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Wage Inequality and Return to Education in Indonesia: Quantile Regression Analysis

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Abstract

It is essential to the government to recognize the factors causing the increasing trend of income inequality in Indonesia since the Gini coefficient increased between 1996 and 2016. Moreover, wage inequality, which represented by high percentile and low percentile of income, also shows widening gap since 2003. This study focuses on the factors of wage inequality acceleration through the supply side approach that follows the Mincerian wage equation model. Specifically, this paper aims to investigate the association between the return to education and wage inequality in Indonesia. The quantile regression method is applied to compute the return on the investment at different points of the wage distribution. The main finding is that education contributes to an increasing wage inequality due to the significant variation in the rate of return to education in different quantile and as increasing wage dispersion within the same education.

Keywords: wage inequality, returns to education, wage dispersion, quantile regression

Abstrak

Penting bagi pemerintah untuk mengenali faktor-faktor yang menyebabkan meningkatnya kecenderungan ketidaksetaraan pendapatan di Indonesia karena koefisien Gini meningkat antara tahun 1996 dan 2016. Selain itu, ketidaksetaraan upah, yang diwakili oleh persentase persentil yang tinggi dan persentil yang rendah, juga menunjukkan kesenjangan yang meluas sejak 2003. Penelitian ini berfokus pada faktor percepatan ketimpangan upah melalui pendekatan sisi penawaran yang mengikuti model persamaan upah Mincerian. Secara khusus, makalah ini bertujuan untuk menyelidiki hubungan antara tingkat pengembalian pendidikan dan ketimpangan upah di Indonesia. Metode regresi kuantitatif diterapkan untuk menghitung tingkat pengembalian investasi pada berbagai titik distribusi upah. Temuan utamanya adalah bahwa pendidikan berkontribusi terhadap peningkatan ketimpangan upah karena variasi tingkat pengembalian pendidikan yang signifikan dalam jumlah yang berbeda dan meningkatnya dispersi upah dalam pendidikan yang sama.

Kata Kunci: ketimpangan upah, tingkat pengembalian pendidikan, dispersi upah, regresi kuantil

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Introduction

Wage inequality has become the focus of much attention for different governments in recent years even though it has been a central issue for many economists for a decade. In Indonesia, income inequality, measured by the Gini coefficient published by the Indonesian statistic agency (BPS), shows an increasing trend during the last decade from 0.355 in 1996 to 0.41 in 2016. Lee and Wie (2015) reported that wage inequality in Indonesia shows a widening gap since 2003 as the financial crisis. Consequently, wage inequality persists making it very important for the government to recognize the causes and factors underlying wage inequality in the distribution of household wages in Indonesia.

This study focuses on the connection between wage inequality and returns to education through the supply side approach that follows the Mincerian wage equation model (Mincer, 1996). In Indonesia, the studies that find the relationship between wage inequality and return to education are insufficient. Several studies only focus on the finding the rate of return to education in Indonesia, such as Duflo (2017), Purnastuti, Miller, and Salim (2017), Magdalyn (2013) and Deolalikar (1993). The novelty of this paper is that it is likely the first study that connects the return to education with wage inequality in Indonesia by using quantile regression method. This research is vital to show the education that may impact on the distribution of wage and can contribute increasing wage gap among workers with the same educational level. Moreover, this study that finds out the rate of return to education is also essential because it reflects the indicator of economic benefits and even the risk of an educational investment (Telhado-pereira, 2011).

Education regarded as the primary tool to improve economic development. According to Barro (2013), to enhance economic growth, the government should focus on human capital development, as observed by increasing educational attainment. In this study, a higher proportion of human capital to physical capital can lead to the acceleration of economic growth because a higher human capital ratio enabled the adoption of modern technology from advanced countries. Barro (2013) concluded that to adopt the foreign advanced technology, governments should focus on more human capital accumulation rather than in the physical capital.

Despite the beneficial effects of education on economic growth as a result of an overall increase in skilled labor, it can also lead to adverse outcomes such as income inequality (Martins & Pereira, 2004). More specifically, the rate of return to education can be varying across the quantile of wage so that it can result in wage dispersion. Wage dispersion is the amount of variation of wage usually among workers with the same educational level, equal skill, and same experience. According to Barrett, et al. (1999); Martins and Pereira (2004); Barth and Lucifora (2006); and Tansel (2010) stated wage dispersion measurement computed by subtracting the lowest quantile from the highest quantile (q90-q10) or by the ratio of the top decile and bottom decile.

Previous research about the effect of changes in return to education on wage inequality has been studied in several countries. Evidence of Ireland and OECD countries suggest that

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the wage dispersion worsened in the OECD countries (Barrett et al., 1999). Based on their study, the wage dispersion computed through the ratio between the top and median decile, median, and bottom decile, and top and bottom decile. Their results reported that several countries that suffer from the high level of earning dispersion such as Ireland, Canada, and the United States. Those countries had a higher value of the ratio between the top and the bottom decile than the ratio's value of both the top and the median decile and between the median and the bottom decile. They also explored the relationship between education and wage distribution through the same method and found that the degree of earning dispersion in Ireland takes place widely in the post-school category. A study of wage inequality and return to education in Turkey also suggested similar results that return to education in Turkey provides a significant impact on wage inequality both of within-group and between-group inequality (Tansel, 2010).

Furthermore, some emerging evidence from Europe reveals that the variation of return to education has contributed to the increasing wage dispersion (Buchinsky, 1994; Budria & Telhado-Pereira, 2011; Martins & Pereira, 2004). To see the variation in the return to education within the same educational level of workers, this paper closely connected to the study of Budria and Telhado-Pereira (2011), who use the variable of the level of education in place of years of schooling. On the other hand, Martins and Pereira (2004) only use the variable of duration of education in the model, assuming that wage dispersion due to the variation of return to education within the same level educational group is constant across education levels.

