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Labor Market Efficiency in Indonesia: An Empirical Evidence from Household Survey

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Abstract

This paper aims to measure labor markets efficiency using production frontier framework. Using Household Social and Economic Survey run by Bureau Statistical Agency, we estimate the production frontier of human capital function in determining earnings. We estimate the model since 1998 until 2014 but with missing some years of observation those are 2004, 2005, and 2011. We estimate the on the basis cross section data and we compare them to other periods applying Corrected Ordinary Least Square (COLS), Corrected Median Absolute Deviation (CMAD), and Maximum Likelihood function for Stochastic Frontier Analysis (SFA). The results shows that all input variables are strongly significant with positive sign. All three methods of estimation results consistent parameters both in terms of values and signs. The efficiency scores of labor markets in Indonesia are relatively very low but have increasing pattern every year.

Keywords: Labor Markets, Efficiency, SFA

JEL: J30, J24, J40

I. Introduction

Indonesia, in terms of its population, is the he fourth largest country in the world after China, India, and United States of America with more than 260 million people. As one of the main production factor of the economy, the role of population in the economic activity is strongly determined by the labor market performance. Solo (1969) re-examines hypothetically that when there is low wage, the optimum technology to maximize production process with available resources is labor intensive rather than capital intensive. This hypothesis is strengthened by the fact that most developing countries has huge number of population compared relatively by advanced economy. Moreover, most developing countries does not have abundant capital to support their economic development (Khatkhate, 1980). Balassa (1964) (Dj et al., 2019; Ghofur et al., 2021; Muhtarom, 2018) show that South East Asia has the largest

capital requirement among other regions in the world in 1975. The simultaneous solution to boost the economy of developing countries such as Indonesia is improving labor markets performance and increasing capital stock.

9 According to the Global Competitiveness Report 2019, published by World Economic Forum (WEF), which contains four aspects those are enabling environment, markets, human capital, and innovation ecosystem. Labor markets, as one of the components of markets aspect in global competitiveness index, has an issue with labor force size. Indonesia with the highest labor force size has the lowest labor markets performance rank among six greatest countries in South East Asian, and 85th rank from 140 countries in the world. It means that if Indonesia may improve the labor markets performance, it will highly contributed to the economic performance rank. One of the most concern regarding labor markets is returns to education which show how much labor paid based on their education, skills, or experience. This means labor markets efficiency in the context of how much return on human capital investment.

Table 1.1 South East Asian Labor Markets and Economic Competitiveness Rank

| No | Country | Competitiveness Rank | Labor Markets Rank |
|----|-------------------|----------------------|--------------------|
| 1 | Brunei Darussalam | 56 | 30 |
| 2 | Indonesia | 50 | 85 |
| 3 | Malaysia | 27 | 20 |
| 4 | Philippines | 64 | 39 |
| 5 | Singapore | 1 | 50 |
| 6 | Thailand | 40 | 46 |

Source: Global Competitiveness Report 2019, World Economic Forum

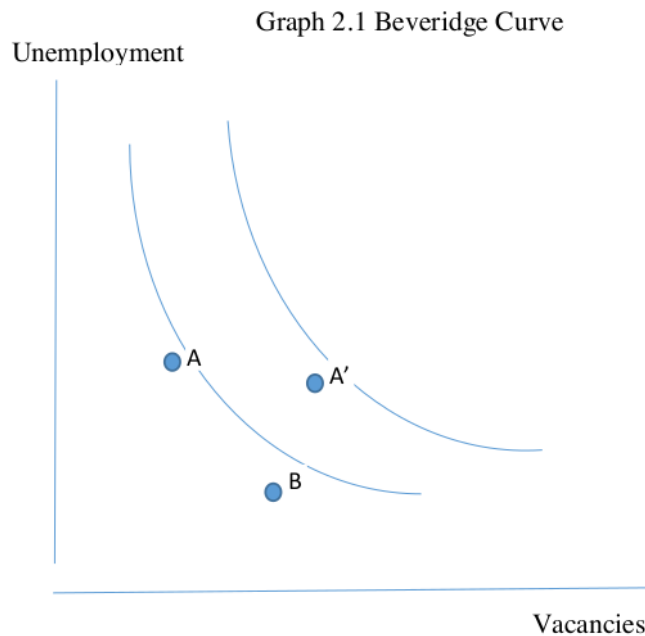
This paper investigates labor markets performance through measuring labor markets efficiency. Efficient in using human capital investment and getting the return from the labor markets is expected by labors when accepting job offer. Using National Social and Economic Household Survey in Indonesia, this paper tries to measure how efficient labor markets in Indonesia in terms of human capital investment returns from labor markets. Landeau and Contreras (2003) and Bishop et all (2007) using frontier approach of income or wage function with human capital investment to calculate technical efficiency of labor markets. If worker invests on education or skills they will expect that they can get more than what they spent.

