A and the area of OWQ.

Figure 1: Education Lorenz Curve



IV. EMPIRICAL RESULTS

1. Education Gini in terms of Areas and Provinces

In terms of region, there was a significant improvement in Gini coefficient of education from 1999 to 2005 (see table 1). Between 1999 and 2005, the national Gini education decreased steadily. Both rural and urban Gini education fell significantly from 0.29 and 0.36 in 1999 to 0.27 and 0.32 in 2005 respectively. In addition, the effort of rural area to improve their education equality is more likely to outweigh urban area. According to Suwignyo (2004), both local and state government put their resources to improve quality of education, mainly in school infrastructure, to stimulate demand of education in rural area, so there is a tendency that rural area grows faster than the urban area.

Table 1: Development of Gini Coefficient of Education in Rural, Urban, and Indonesia

Area	1999	2001	2003	2005
Indonesia	0.35	0.35	0.33	0.32
Rural	0.36	0.35	0.34	0.32
Urban	0.29	0.30	0.28	0.27

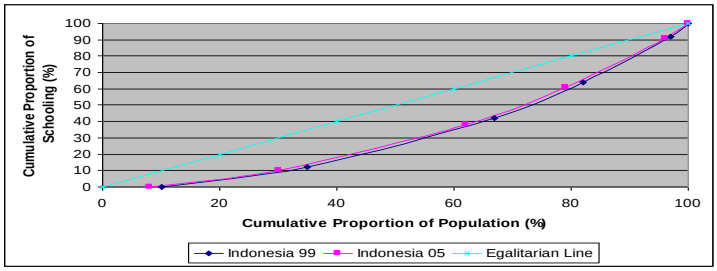
Source: Author's calculation, data available upon request

In terms of provinces, education Gini in 23 provinces fell gradually.[8] There was a sharp decrease in Gini coefficient of education in West Borneo, Jambi, South Sumatra, East Java, North Celebes, and South-East Celebes. In contrast, Daerah Istimewa Yogyakarta (DIY) almost remained stable in its Gini education. Overall, DKI Jakarta has the lowest level of education inequality whereas the highest level is West Nusa Tenggara (NTB). In the case of NTB, regional budget in education sector is very limited (only 5 per cent) and it affects the supply education factors such as the inadequacy on facility and the less number of schools. Furthermore, the demand education factors, such as the inadequacy on household, child inability, and the low quality of schooling, give the impact on high education inequality in NTB. On the other hand, DKI Jakarta spends almost 20 per cent of total regional budget on education sector, primarily on the effort to increase quality and quantity of schooling (Digdowiseiso, 2007).[9]

2. Education Lorenz Curve in terms of Areas

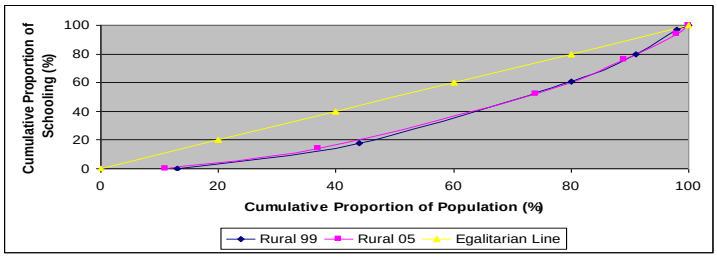
In Figure 2 distribution of schooling in 2005 is more equal than that in 1999 as the Gini coefficient of education in 2005 is much better than that in 1999. In addition, the same condition takes place in rural and urban area in distribution of schooling in 2005 (see Figure 3 and Figure 4).