According to Akita (2002), the various factors that influence the increase in wage inequality in Indonesia are the rural-urban gap, educational disparity of workers, age distribution, regional disparity and the gender gap. Kijima (2006) also found that the increasing wage gap in India during the 1980s and 1990s was due to unequal education attainment, the difference in working experience and the gap between the demand and supply of skilled labor. Other factors that contribute to rising wage inequality are due to globalization activities, such as the influx of foreign direct investment and international trade (Tsai, 1995). Kijima (2006) used the decomposition of wage differential to trace the cause of accelerating wage inequality. His findings, through the study of Indian households in 2005, suggested that the increasing gap due to an additional year of schooling, the working experience and the gap between the demand and supply of skilled labor were the main factors of the increase in wage inequality in India during the 1980s and 1990s respectively.

Based on the abovementioned motivation above, the primary research of this study is as follows: what is the relationship between the wage inequality and the return to education in Indonesia? While the sub research questions are as follows: First, what is the correlation between the educational level attainment and the amount of wage in Indonesia? Second, what is the relationship between the covariates, including the urban/geographic location, a cohort of age, industrial classification, and amount of wage in Indonesia?

Method

The source of data is from the national labor survey (Sakernas) that is conducted every year by the Indonesian Statistic Agency. This review gives various kinds of information related to the labor forces, educational attainment of workers, duration of the school of workers, the age of workers, monthly wage and, an overview of the labor market, so that it is beneficial to formulate policy recommendations in the labor market and education sectors. In this study, only the people with job and age 15–65 years old, who are in labor force classification, are taken into consideration. Gender and marital status not included because of this study emphases on labor force as general, not limited to the specific gender workers.

In addition, the regressions in this paper use two cross-section data year 2008 and 2015. Two cross-section regressions aim to find out an increase in wage dispersion between these years. That is not to compare the result between 2008 and 2015. The National Labor Survey (Sakernas) provides raw data of monthly wages in the form of money and goods. Therefore, nominal wages should calculate by a sum amount of money and value of goods. The nominal monthly wage is then changed into real monthly wage by adjusting the consumer price index (CPI).

This study applies quantile regression method instead of an ordinary least square (OLS) because quantile regression can give analysis about the effect of the dependent variable on the independent variables at different points of the quantile of the conditional distribution of real wages. The quantile regression model, which was introduced by Koenker and Basset (1978) and modified as a wage equation model by Mincer (1987), consists of the duration of schooling, experience or job tenure and the square of experience. This equation wage model of quantile regression can write as:

$$ln\ Wi = x_i + e_{\theta i} \ \ with\ Quant_\theta\ (ln\ W_i|X_i) = X_i \beta_\theta \qquad (1)$$

where

$ln\ Wi$ is logarithm of real wage;

β_θ is the vector of parameters;

X_i is the vector of exogenous variables;

$e_{\theta i}$ is error term of each quantiles;

$Quant_\theta\ (ln\ W_i|X_i)$ is the θ^{th} conditional quantile of ln W given X.

The θ^{th} regression quantile, ranged $0 < \theta < 1$, is defined as asymmetrically weighted sum of absolute error (Koenkers & Hallock, 2011). In ordinary least square, the sum of squared residuals is regarded as a solution. Compared to OLS estimation, in which one can just see the change of conditional log wage distribution, quantile regression results in a different dispersion of change in the conditional log wage distribution. Furthermore, quantile regression gives benefits to the estimates that are more robust for the outliers of the endogenous variables (ln real wages), and this kind of regression is more efficient than OLS in terms of non-normality of error term (Tansel, 2010).

According to the human capital theory, the rate of return to education is viewed as the

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rate of return investment (r_i) and the individual income (w_i) is regarded as the product of the accumulated investments (K_i). Mincer (1996) defined the school investments as logarithms of wages as the investment itself can be measured as continuous value in time unit. By adding the duration of the working experience (j) on the logarithms of wages, the capacity log wages of individuals i is as follows:

$$\text{Ln } w_{ij} = \alpha_{i0} + r_i K_{ij} \quad (2)$$

Where: K_{ij} is human capital accumulation in period j and r_i as the rate of return of the accumulation of human capital. The wage inequality is measured by the variance of ln w_{ij}.

To understand the concept of the rate of return to education, two methods can be followed. The first method from Deolalikar (1993) where the average return defined , as the level of education (β_k) is divided by and the number of years required to complete the education (n_k). The formula is as follows:

$$r_k = \frac{\beta_k}{n_k} \quad (3)$$

Another method to formulate is the rate of return to education by dividing the difference between the coefficients of adjacent schooling levels by the difference in the years of schooling associated with these levels (Kimenyi, et al, 2006; Sakellariou, 2003). This approach emphasizes on a marginal return. In this specification, the rate of return to education is as follows:

$$r_k = \frac{\beta_k - \beta_{k-1}}{\Delta n_k} \quad (4)$$

The empirical model in this paper utilizes the modified human capital wage equation that uses years of schooling for the first regression and dummy variable of educational level for the second regression. The dummy variables of different education levels consist of primary school (SD, MI), junior high school (SMP, MTS), senior high school (SMU, SMK, MA), Vocational School (D1, D2, D3) and University (S1, S2, S3). The flexible human capital wage equation can be written as follows:

For the first regression,

$$\begin{aligned} ln(wage_i) = {} & \beta_0 + \beta_1 yearofsch_i + \beta_2\, exper_i + \beta_3 exper^2{}_i + \beta_4 cohort25\_45_i \\ & + \beta_5 cohort46\_65_i + \beta_6 urban_i + \beta_7 \text{industry}1_i + \beta_8 \text{industry}2_i \\ & + \beta_9 industry3_i + \beta_{10} industry4_i + \beta_{11} industry5_i + \beta_{12} industry6_i \\ & + \beta_{13} industry7_i + \beta_{14} industry8_i + v_i \quad (5) \end{aligned}$$

For the second regression,

$$\begin{aligned} ln(wage_i) = {} & \beta_0 + \beta_0 primarysch_i + \beta_2\, middlesch_i + \beta_3 highsch_i + \beta_4 vocation_i \\ & + \beta_4 univ_i + \beta_5\, exper_i + \beta_6 exper^2{}_i + \beta_7 cohort25\_45_i \\ & + \beta_8 cohort46\_65_i + \beta_9 urban_i + \beta_{10} industry1_i + \beta_{11}\, industry2_i \\ & + \beta_{12} industry3_i + \beta_{13} industry4_i + \beta_{14} industry5_i + \beta_{15} industry6_i \\ & + \beta_{16} industry7_i + \beta_{17} industry8_i + v_i \quad (6) \end{aligned}$$

Where:

$ln(wage_i)$ = Natural log of individual wage i

$yearofsch_i$ = duration of education (years)

$exper_i$ = working experience (years)

$exper^2{}_i$ = quadratic of working experience (years)

$cohort25\_45_i$ = dummy variable for individuals in the 25–45 age cohort (people/workers age 15–24 as the reference)

$cohort46\_65_i$ = dummy variable for individuals in the 46–65 age cohort (people/workers age 15–24 as the reference)

$urban_i$ = dummy variable of urban location (rural as the reference)

$industry1_i$ = dummy variable of industry 1 (mining)

$industry2_i$ = dummy variable of industry 2 (manufacturing)

$industry3_i$ = dummy variable of industry 3 (electricity, gas & water)

$industry4_i$ = dummy variable of industry 4 (construction)

$industry5_i$ = dummy variable of industry 5 (trade (wholesale & retail), hotel & restaurant)

$industry6_i$ = dummy variable of industry 6 (transport, warehouse & communication)

$industry7_i$ = dummy variable of industry 7 (financing, insurance, real estate & business services)

$industry8_i$ = dummy variable of industry 8 (community service, social & private service), while industry of agriculture, forestry, hunting & fishery (as the reference category)

$Primarysch_i$ = dummy variable for elementary school level

$Middlesch_i$ = dummy variable for junior high school level

$Highsch_i$ = dummy variable for senior high school level

$Vocation_i$ = dummy variable for vocational school (D1, D2, D3)

$Univ_i$ = dummy variable for university level (S1, S2, S3)

The independent variables are educational attainment, separated into years of schooling and educational level attainment, experience, square of experience, dummy of the geographic location (urban) that is rural area as the reference, dummy of the cohort of age 25–26 years old and 46–65 years old, where the group of 15–24 year old's are the reference, and eight dummies of industrial classifications where the forestry and agricultural industry are the reference. The nine industrial classifications are 1) mining, 2) manufacturing, 3) electricity, gas and water, 4) construction, 5) trade (wholesale and retail), hotel and restaurant, 6) transport, warehouse and communication, 7) financing, insurance, real estate and business services, 8) community service, social and private service, and 9) agriculture, forestry, hunting and fishery (as a reference category).

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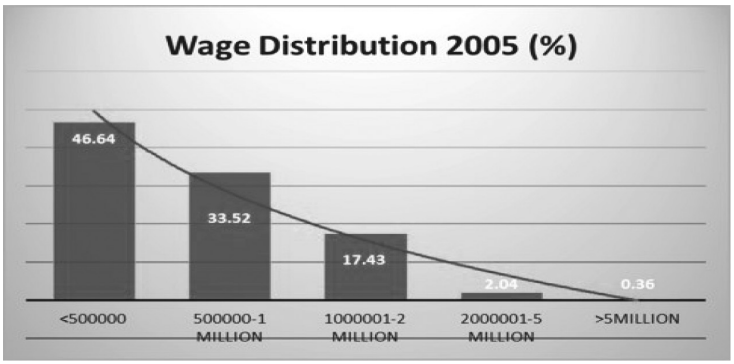
Results and Discussion

In order to review the changes of wage inequality in Indonesia, the histograms of the monthly real wage year 2005, 2010 and 2016 are created. First, the author constructs a distribution of the real wage based on a range of real wages. Figure 1, Figure 2, and Figure 3 demonstrate that there is more balance in the distribution of wages for 2005, 2010 and 2016.

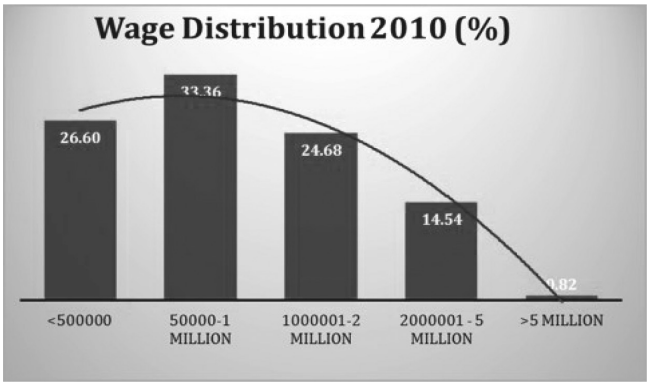
Figure 1. Wage Distribution 2005 (%)



Sources: Sakernas

The percentage of the lowest income (< IDR 1,000,000) decreased, while the proportion of the middle and high income (from IDR 1,000,0001 up to > IDR 5,000,000) increased significantly between 2005 and 2016. However, if we analyze the real monthly wage by percentile, which is presented by Figure 4, the inequality increased as seen by an increasing trend of the 90th percentile of wage and stagnant trend of the 10th and 50th percentile of wage. Thus, we can conclude that wage inequality in Indonesia exists and economic growth has been enjoyed by the middle-upper class only.