17 The construction of this paper can structured as follows: the following part is the literature survey which describe some evidence and theoretical ideas concerning labor markets efficiency. The third part is describing data and econometric model as well as estimation

techniques. The following chapter examines the estimation results and its analytical concern, and last but not least is the concluding remarks.

II. Literature Survey

The concept of labor markets efficiency is derived from two parts. The first part is how elastic new position in responding changes in unemployment and vacancies. In other words, labor markets is efficient when the number of new hired positions accommodate the number of unemployment and vacancies. Markets is effective and response to what are provided by the markets so that the equilibrium of labor demand and supply is fulfilled at all time. This idea is developed from the Beveridge curve which graphically describe the relationship of vacancies and unemployment. The Beveridge curve can be drawn as below:



Source: Rama (2016)

Graph 2.1 shows us that shifting from point A to point A' is worsening labor market efficiency since there are more vacancies and more unemployment. On the other side, movement from point A to B is tightening without changes in efficiency of the labor markets because more vacancies and less unemployment so that more employers competitively attract workers to join with them. The way to examine the beveridge curve is matching functions. The functions connect the number of new hired workers (H), the number of job seekers (U), and the number of

current vacancies. Intuitively, H will increase when more people are actively searching for a job and when there are more vacant positions. The function of matching can be written as follows:

$$H = h(U, V) \quad (2.1)$$

h is the matching function. Some empirical evidence try to investigate this relationship such as Rama (1998), Cotti and Drewianka (2007), and Ilmakunnas and Pesola (2003).

The second part of how to understand labor markets efficiency is by using human capital investment returns which is earnings. The labor markets is the place where investment in human capital investment such as education, experience, and or skills get paid off. Labor markets is efficient when human capital investment is as workers income expected. Labor income represents the equilibrium between labor supply and labor demand so that when factors determining income changes, it will change the equilibrium income. The equilibrium point, which is equilibrium income/wage, rely on the intersection of labor demand and supply function is the labor markets efficiency. Bishop et al (2007) derived this income equilibrium as follows:

$$L_{jk}^D = \theta_1^D + \theta_2^D X_{jk} + \theta_3^D w_{jk} - \mu_{jk}^D, \mu_{jk}^D \geq 0 \quad (2.2)$$

$$L_{ji}^S = \theta_1^S + \theta_2^S X_{ji} + \theta_3^S w_{ji} - \mu_{ji}^S, \mu_{ji}^S \geq 0 \quad (2.3)$$

Where L_{jk}^D and L_{ji}^S is the number of labor demanded for firm k in labor market j and individual decision of labor supply. The term μ_{jk}^D is the inefficiency for firm looking for potential qualified workers in a certain labor markets and μ_{ji}^S represents the inability of job seeking workers to find potential employers where they can expect what they have spent in human capital as well as immobility because the labor markets is employer's monopsony. Based on that, we may conclude that inefficiency in labor markets come from demand and supply side. So that the gap between received earnings and frontier earning represents the inefficiency of labor markets. Labor market clearing can be derived into following equation for N potential job seekers and K employers:

$$\sum_{k=1}^{K_j} L_{jk}^D = \sum_{i=1}^{N_j} L_{ji}^S \quad (2.4)$$

From the equation 2.4, market clearing equilibrium wage, we can derived the reduced form of wage earning equation as follows:

$$\ln(w_i) = \alpha + \beta X_i + v_i - \mu_i \quad (2.5)$$

Where w is the natural logarithm of wage and X is the human capital factors such as education and experience. $v_i \sim N(0, \sigma_v^2)$ is normal error, and $\mu_i \geq 0$ is earning inefficiency. This paper concerns with the application of frontier model in estimating earning function since the structure of micro data in individual and household survey in Indonesia do not contain information regarding the number of new hired positions so that the most possible techniques to estimate labor market efficiency is earning function approach. Some empirical evidence applying this

approach are Landeau and Dante (2003), Bishop et all (2007), Adamchik and King (2007), Angeles Diaz and Sanchez (2011), and Bazen and Waziri (2017)

III. Methodology

3.1 Data

The data used in this study is cross sectional data from annual household and individual survey held by Indonesia Bureau Statistical Agency (Badan Pusat Statistik, BPS). The data from survey are collected from all districts and municipal in Indonesia and the data is valid at district level (Kabupaten and City) but not valid at sub districts (Kecamatan) level. It means that targeted households of the survey is randomly chosen as respondent at district and municipal level. The number of respondents is vary and it depends on population size that is normally increasing every year. In some years since 2008 until 2010 the number of sample size was significantly decreasing but since 2011 the sample size is much greater and proportionately increase.

This study covers from 1998 until 2014 with some missing data for some years those are 2004, 2005, and 2011. Micro data of household survey since 2015 until 2017 does not provide the details of income composition and also the total income so that welfare is measured by spending composition. The raw data from the survey are needed to be clean by eliminating some respondents which are not consistent in answering the survey questions. This study choose respondents who are in the productive age, categorized by BPS, which is 15 until 64 years old. Any respondents who are not in this age range will be excluded. The details of descriptive statistics of the variables are presented in appendix.

3.2 Econometric Model

This paper use comparison three estimation techniques for earning function or individual workers which are Corrected Ordinary Least Square (COLS), Corrected Mean Absolute Deviation (CMAD), and Frontier Models with maximum likelihood estimation. We presents those three methods to compare the efficiency measure among the techniques. The basic model used in this model can be written as follows:

$$\ln y_i = \ln y_i^* - \mu_i, \quad \mu_i \geq 0 \quad (3.1)$$

$$\ln y_i^* = f(x_i; \beta) + v_i \quad (3.2)$$

Where the subscript i represents individual workers observed. y_i is the scalar of earnings, x_i is the vector of input variables and in this case are highest education attained which is ranged from 0 to 6 which is 0 is no formal education certificate and 6 is bachelor's degree or higher, age, age², and some dummy variables such as gender which is 1 for male, 0 otherwise, working location (Loc) which is 1 for urban and 0 otherwise, and working economic sector (sector) which is 1 for agriculture sector and 0 otherwise, β is a $J \times 1$ vector of the corresponding coefficient vector of input variables, and v_i is a zero mean random error and $\mu_i \geq 0$ is labor markets inefficiency. Given input variables, the frontier function gives the maximum possible level of

earnings and it is stochastic because of v_i . So that the equation 3.1 empirically can be re written as:

$$\ln(\text{earnings}_i) = \alpha + \beta_1 \text{Educ}_i + \beta_2 \text{Age}_i + \beta_3 \text{Age}_i^2 + \beta_4 \text{Gender}_i + \beta_5 \text{Loc}_i + \beta_6 \text{Sector}_i + \mu_i \quad (3.3)$$

When we used COLS method, the equation 3.2 must be changed into:

$$\ln y_i^* = f(x_i; \beta) \quad (3.4)$$

What we miss in the equation 3.4 is the v_i random error which is not allowed in COLS and therefore the equation 3.4 is non stochastic. If we take out the intercept from 3.4, the equation may be written as follows:

$$\ln y_i = \beta_0 + \tilde{x}_i' \tilde{\beta} - \mu_i \quad (3.5)$$

Kumbhakar, Wang, and Horncastle (2015) give explanation COLS estimation step as written bellows:

1. Running frontier equation by using OLS technique and having this:

$$\ln y_i = \hat{\beta}_0 + x_i' \hat{\beta} + \hat{e} \quad (3.6)$$

Where \hat{e} are the OLS error terms. Since $E(\mu_i) \neq 0$, $\hat{\beta}_0$ generated from equation 3.6 is biased estimate of β_0 in 3.5. Even though, $\hat{\beta}$ is consistent estimate of $\tilde{\beta}$ in 3.5. so that OLS estimation for equation 3.5 generates consistent coefficients but biased intercept. At this stage we can get zero mean OLS regression residuals \hat{e}_i that can be derived as:

$$\hat{e}_i = \ln y_i - [\hat{\beta}_0 + \tilde{x}_i' \hat{\beta}] \quad (3.7)$$

From equation 3.7, the value of \hat{e}_i can be higher, equal, or less than 0.

2. The second stage of COLS is to adjust upward the intercept by the maximum value of $\max\{\hat{e}_i\}$ as consequences, the function bounds observation from above and then the error terms becomes:

$$\hat{e}_i - \max\{\hat{e}_i\} = \ln y_i - \left[\hat{\beta}_0 + \max\{\hat{e}_i\} + \tilde{x}_i' \hat{\beta} \right] \leq 0 \quad (3.8)$$

And

$$\hat{\mu}_i \equiv -(\hat{e}_i - \max\{\hat{e}_i\}) \geq 0 \quad (3.9)$$

Where $\hat{\mu}_i$ in equation 3.9 is the predicted inefficiency for model 3.5. Technical efficiency of individual workers is can be measured by $\hat{TE} = \exp(-\mu_i)$

The second alternative used in this study is CMAD which is OLS regression that use mean or median absolute deviation (MAD) regression. By applying the same procedure as the COLS we can measure technical efficiency produced by MAD regression. COLS and CMAD is different in terms of estimation process where COLS regression use the average or mean of the data while CMAD use median as the passed through points.

The third method used in this paper is frontier model with maximum likelihood estimation. The model 3.5 assumes that inefficiency has distribution that is needed to estimate the model. There is half normal distribution proposed by Aigner, Lovell, and Schmidt (1977), Meeusen and van den Broeck (1977) argue there is exponential distribution, Truncated normal distribution that is proposed by Stevenson (1980), and the last but not least is Greene (1980a, b, 2003). Belotti, et al (2013) argues that distributional assumption needed for the identification of value of inefficiency term implies that the model is commonly suitable with maximum likelihood. Moreover, stochastic frontier model is conducted in two steps. The first is estimates the model coefficients $\hat{\theta}$ are generated by maximizing the log likelihood function $\lambda(\theta)$, where $\theta = (\alpha, \beta', \sigma_u^2, \sigma_v^2)$. The next step, the efficiency can be calculated through the mean of conditional distribution $f(u_i | \hat{\varepsilon}_i)$, where $\hat{\varepsilon}_i = y_i - \hat{\alpha} - x_i' \hat{\beta}$.