Figure 2: Education Lorenz Curve in Indonesia



Source: Author's Calculation

Figure 3: Education Lorenz Curve in Rural Area

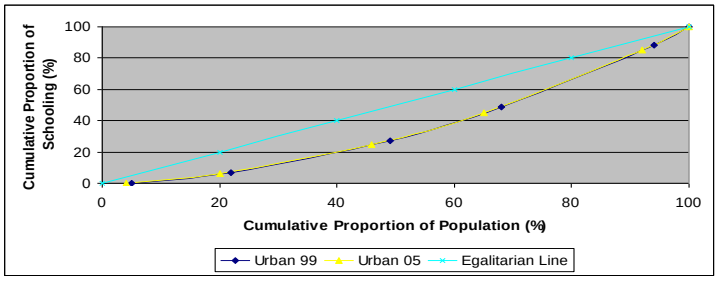


Source: Author's Calculation

[8] For further information please contact the author at kumbadigdo@yahoo.com

[9] The author did a comparative study to analyze impact regional budget in education sector on demand and supply education in Indonesia by using these provinces as a case study

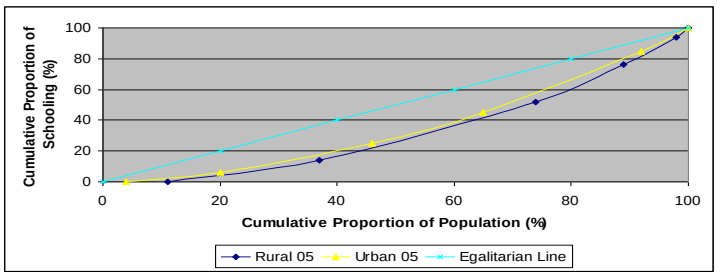
Figure 4: Education Lorenz Curve in Urban Area



Source: Author's Calculation

Figure 5 shows the comparison between rural Lorenz curve and urban Lorenz curve and indicates that the education inequality gap between rural and urban area is much more slightly. The fact that there is a promising development of distribution of education in rural area endorses a specifically targeted policy to reduce the gap between rural and urban area.

Figure 5: Education Lorenz Curve between Rural and Urban Area



Source: Author's Calculation

3. Average Years of Schooling in the Period of 1999-2005 in Terms of Areas and Provinces

Average years of schooling in rural, urban, and Indonesia rose sharply (see table 2). It means that there is an improvement in education equality in these areas, particularly rural. Setyorini (2002) took issue with the differences between rural and urban average years of schooling that rural area was "gifted" an innate ability so that it boost the demand of education. However, it might not be true as increasing quantity of education and thus supply of education leads to a significant rise in average years of education (Duflo, 2001).

Table 2: Development of Average Years of Schooling in Rural, Urban, and Indonesia

Area	1999	2001	2003	2005
Indonesia	6.30	6.33	6.57	6.79
Rural	5.08	5.17	5.47	5.75
Urban	7.80	7.68	8.10	8.27

Source: Author's calculation, data available upon request

In terms of provinces, there was a gradual increase in average years of schooling in 23 provinces in Indonesia from 1999 to 2005.[10] North Celebes attains the greater difference on average years of schooling and an evidence of state government intervention, as in Duflo case, occurs in this area.[11] Yet, Samiadji (2001) argued that the household characteristics are positively correlated with average years of schooling, while quantity of education has no impact in education equality in North Celebes. Furthermore, there was a significant rise in average years of schooling in East Java, Jambi, Central Borneo, and Bali. Overall, DKI Jakarta has the highest average years of schooling while East Nusa Tenggara (NTT) has the lowest one. In the case of NTT, the inadequacy on household (i.e. lack of income and higher siblings in the family) and the lower quality of schooling play a major role on the inefficiency demand of education (Samiadji, 2001).

4. Standard Deviations of Schooling in terms of Areas and Provinces

Standard deviations of schooling in rural, urban, and Indonesia fluctuated annually (see table 3). Increasing and decreasing on standard deviations of schooling will decrease and increase the level of education inequality. Thus, this condition is very contrast to the fact that Gini coefficient of education can measure the equality on education in rural, urban, and Indonesia appropriately.