Figure 2. Wage Distribution 2010 (%)

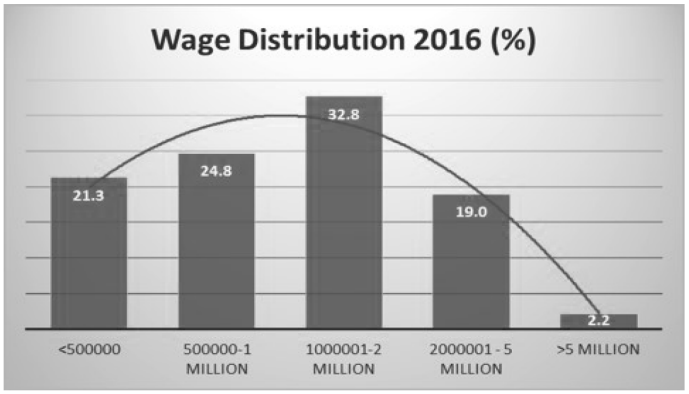


Sources: Sakernas

Using data from the National Labor Survey (Sakernas), the author also analyzes the Indonesian labor market including the decomposition of a group of workers by gender, level of education and regions. According to Table 1, the majority of Indonesian workers are less

educated and/or unskilled. In 2011 and 2016, workers with Junior high school attainment accounted for around 70% and 64.84% of the total workforce.

Figure 3. Wage Distribution 2016 (%)



Source: Sakernas

Table 2 and 3 present the estimates of quantile regression for the year 2015 and 2008 that use the first wage equation model. This model uses years of schooling variable as a proxy for education. The coefficient estimates are positive and significant at one percent level of significance for both years 2008 and 2015. In 2008, the return to education was 7.13% in the 10th quantile, 7.54% in 25th quantile, 6.84% in the 50th quantile, 5.6% in the 75th quantile and 4.2% in the 90th quantile. This estimate means in 2008 an additional year of education the workers spend in their school will increase their wage by around 4.2% to 7.54%. The rate of return to education in 2015 is 5.7% for the 10th quantile, 6.78% for the 25th quantile, 7.26% for the 50th quantile, 6.16% for the 75th quantile and 5.67% for the 90th quantile. These results suggest that in 2015, an additional year of education has the potential to increase the wage of individuals by around 5.7% to 7.26%.

Table 1. Classification of Indonesian Labor Force

Category	Classification	2011 (%)	2016 (%)
EDUCATION	Not graduate elementary school	25.01	21.53
	Elementary school	26.89	26.67
	Junior High School	18.13	16.94
	Senior High School and Vocational high school	22.87	24.91
	Vocational School (D1, D2, D3)	2.57	2.42
	University (D4, S1, S2, S3)	4.53	7.53
REGION	Urban	46.11	46.74
	Rural	53.89	53.26
GENDER	Male	49.68	49.37
	Female	50.32	50.63

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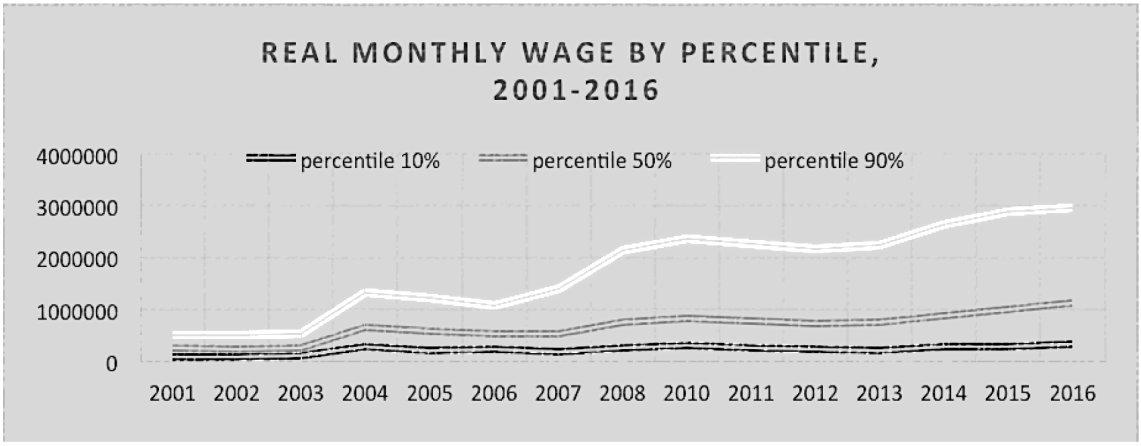
Table 4 shows the estimates of quantile regression that uses the second wage equation model. The second model's version uses dummy variables of educational level as a proxy for education. The coefficient estimates are also positive and significant at one percent level of significance for both years 2008 and 2015.