IV. Results

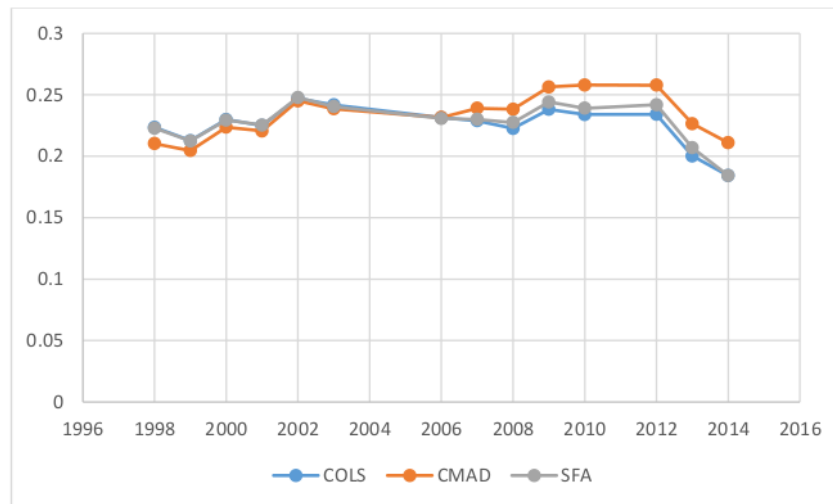
4.1 Regression Results

Estimation results of the production frontier model with earning as the output the human capital investment from the model 3.3 shows that all variables are statistically significant and the signs are as expected. The contribution of education as the most important issue in this discussion can be seen on the Graph 4.1. Since 1998 the role of education level in generating earnings does not have trend or moves near the average value which is 0.225 for COLS, 0.233 for CMAD, and 0.227 for Stochastic Frontier with maximum likelihood estimation. CMAD model has slightly higher predicted coefficient than other two methods. The coefficient means that increasing a level on education will increase 0.2 more percent of earnings. Off course the average contribution will different on each education level but we may say that the generally the trend is relatively constant. If we look at the graph, SFA line coincides with CMAD but COLS has higher fluctuation that other two method. The estimation considers high heteroskedasticity since cross sectional data with high range of characteristics may rise probability of of being non constant variace of error term of the estimation. Robust standard error to check and dealing with heteroskedasticity.

The contribution of education level variable has diminishing after 2012 as we look at the three lines of coefficients. According to Badan Pusat Statistik (BPS) since 2013 to 2014, the changes of nominal wage in percent had been decreasing this made the contribution of education factors to predict wages lower since there may be other factors forces income to change lower, minimum wage policy, production activity, and macroeconomic condition that was slowing

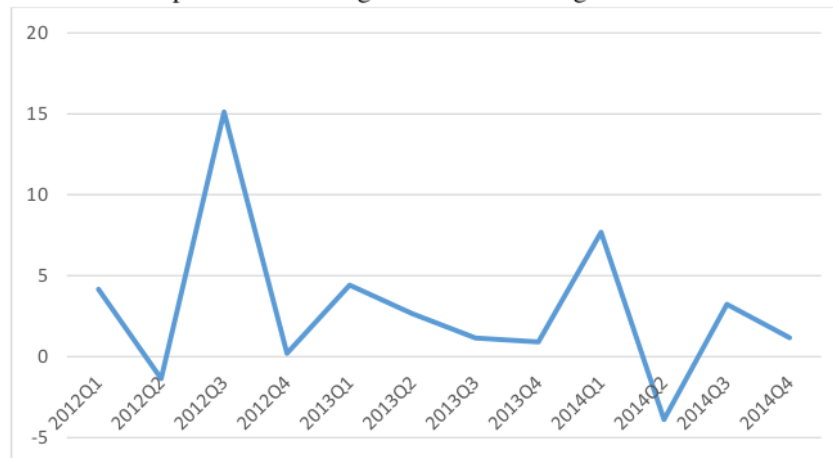
down can be some determining wage. Graph 4.2 show us the slowing down the percentage of changes in nominal wage drastically in 4th quater 2012 and remains contant ans lower after that.

Graph 4.1 Education Coefficients per Year



Source: Author's Calculation

Graph 4.2 The Changes in Nominal Wage 2012-2014

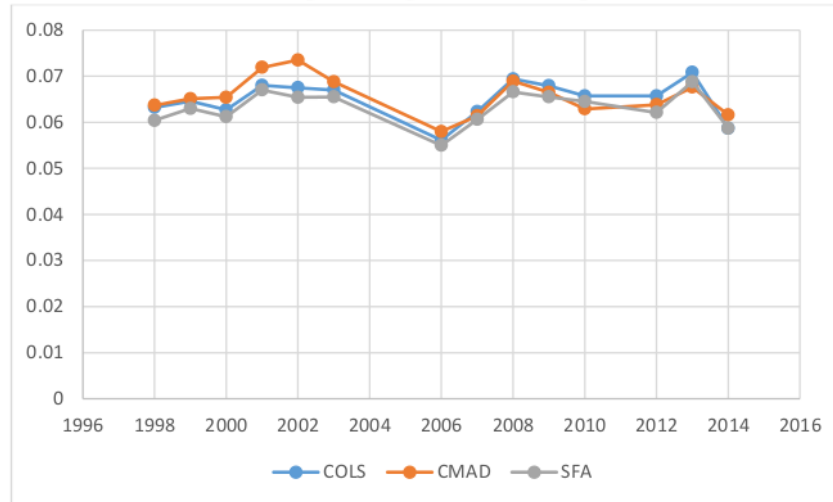


Source: Author's Calculation

The second input variable is age. Age represents physical capacity, emotional maturity, and also working experience. In equation 3.3, this variable is written in single and quadratic form since there is nonlinearity theoretically between earnings and age. Luong and Hebert (2009) uses more power on their model by using cubed and the fourth power of age variable in the model determining earnings. Age and Age² are strongly statistically significant at 1 percent level and