Table 3: Development of Standard Deviations of Schooling in Rural, Urban, and Indonesia

Area	1999	2001	2003	2005
Indonesia	3.94	3.92	3.90	3.99
Rural	3.35	3.40	3.36	3.58
Urban	4.07	4.12	4.08	4.14

Source: Author's calculation, data available upon request

In terms of provinces, standard deviations of schooling in Central Borneo, South Borneo, Riau, Daerah Istimewa Yogyakarta, and South-East Celebes fell significantly from 1999 to 2005.[12] This means that education inequality between one province and the other is decreasing. In addition, standard deviations of schooling in 18 provinces rose dramatically in 2005. It indicates that the spread of education attainment between one province and another province becomes wide every year. Thus, education inequality between one province and the others is increasing.

5. Education Gini in terms of Gender

Education equality improved significantly from 1999 to 2005 (see table 4). In terms of total, there was a dramatic decline in both male and female Gini coefficient of education within this period. In terms of urban and rural area, between 1999 and 2005 both male and female Gini

[10] For further information please contact the author at kumbadigdo@yahoo.com
[11] According to state government calculation, the number of school constructions rise dramatically by 20 per cent within this period
[12] For further information please contact the author at kumbadigdo@yahoo.com

coefficient of education fell slightly. Overall, total population in urban area has bigger education equality than that in rural. Moreover, male population has bigger chance to extend their education, due to the possibility of the parents to give larger opportunity of schooling to male children (Digdowiseiso, 2007).[13]

Table 4: Development of Gini Coefficient of Education in Rural, Urban, and Indonesia in terms of Gender

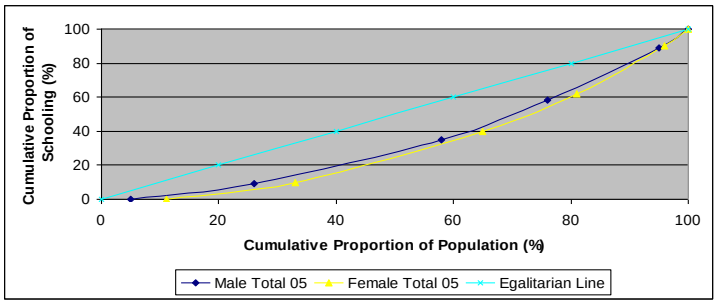
Gender	Region	1999	2001	2003	2005
Male	Rural	0.32	0.32	0.31	0.31
	Urban	0.27	0.27	0.27	0.26
Female	Rural	0.38	0.38	0.36	0.36
	Urban	0.31	0.31	0.30	0.29
Total	Rural	0.37	0.38	0.35	0.35
	Urban	0.32	0.32	0.30	0.30

Source: Author's calculation, data available upon request

6. Education Lorenz Curve in terms of Gender

In 2005 total female Lorenz curve moved closer to the male Lorenz curve (see Figure 6). On the other hand, the gap between female and male Lorenz curve decreased slightly in 2005 in both urban and rural Lorenz curve (see Figure 7 and 8). The positive developments in female education were apparently not large enough to reverse the widening education gender-gap in Indonesia. This proves that changing inequality in Indonesia requires increased public attention and proper policy targeting towards female schooling.

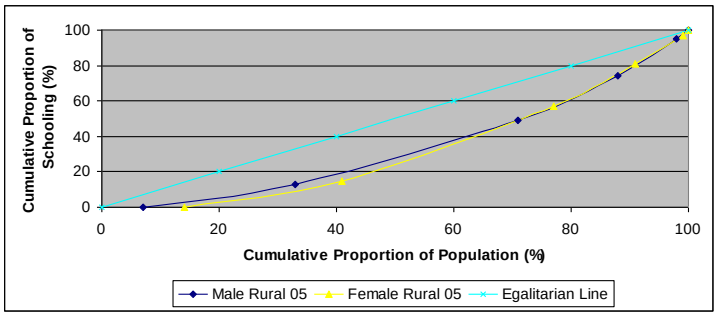
Figure 6: Gender Lorenz Curve in terms of Total