Figure 4. Real Monthly Wage by Percentile, 2001-2016



Source: Sakernas

Estimation results for the variable of experience of working ($exper_i$) and its square ($exper^2_i$) in both year 2008 and 2015 (Table 3 and Table 2) are statistically significant at one percent level of significance. In 2008, the coefficient estimates of the variable of experience were 0.0613 for 10th quantile, 0.0561 for 25th quantile, 0.0472 for 50th quantile, 0.0382 for 75th quantile and 0.0308 for 90th quantile. In 2015, the coefficient estimates of the variable of experience were 0.0384 for 10th quantile, 0.0421 for 25th quantile, 0.0432 for 50th quantile, 0.0387 for 75th quantile and 0.0391 for 90th quantile.

The coefficient estimates of covariates dummy variables in both year 2008 and 2015 (Table 3 and Table 2) also are also significant at the different level of significance, except for dummy urban that is not significant for 25th quantile and 90th quantile in 2015 and 25th quantile in 2008. The description of these coefficient estimates will explain in the discussion section.

Discussion

The impact of education on wage inequality can be traced through wage dispersion within the same-educational group and between the different-educational groups as a result of significant variation in the rate of return to education. Wage dispersion within the same-educational group defines as the amount of variation in the wages of workers having the same level of education, same skills and/or same experience. The variation in wage dispersion between groups of different-educational levels defines as the amount of variation in wages of laborers with different levels of education, skills, and experience.

Table 2. Quantile Regression Estimates of the Wage Equations, 2015

Indep.Var	q10	q25	q50	q75	q90
Yearos sch	0.0571	0.0678	0.0726	0.0616	0.0567
	(0.0010)***	(0.0008)***	(0.0005)***	(0.0004)***	(0.0006)***
Cohort25_45	0.2340	0.2247	0.1862	0.1641	0.1655
	(0.0113)***	(0.0083)***	(0.0058)***	(0.0049)***	(0.0066)***
Cohort46_65	0.2640	0.2636	0.2403	0.2023	0.2092
	(0.0134)***	(0.0099)***	(0.0069)***	(0.0058)***	(0.0078)***
Exper	0.0384	0.0421	0.0432	0.0387	0.0391
	(0.0012)***	(0.0009)***	(0.0006)***	(0.0005)***	(0.0007)***
Exper2	-0.0008	-0.0008	-0.0008	-0.0007	-0.0007
	(0.0000)***	(0.0000)***	(0.0000)***	(0.0000)***	(0.0000)***
Urban	0.1622	0.1319	0.0687	0.0534	0.0661
	(0.0091)**	(0.0067)	(0.0047)***	(0.0040)***	(0.0053)
Industry1	0.5218	0.5772	0.5998	0.5982	0.6486
	(0.0298)***	(0.0219)***	(0.0154)***	(0.0130)***	(0.0174)***
Industry2	-0.0646	0.0383	0.0662	0.0510	0.0303
	(0.0159)***	(0.0117)***	(0.0082)***	(0.0069)***	(0.0093)***
Industry3	0.6427	0.4573	0.3575	0.2877	0.2862
	(0.0685)***	(0.0503)***	(0.0353)***	(0.0298)***	(0.0400)***
Industry4	0.6460	0.5714	0.4509	0.3313	0.2441
	(0.0168)***	(0.0124)***	(0.0087)***	(0.0073)***	(0.0098)***
Industry5	0.1735	0.1193	0.0744	0.0572	0.0674
	(0.0138)*	(0.0102)***	(0.0071)***	(0.0060)***	(0.0081)***
Industry6	0.3395	0.2506	0.1792	0.1619	0.1487
	(0.0194)***	(0.0143)***	(0.0100)***	(0.0085)***	(0.0113)***
Industry7	0.3209	0.3740	0.3079	0.2855	0.3222
	(0.0265)***	(0.0194)***	(0.0137)***	(0.0115)***	(0.0155)***
Industry8	-0.3195	-0.0948	0.1186	0.1235	0.0842
	(0.0142)***	(0.0104)***	(0.0073)***	(0.0062)***	(0.0083)***
_cons	11.6668	0.0103	12.6655	13.2676	13.6784
	(0.0140)***	(0.0103)***	(0.0072)***	(0.0061)***	(0.0082)***
Pseudo R^2	0.0787	0.1045	0.1422	0.1716	0.1791
Obs.	184,105	184,105	184,105	184,105	184,105

The estimates of the first regression reported in Table 2 and Table 3, the rate of return to education in 2015 is 5.7% for the 10th quantile, 6.78% for the 25th quantile, 7.26% for the 50th quantile, 6.16% for the 75th quantile and 5.67% for the 90th quantile. In 2008, the return to education was 7.13% in the 10th quantile, 7.54% in 25th quantile, 6.84% in the 50th quantile, 5.6% in the 75th quantile and 4.2% in the 90th quantile. These results suggest that significant variation in the coefficients of return to education across wage distribution has contributed to the increase in wage inequality.

For the second regression, Mincer's wage equation model extended by add dummy variables of educational attainment in place of the year of schooling variable. This aims to

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investigate whether there is a contribution of wage inequality between educational groups. Table 4 shows that the coefficient of return to education on the different levels of education is diverse. For example, in 2008 for the median (50th quantile), the return to education for the primary school compared to not schooling or not complete primary school is 14.38%, while the return to education from university graduates compared to non-graduates is around 113.21% in 2008. In the same year, for the median quantile (50th quantile), the rate of returns to education of the high school level, vocational level, and university level compared to non-graduated school accounted at 66.17%, 94.14% and 113.21% for high school level, vocational level and university level, respectively.