relatively constant at all observed year according to Graph 4.3. The coefficients of Age2 are all negative as its theory expected meaning that at a certain point age has negative effect on additional income of workers. Deelan and Euwals (2014) shows that at some points the age can still be positive in older age but depend on the working contract which sometimes allow older worker get higher payment. If we calculate the maximum point of the regression results we find the premium age, where workers get highest earnings range from 42-53 years.

Graph 4.3 Age Coefficients per Year



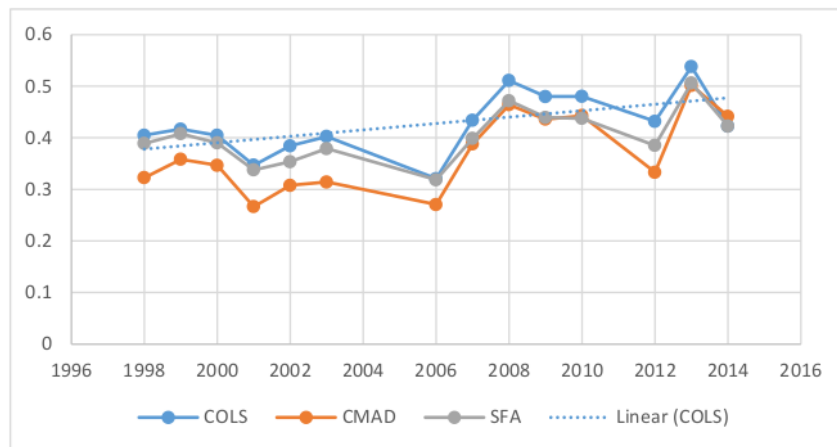
Source: Author's Calculation

Other variables in the models are dummy variables which are also statistically significant at all three models. Gender earnings gap is an arguing issue where there is different treatment between male and female workers. Abundant papers provide empirical evidence on gender earning gap and most of them argue that there is a gap on earnings between male and female workers. Graph 4.4 shows that there is not only statistically significant but the trend is positive meaning that the gender gap is increasing. Since 1998, the increase of gender gap in 2014 is 4,37 percent based COLS estimation, 36,8 percent for CMAD, and 8,63 percent for SFA model. Nopo, Daza, and Ramos (2011) find gender gap earnings range between 8 until 48 percent in 64 countries that in some regions such as South Asia and Sub Saharan Africa. Hypothetically, male workers more productive on strong physical type of jobs. Based on Graph 4.4, gender earning gap in Indonesia range between 0.4 until 0.5 percent meaning that male workers 0.4 or 0.5 percent higher than female workers.

Another dummy variable is location which describe working place area those are urban and rural area. Based on the Graph 4.5 the wage gap of urban and rural is going higher. Urban