Source: Author's Calculation

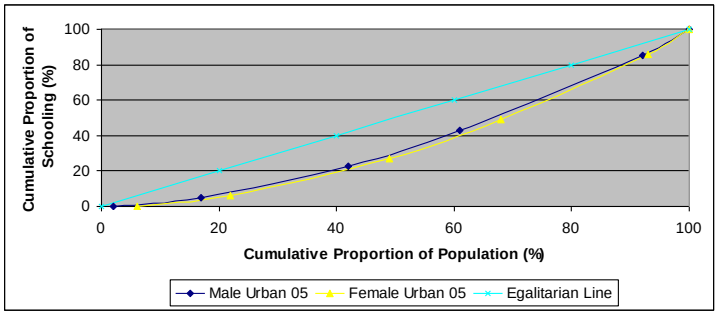
[13] It is common knowledge that discriminations do matters in creating gender bias

Figure 7: Gender Lorenz Curve in Rural Area



Source: Author's Calculation

Figure 8: Gender Lorenz Curve in Urban Area



Source: Author's Calculation

7. Average Years of Schooling in terms of Gender

The gap between male and female average years of schooling is an important indicator of developmental differential (Siddhanta and Nandy, 2003). Table 5 reveals that average years of schooling of male population, female population, and Indonesia rose significantly from 1999 to 2005. It shows that the difference of the increment in female average years of schooling is bigger than that in male. Siddhanta and Nandy (2003) argued that improving female education is far more than that of educating male. However, social preferences may deter investment in female education and thus, functioning equality (Samiadji, 2001).

Table 5: Development of Average Years of schooling in terms of Gender

Gender	1999	2001	2003	2005
Indonesia	6.30	6.33	6.57	6.79
Male	6.85	6.82	7.03	7.25
Female	5.88	5.94	6.24	6.46

Source: Author's calculation, data available upon request

8. Standard Deviations of Schooling in terms of Gender

Male standard deviations of schooling and female standard deviations of schooling fluctuated gradually from 1999 to 2005 (see table 6). There was an improvement in male standard deviations

of schooling and a decrease in female's standard deviations of schooling. Intuitively, this result should give the impact on the higher male Gini coefficient of education and the lower one in female. However, both male and female Gini education falls significantly in table 4.

Table 6: Development of Standard Deviations of Schooling in terms of Gender

Gender	1999	2001	2003	2005
Indonesia	3.94	3.92	3.90	3.99
Male	3.92	3.96	3.82	3.95
Female	3.99	4.02	3.96	3.98

Source: Author's calculation, data available upon request

9. The Difference Illiteracy Rate among Gender[14]

To analyze education inequality among gender, the author uses the difference of illiteracy rate between male population and female population. The gap between men's and women's literacy rate is a rough but informative indicator of the gender difference in many forms of human capital (Siddhanta and Nandy, 2003). In the 2005 spatial pattern of gender inequality, If 6-percentage point[15] of gender disparity is considered as a crucial level, then I found that 18 provinces lie below this level.[16] Among these, the location of 17 provinces is striking; together they form a contiguous belt.

An even more striking spatial contiguity of provinces has been found for the rural population above the cut-off point 7.6-percentage point[17] since most of them are located in western part of Indonesia. In the urban population, 6 provinces have gender gap in literacy rate more than national average.[18] Of these, 5 provinces form a geographical contiguity. The pattern of the spatial contiguity for the urban population is similar with that of the rural population.

In 1999, DIY and North Celebes (SULUT) are the highest and lowest difference of illiteracy rate among gender in both rural and urban area respectively. The result is very surprising, considered that DIY is well known as "province of education". Suwignyo (2004) claimed that DIY has low demand of education in rural area such as the tradition of parents to give education only on male children and insufficient household characteristics. In contrast, NTB and SULUT are the highest and lowest gender gap in illiteracy rate in terms of total.