Table 3. Quantile Regression Estimates of the Wage Equations, 2008

Indep.Var	q10	q25	q50	q75	q90
Yearos sch	0.0713	0.0754	0.0684	0.0560	0.0420
	(0.0011)***	(0.0007)***	(0.0005)***	(0.0005)***	(0.0007)***
Cohort25_45	0.1686	0.1789	0.1891	0.2011	0.2220
	(0.0117)***	(0.0074)***	(0.0054)***	(0.0052)***	(0.0077)***
Cohort46_65	0.0613	0.2526	0.2291	0.2472	0.2967
	(0.0178)***	(0.0112)***	(0.0081)***	(0.0079)***	(0.0117)***
Exper	0.0613	0.0561	0.0472	0.0382	0.0308
	(0.0012)***	(0.0008)***	(0.0006)***	(0.0005)***	(0.0008)***
Exper2	-0.0010	-0.0008	-0.0006	-0.0005	-0.0004
	(0.0000)***	(0.0000)***	(0.0000)***	(0.0000)***	(0.0000)***
Urban	0.0226	-0.0093	-0.0276	-0.0107	0.0631
	(0.0105)**	(0.0066)	(0.0048)***	(0.0047)***	(0.0069)
Industry1	0.6372	0.5752	0.5938	0.7007	0.7705
	(0.0315)***	(0.0199)***	(0.0144)***	(0.0140)***	(0.0208)***
Industry2	0.0609	-0.0596	-0.0964	-0.0957	-0.1270
	(0.0188)***	(0.0119)***	(0.0086)***	(0.0084)***	(0.0124)***
Industry3	0.3046	0.1705	0.1473	0.1992	0.2758
	(0.0612)***	(0.0386)***	(0.0280)***	(0.0272)***	(0.0403)***
Industry4	0.2877	0.1978	0.1488	0.1243	0.0341
	(0.0223)***	(0.0141)***	(0.0102)***	(0.0099)***	(0.0147)***
Industry5	0.0341	-0.0910	-0.1476	-0.1526	-0.1804
	(0.0204)*	(0.0129)***	(0.0094)***	(0.0091)***	(0.0135)***
Industry6	0.1477	0.0848	0.0616	0.1183	0.1360
	(0.0244)***	(0.0154)***	(0.0112)***	(0.0109)***	(0.0161)***
Industry7	0.2478	0.1434	0.1483	0.2577	0.3433
	(0.0309)***	(0.1434)***	(0.0142)***	(0.0138)***	(0.0204)***
Industry8	-0.1341	0.1434	-0.0302	0.0011	0.0007
	(0.0173)***	(0.0109)***	(0.0079)***	(0.0077)***	(0.0114)***
_cons	11.63420	11.8755	12.4575	12.9743	13.4636
	(0.0175)***	(0.0111)***	(0.0080)***	(0.0078)***	(0.0116)***
Pseudo R^2	0.1050	0.1550	0.2110	0.2267	0.1626
Obs.	117,836	117,836	117,836	117,836	117,836

In 2015 for the second regression, which also reported in Table 4. The gap of rate returned to education between the different levels of education persisted and shown by the extreme value of the rate among primary education (37.27%), middle education (86.96%) and tertiary education (148.51%) for a median quantile (50th quantile). This suggests that the extreme variation in wage among educational level groups may contribute to the widening wage gap among individuals. In reality, the wage of a worker with primary and middle education attainment extremely lower than the wage of a worker with tertiary education attainment. This fact supports the result findings that wage gap among primary, middle and tertiary education level is one of the sources of wage inequality in Indonesia. Wage inequality due to extreme variation in wage among the different educational level already proved. The next analysis is to demonstrate whether wage inequality persists because of variation of wage among the workers with the same level of education.

Table 4. Estimation of The Rate of Return Investment in Education Among Workers

2008	**q10**	**q25**	**q50**	**q75**	**q90**
Primarysch	0.2308	0.1851	0.1438	0.1073	0.0824
	(0.0221)***	(0.0139)***	(0.0094)***	(0.0087)***	(0.0130)***
Middlesch	0.4790	0.4321	0.3616	0.3217	0.3174
	(0.0228)***	(0.0144)***	(0.0097)***	(0.0089)***	(0.0134)***
Highsch	0.7545	0.7134	0.6617	0.6262	0.6333
	(0.0216)***	(0.0136)***	(0.0092)***	(0.0085)***	(0.0127)***
Vocation	0.9666	1.0208	0.9414	0.7839	0.7333
	(0.0270)***	(0.0170)***	(0.0115)***	(0.0106)***	(0.0159)***
Univ	1.3068	1.3220	1.1321	1.0884	1.0447
	(0.0253)***	(0.0159)***	(0.0108)***	(0.0099)***	(0.0149)***
2015	**q10**	**q25**	**q50**	**q75**	**q90**
Primarysch	0.3735	0.3523	0.3727	0.3373	0.2535
	(0.0284)***	(0.0193)***	(0.0137)***	(0.0132)***	(0.0157)***
Middlesch	0.6274	0.5860	0.5920	0.5146	0.4084
	(0.0297)***	(0.0202)***	(0.0144)***	(0.0138)***	(0.0161)***
Highsch	0.8191	0.8272	0.8696	0.7863	0.6764
	(0.0292)***	(0.1983)***	(0.0141)***	(0.0135)***	(0.0161)***
Vocation	1.0252	1.1667	1.2704	1.0736	0.9651
	(0.0365)***	(0.0247)***	(0.0176)***	(0.0169)***	(0.0201)***
Univ	1.1447	1.4691	1.4851	1.2633	1.2149
	(0.0317)***	(0.2149)***	(0.0153)***	(0.0147)***	(0.0175)***