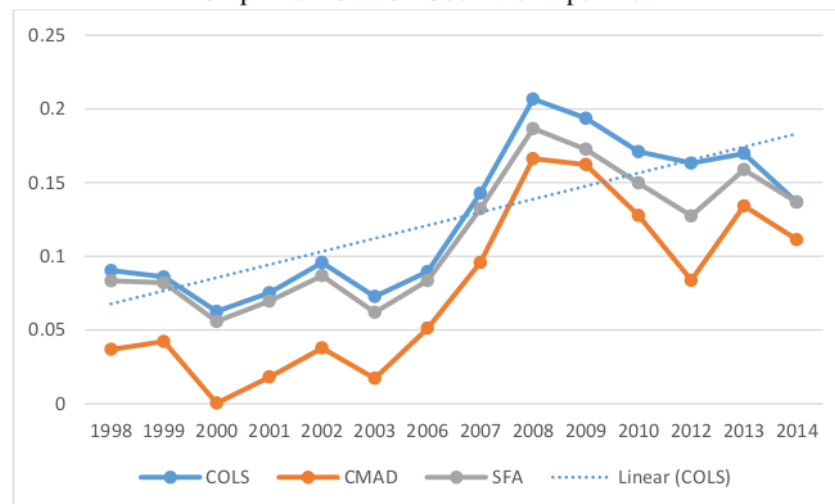
area is built from modern economic activity and most of them has higher mobility and speed of transaction since modern sector is elastic to the market demand. This is true when there is structural changes from traditional to modern economy. Modern economy, such as trade, services, manufacturing, and infrastructure, provides more flexible to response changes in markets and higher value added of production so that wage is relatively higher. This is closely connected with the Graph 4.6 showing us that traditional sector (agriculture) is paid lower than modern sector.

Graph 4.4 Gender Coefficient per Year



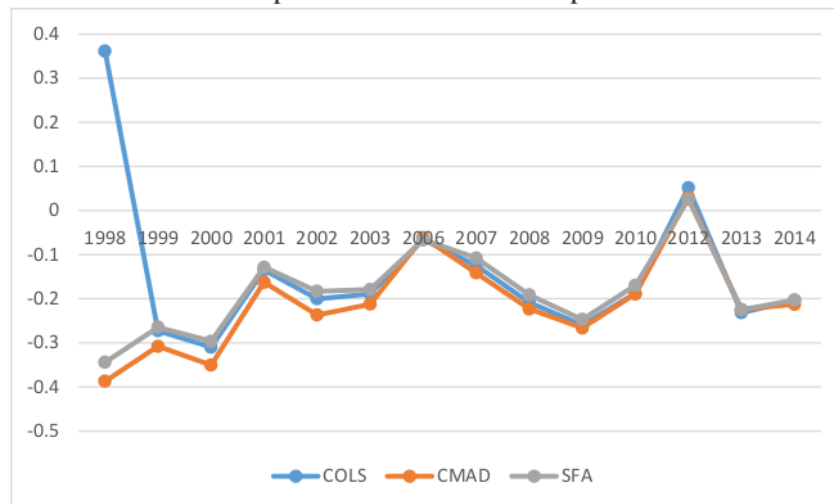
Source: Author's Calculation

Graph 4.5 Location Coefficients per Year



Source: Author's Calculation

Graph 4.6 Sector Coefficients per Year

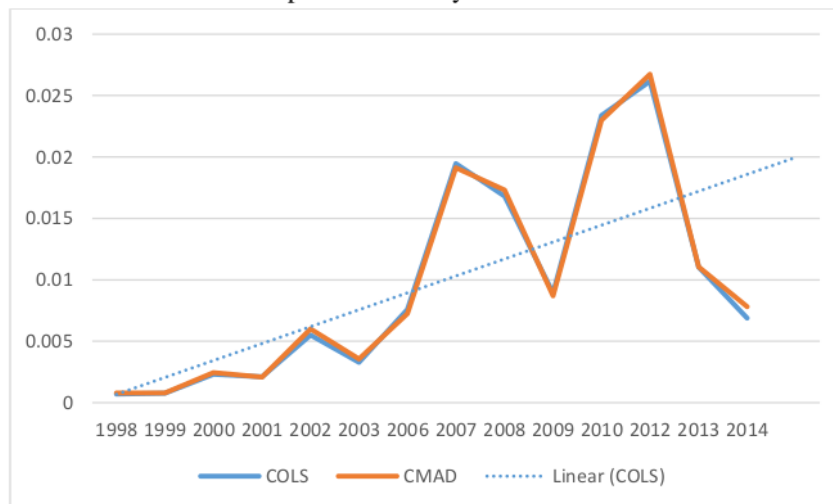


Source: Author's Calculation

4.2 Labor Markets Efficiency

The efficiency in labor markets are calculated using equation 3.5 and the value range from 0 to 1. The closer to 1 is the more efficient. Based on the calculation from regression results the efficiency score is relatively very small. The mean of technical efficiencies is less than 1 percent and maximum value is 1 or 100 percent. The difference between the two methods is only 1.29 percent. Nevertheless, the efficiency score is increasing significantly since 1998, the trend line has positive slope.