[14] For further information please contact the author at kumbadigdo@yahoo.com
[15] All Indonesia gender gap in literacy rate (total) was 6 percentage points in 2005
[16] Although the estimation of gender gap literacy rate declined dramatically, however, there is a tendency that in terms of total, gender gap increased in 2005. In 1999, 6 provinces lie above 7.8-percentage point of gender disparity
[17] All Indonesia gender gap in literacy rate (rural) was 7.6 percentage points in 2005
[18] There is a tendency that gender gap of urban area increased in 2005 though the estimation of gender fell steadily. In 1999, 6 provinces lie above 5.1-percentage point of gender disparity

In 2005, Bali and DKI Jakarta had the highest and lowest difference of illiteracy rate among gender in rural area and total respectively. Another shocking finding occurs in the former where tourism sector is the biggest contribution of its regional budget. Samiadji (2001) believed that culture in Bali is associated with gender bias and thus, functioning demand for education. On the other hand, NTB and SULUT are the highest and lowest gender gap in illiteracy rate in urban area.

10. The Association between Education Gini and Average Years of Schooling

This study proves that there is a significant association between Gini coefficient of education and average years of schooling. The relation between both factors is briefly explained in the exponential equation as shown below:

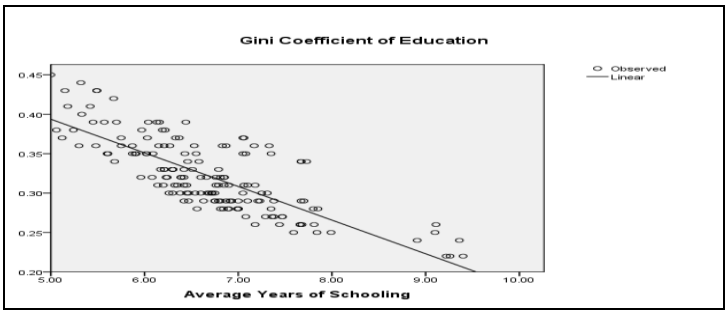
ln GINI = -0,171 LAMA (4)

$R^2 = 0.994$ t = (-159.833)

Where: GINI is Gini coefficient of education; LAMA is average years of schooling.

Equation 4 states the estimation of t at -159.833, signification at 0.00, and R^2 at 0.994, hence average years of schooling influence significantly to Gini coefficient of education at 5 percent level. Figure 9 shows the decreasing of Gini coefficient education, at the time average years of schooling rise. Thus, there is a negative correlation between Gini coefficient of education and average years of schooling and this supports Thomas's et al (2001) finding.

Figure 9: Education Gini and Average Years of Schooling



Source: Author's Calculation

11. The Relationship between Education Gini and Standard Deviations of Schooling

This research establishes a significant relation between Gini coefficient of education and standard deviations of education. The relation between two factors is briefly described in the linier equation as shown below:

GINI = 0,083 DEV (5)

$R^2 = 0.985$, t = (101.419)

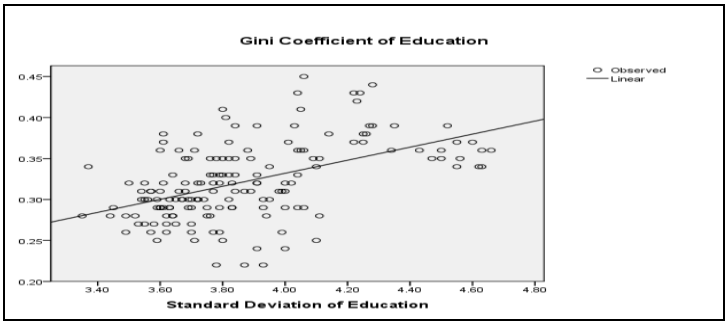
Where: GINI is Gini coefficient of education; DEV is standard deviations of schooling.

Equation 5 describes the estimation of t at 101.419, signification at 0.00, and R^2 at 0.985, therefore standard deviations of schooling influence significantly to Gini coefficient of education at

5 percent level. Figure 10 indicates that once standard deviations of schooling increase, Gini coefficient of education rise. Thus, this result is very similar to Inter American Development Bank's (1999) finding where Gini coefficients of education and standard deviations of schooling are positively correlated.

Logically, if there is any improvement on Gini coefficient of education, education inequality will increase represented by the increasing in standard deviations of schooling. Of course, it is very contrast to the principle of equality distribution of education. Therefore, standard deviation of schooling is not appropriate measure to describe educational equality (Thomas *et al*, 2001).