According to Barrett et al. (1999) and Lee and Wie (2015), calculation of the difference between the rates of return investment in the education of the 90th quantile and 10th quantile. Besides that, the difference between the rates of return investment in the education of the 75th quintiles and 25th quantile is suggested to find an increase in wage

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dispersion among workers with the same educational level. Table 5 in the appendix shows that wage dispersion occurs among workers with the same level of education since the changes of the difference between the rates of return investment in the education of high quantile and low quantile are positive for the primary school, vocational school and university attainment. This result implies that among the workers with university-level attainment, wages that the workers obtain is indeed not equal among them. This fact happened because they have different skills, different job experience and importantly different in quality of bachelor graduates even though they attain university level. Furthermore, the positive signs of the changes imply that wage dispersion in the university level attainment increased from 2008 to 2015. The analysis is also the same for primary and vocational level attainment. Therefore, the positive changes of the difference between the rates of return investment in the education of high quantile and low quantile suggest that high level of education (vocational school and university) and low level of education (primary school) are likely to contribute to wage inequality in Indonesia.

Table 2 shows that the rate of return to education in 2015 is from 5.7% in the 90th quintile to 7.2% in the 25th quintiles in 2015. Table 3 presents that the rate of return to education is from 4.2% in the 90th quintile to 7.5% in the 25th quintiles in 2008. These results are lower than those in the study by Duflo (2001), which was around 6.8% to 10.6% in 1995. The declining the profitability of education may be because the expansion of the educational sector in Indonesia is much developed than the growth of jobs recruiting higher education level (Purnastuti et al., 2013). In other words, the growth of jobs vacancy for higher educational attainment is less than the growth of job seeker with a diploma or bachelor degree.

In the second regression estimates seen in Table 4, there are several analyses of the return to education estimates. Firstly, from the10th to 90th quintile estimates, the performance of education increases from primary school level to university level both in 2008 and 2015. In all quintiles of real wages, the university level, including undergraduate/D4, master's degree, and doctoral degree, obtained the highest return on education among others. Conversely, primary education, which is elementary school graduation, got the lowest return to education across all quintiles of real wage.

Secondly, in both years 2008 and 2015, the return to education of the university level is higher than the return to education of the vocational school. This result suggests that entering a university is the most beneficial human capital investment to get the highest return on its investment. Overall, the estimates of this quintile regression are the same with the hypothesis of the wage model by Mincer that workers with higher education will obtain higher salaries and better jobs rather than workers with lower educational attainment. Furthermore, to increase the rate of investment in education for vocational level, the government should evaluate curriculum, workshop & training and education facilities to improve the quality of vocational schools and their graduates. Lastly, the differences of rate return to investment in education among the different educational levels indicate that wage inequality may exist due to the factor of educational attainment gap. These results are similar to those in the study by Barrett et al. (1999) in Ireland, Tansel (2010) in Turkey and Martins and Pereira (2004) in 16 cross-countries.

Table 5. Impact of Education on Wage Dispersion

	2015		2008		Change	
	q75-q25	q90-q10	q75-q25	q90-q10	Δ(q75-q25)	Δ(q90-q10)
Yearofsch	-0.0062	-0.0004	-0.0194	-0.0292	0.0132	0.0288
Exper	-0.0034	0.0007	-0.0180	-0.0304	0.0146	0.0311
Exper2	0.0001	0.0001	0.0003	0.0007	-0.0828	-0.0005
Cohort25_45	-0.0606	-0.0685	0.0222	0.0534	-0.0828	-0.1219
Cohort46_65	-0.0613	-0.0547	-0.0054	0.2354	-0.0559	-0.2902
Urban	-0.0785	-0.0961	-0.0014	0.0404	-0.0771	-0.1365
Industry1	0.0209	0.1268	0.1254	0.1332	-0.1045	-0.0064
Industry2	0.0128	0.0949	-0.0361	-0.1879	0.0489	0.2828
Industry3	-0.1696	-0.3564	0.0287	-0.0289	-0.1983	-0.3276
Industry4	-.02400	-0.4109	-0.0735	-0.2536	-0.1665	-0.1482
Industry5	-0.0621	-0.1062	-0.0615	-0.2145	-0.0006	0.1084
Industry6	-0.1019	-0.1908	0.0336	-0.0117	-0.1355	-0.1791
Industry7	-0.0518	0.0014	0.1123	0.0955	-0.1641	-0.0941
Industry8	0.1790	0.4036	-0.1423	0.1349	0.3213	0.2688
Education Attainment						
Primarysch	-0.0151	-0.1200	-0.0777	-0.1484	0.0627	0.0283
Middlesch	0.4944	-0.2190	-0.1104	-0.1616	0.6047	-0.0574
Highsch	-0.0410	-0.1427	-0.0872	-0.1212	0.0463	-0.0214
Vocation	-0.0930	-0.0600	-0.2369	-0.2333	0.1439	0.1732
univ	-0.2058	0.0702	-0.3136	-0.2620	0.1078	0.3322

The estimated coefficient of the dummy variable for the urban area suggests that those who live in urban areas earn salaries higher than those in rural areas, which depends on the quintile of wage. Table 2 shows that for all quantile estimates, people who live in an urban area have the higher wage than people living in a rural area. For the low-income group (10th and 25th quantiles of wages), the wage of urban people is higher around 16% and 13% than the wage of rural people respectively. However, for the middle-upper-class income (50th, 75th, 95th quintile), the difference in the amount of wage between rural and urban areas is very small, accounted around 5% to 6%.