Figure 10: Education Gini and Standard Deviations of schooling

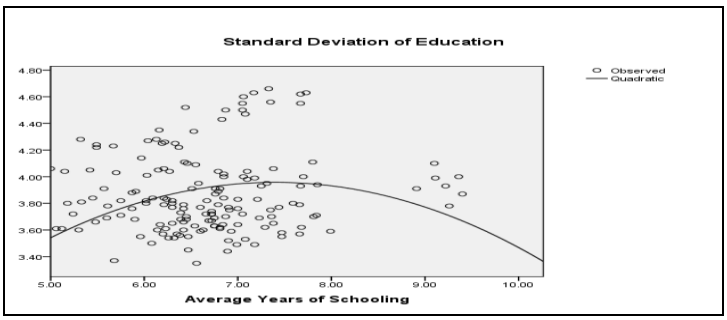


Source: Author's Calculation

12. The Relationship between Average Years of Schooling and Standard Deviations of Schooling

This study finds that Gini coefficient of education associates with standard deviations of education where this relation will form education Kuznets curve. Figure 11 explains that at first, education inequality increases, then after reaching a peak, education inequality fall gradually. This result endorses Ram's (1990) finding, however, the turning point of his finding is about 7 years while the turning point of this study is about 7.4 years. It means that a country with average years of schooling below 7.4 years should increase its standard deviations of schooling to gain equality on education. In contrast, a country with average years of schooling above 7.4 years should decrease its standard deviations of schooling to attain education equality.

Figure 11: Educational Kuznets Curve



Source: The Author's Calculation

13. The Association between Gini Education and The Difference of Illiteracy Rate among Gender

Thomas *et al* (2001) suggested that the Gini coefficient of education is positively associated with gender gap in literacy rate and the relation between education inequality and gap among gender is getting much stronger over time. The result maintains that education inequality are clearly related to gender gap from 0.79 in 1999 to 0.83 in 2005 (see Figure 12 and 13).

GINI99 = 0.275 + 0.009 GENDER99 (6)

R^2 = 0.625, R = 0.79, t = (5.914)

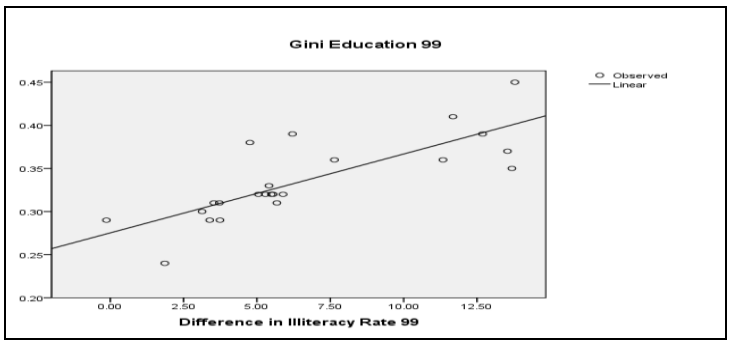
GINI05 = 0.248 + 0.011 GENDER05 (7)

R^2 = 0.694, R = 0.83, t = (6.901)

Where: GINI99 is Gini coefficient of education in 1999; GINI05 is Gini coefficient of education in 2005; GENDER99 is difference illiteracy rate among gender in1999; GENDER05 is difference illiteracy rate among gender in 2005.

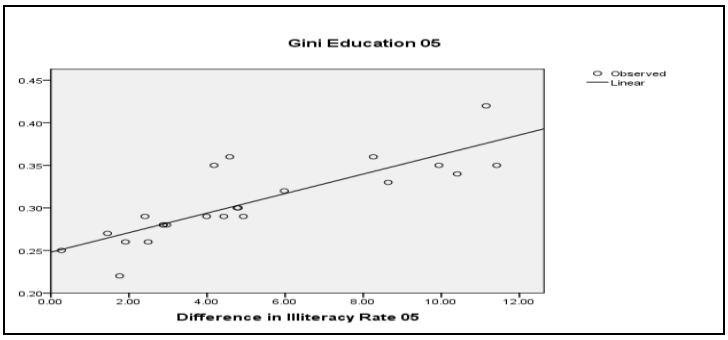
Equation 6 and 7 show that the estimation of t is 5.914 in 1999 and 6.901 in 2005 and most importantly, the signification of both years at 0.00. Therefore, difference of illiteracy rate and Gini coefficient of education is significantly related at 5 percent level.

Figure 12: Education Gini and Gender Gaps in 1999



Source: Author's Calculation

Figure 13: Education Gini and Gender Gaps in 2005



Source: Author's Calculation

V. CONCLUDING REMARKS

This study measures education inequality in Indonesia from the period of 1999 to the period of 2005 by using two methods, the direct method and the indirect method. The direct method will be focused on estimating Gini coefficient of education while the indirect method will be applied on formulating education Lorenz curve. By using both direct and indirect method, the author can analyze education inequality in terms of areas and gender. To sum up, there are several major findings on education inequality aspect in Indonesia.

Firstly, in terms of national, there was a significant decrease in education Gini from 0.35 in 1999 to 0.32 in 2005. Meanwhile, in terms of provinces in Indonesia, there is an annual improvement on education inequality. The exceptional case occurs in Bali, East Nusa Tenggara, and West Borneo where their Gini education is very vulnerable to the immediate shock. Secondly, study among areas describes that over time, rural area has higher education inequality than urban area. Between 1999 and 2005, the Gini coefficient of education of rural area decreased dramatically from 0.36 to 0.33 and there was a slight fall in Gini coefficient of education of urban area from 0.29 to 0.28.

Thirdly, study among gender shows that female population has higher education inequality than male population over time. Between 1999 and 2005, the Gini education of female population declined steadily from 0.37 to 0.35 and there was a significant decrease in the Gini education of male population from 0.32 to 0.30. Fourthly, the interrelatedness study between gender and area states that the level of education inequality of both female and male population in rural area is higher than that in urban area.

Lastly, in terms of association between two variables, there is a negative correlation between Gini coefficient education and average years of schooling. This research substantiates standard deviations of schooling is not a proper measurement to estimate distribution of schooling, due to the increasing standard deviations of schooling will give a bad impact on education equality. Another major finding is that there is a relationship between standard deviations of schooling and average years of schooling which forms education Kuznets curve, where at first, educational inequality increases, then after reaching a peak at 7.4 years, educational inequality starts to decline. Furthermore, this study claims that there is a positive relation between education inequality and the difference of illiteracy rate of gender, and over time, the association between gender-gaps and inequality becomes stronger.

Based on these findings, it clearly states that Gini index need to be incorporated with the quality aspect and examined any causal relationship between education Gini and income growth, which are challenges for future studies. The need to disentangle the association between education inequality and other aspects of development, such as income inequality, income level and growth,

gender gaps, education-related policies, poverty is very essential in any future research. Another item on research agenda is how to account the interaction effects between education 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 education inequality in the future.

There are several policies that the government could take the steps to help the efforts in achieving education equality in Indonesia. Firstly, both state and local governments must have taken over the responsibility to managing every potential resource in their own, primarily human resource. For instance, they have to increase both the quality and quantity of schooling such as teacher's quality and qualification, student per teacher ratio, teacher's wage and other incentives, school facilities and maintenance, and the number of school. Beside that, they have to empower female and rural population by mitigating literacy rate, applying the nine-year education program, and developing the one-roof education program which combines primary school and junior secondary school into one building closes to the community.

Secondly, the central government must increase national budget on education sector to improve education equality and to give financial support to both state and local governments, if required. Moreover, the central government has to alter the scholarship scheme to reach children who cannot continue to school after completing primary school. Another policy is that the central government must increase the opportunity cost of not going to school by providing cash subsidies directly to the family. In addition, the central government must give a specifically targeted campaign to promote the importance of education. Lastly, people should actively enact as a leading role in the implementation of education.

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