Variable of experience or job tenure also has the significant impact on the amount of wage. Specifically, the coefficient of job experience means that one additional year of working experience might increase the amount of wage from 3.8% to 4.3% in 2015 and from 3% to 6% in 2008. This result is quite similar to those in the study by Dumauli (2015), in which the coefficient of experience ranged from 1.6% to 4.6% for males and 2.3% to 5.4% for females. The coefficient of the variable of square experience is negative, which means that there are diminishing returns on job experience.

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The coefficient estimates of the cohort of age are positive and statistically significant at one percent level of significance in all quintiles. The results show that in 2015, workers aged 25–45 years old had higher wages around 16.41% to 23.47% than workers aged 15–24 years old. For the workers aged 46–65 years old, the estimates suggest that workers enjoyed real monthly wage higher around 24% than workers aged 15–24 years. Experienced workers that usually age 30 years old above have salary significantly higher than non-experienced workers. However, now the difference is not so deep because millennia workers in big cities ages 20-30 years old mostly have excellent skills, education, and creativity to work in big companies or running their owned business.

The Mincerian model improved by adding industry classification. There are 9 industry classifications: industry 1 (mining), industry 2 (manufacturing), industry 3 (electricity, gas & water), industry 4 (construction), industry 5 (trade, wholesale & retail, hotel & restaurant), industry 6 (transport, warehouse & communication), industry 7 (financing, insurance, real estate & business services), industry 8 (community, social & private service), and industry 9 (agriculture, forestry, hunting & fishery). The last category is the reference category.

According to Table 2, workers that work in industry 1 (mining) obtains significantly higher wages around 52.18% to 64.86% than labors who work in industry 9 (agriculture, forestry, hunting & fishery. Across the quintile of wages, the mining sector pays the highest salary to their workers compared to all other industries in Indonesia. The results that the mining industry offers the highest salary to their workers are similar to those in the study by Magdalin (2013) and Pirmana (2006).

Workers who worked in industry 2 (manufacturing) enjoyed wages higher around 3% to 6.6% than workers in industry 9 (agriculture, forestry, hunting & fishery) in 2015. Except for the lowest group of wages (10th quantile), the salary in industry 2 (manufacturing) was lower around 6% than the salary in industry 9 (agriculture, forestry, hunting & fishery). These findings indicate that the low level of labors in agriculture, forestry, hunting & fishery sectors obtained salary bit higher than the labors in manufacture industry. This might happened because manufacture industry in Indonesia such as textile and garment factories is the commonly labor-intensive type of low-level education.

Industry 3 (electricity, gas & water) paid salary to their workers significantly higher about 28.62% to 64.27% than industry 9 (agriculture, forestry, hunting & fishery) in 2015. In fact, most of the agriculture, forestry, hunting & fishery industries in Indonesia still use conventional technology in their business operations that notably influence their productivity and firm profit. According to the estimates, among all sector industries, the mining industry is the industry sector that offers the highest salary to their workers, while the community, social & private service industry gives the lowest pay across all quintile of wages. For the middle up wage (50th–90th quintile), industry 1 (mining), industry 3 (electricity, gas & water), industry 4 (construction) and industry 7 provide wages higher than other sector industries. For the category of low wages (10th-25th quintile), industry 1 (mining), industry 3 (electricity, gas & water) and industry 7(financing, insurance, real estate & business services) pay higher wages than other industries.

Conclusion

Several findings discussed in the paper. First, increasing wage inequality in Indonesia can trace through two channels: variation of the rate of return to education in each quantile of wage and a rise of wage dispersion within the same educational group. Second, the significant variation in the rate of return to education across wage distribution implies that there is a wide gap of wage between the low and the high quantile of wages in Indonesia. Third, the extreme variation in the rate of return to education among the workers with the different level of education gives insight that educational-attainment gap contributes to the wage inequality in Indonesia. Fourth, the increase in wage dispersion, which implies widening wage gap, also occurred among workers with the same level of education. Last, the difference between the top and bottom quantile is larger than the difference between the 75th and 25th quantile of wage, meaning that wage inequality probably takes place in the tail of wage distribution. In other words, the gap of salary between the lowest group and the highest group is huge.

The return to education in Indonesia has a positive correlation with the duration of schooling, and it increases along with the higher level of educational attainment. Quantile regression estimations suggest that sending students to pursue a bachelor's degree and a higher degree will yield the highest return on educational investment compared to the university attainment below. Also, the data from Sakernas 2011 and 2016 informed that more than a half of workers in Indonesia only graduated from a junior high school. According to these reports, the Indonesian government should increase the educational attainment of labors. This policy will reduce the wage gap between skilled and unskilled labor. As globalization developed massively, multinational companies in developing countries require many skilled labors to adapt and cope out with modern technology in the factories. The rising demand for skilled labor leads to a sharp increase in the wages of skilled labor, while the wages of unskilled labor will remain the same. Thus, if the proportion of unskilled labor is higher than skilled labor, it is highly possible that wage inequality in Indonesia may persist in the next periods.

In the light of these findings, several policy recommendations can be formulated to overcome the issue of wage inequality due to the inequality in educational attainment. First, regarding the data that in 2011 and 2016 more than a half of Indonesian workers graduated from junior high school only, the Indonesian government should extend the length of compulsory school for Indonesian children from 9 years to 12 years. This kind of policy is beneficial to enhance the level of educational attainment for Indonesian workers and to reduce wage inequality between the workers with the basic and the tertiary level of education. Second, due to the results that the wages of workers living in urban areas are higher than workers living in rural areas, the government education policy should focus on developing education infrastructures in rural areas. This will reduce the rural-urban wage gap in the following years. Last, because university level graduates earn the highest return on education, the government should create broader opportunities for the Indonesian youth to study in college by increasing the government scholarship for selected students.

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