Graph 4.7 Efficiency Score Trend



Source: Author's Calculation

Labor markets efficiency means that the efficiency of human capital investment to generate future income so that the low score show us the low of relative return of the investment. Simulation data during estimation of the three techniques has also been done but the results is still not statistically different. Changing variables such as years of schooling, and working experience as the input variables instead of level of highest education attained and age results in the similar efficiency score which is very low.

Table 4.1 Labor Markets Efficiency Score

| Tahun | COLS | | | CMAD | | |
|-------|----------|----------|-----|----------|----------|-----|
| | Mean | Min | Max | Mean | Min | Max |
| 1998 | 0.000711 | 2.35E-07 | 1 | 0.000786 | 2.64E-07 | 1 |
| 1999 | 0.000767 | 5.11E-07 | 1 | 0.000793 | 5.54E-07 | 1 |
| 2000 | 0.002311 | 1.34E-05 | 1 | 0.002436 | 1.51E-05 | 1 |
| 2001 | 0.002098 | 2.62E-08 | 1 | 0.002077 | 2.75E-08 | 1 |
| 2002 | 0.005507 | 0.00003 | 1 | 0.006008 | 3.34E-05 | 1 |
| 2003 | 0.003285 | 2.67E-05 | 1 | 0.003561 | 2.98E-05 | 1 |
| 2006 | 0.007592 | 0.000153 | 1 | 0.007254 | 0.000146 | 1 |
| 2007 | 0.019454 | 0.000368 | 1 | 0.019121 | 0.000361 | 1 |
| 2008 | 0.01681 | 7.32E-05 | 1 | 0.017298 | 7.44E-05 | 1 |
| 2009 | 0.008916 | 3.87E-05 | 1 | 0.008699 | 3.68E-05 | 1 |
| 2010 | 0.02337 | 0.000239 | 1 | 0.023004 | 0.000225 | 1 |
| 2012 | 0.026165 | 0.000129 | 1 | 0.02673 | 0.000133 | 1 |
| 2013 | 0.011025 | 0.000117 | 1 | 0.011061 | 0.000106 | 1 |
| 2014 | 0.006881 | 3.72E-05 | 1 | 0.007811 | 4.31E-05 | 1 |

Source: Author's Calculation

V. Conclusion

This paper aims to measure the efficiency score of labor markets using the human capital investment return using production frontier function to estimate individual labor markets efficiency score from Indonesia household social and economic survey. The results in efficiency score of labor markets efficiency in Indonesia has relatively very low compared to other previous studies. This is supported by that Indonesia very low rank on labor markets performance according to global competitiveness report. Applying three method of estimation for production function of human capital investment those are COLS, CMAD, and maximum likelihood (SFA) results in similar score of efficiency so that the results is robust regarding the efficiency score and parameters of estimation. The coefficients of estimation performs excellent in by strongly determining the earnings variable.

There are three issues that can be followed up other studies about the efficiency of labor markets in Indonesia, there are the gender earning gap is increasing since 1998 so that to find out more deeply what drives this situation would valuable for the discussion concerning labor

markets and gender study. The second issue is that there is location gap earnings which is between urban and rural area which can generate inequality in the whole economy, this may be interesting to be investigated its connection with urbanization, and income inequality. The third issue is about what are the determinants of efficiency score in Indonesian labor markets. Nevertheless, the efficiency score is consistently increasing since 1998. There are some points of slowing down but the trend is positive. Since labor markets performance is the only way of population in the a country contributing to the its economic development, improvement of labor markets through some instruments bot demand and supply side must be implemented in order to optimize the role of human capital in the development process.

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Appendix 1: Descriptive Statistics: Location

| Year | Location | Freq. | Percent | Total Obs. |
|------|----------|---------|---------|------------|
| 1998 | Rural | 50,265 | 45.41 | 110,691 |
| | Urban | 60,426 | 54.59 | |
| 1999 | Rural | 54,300 | 50.06 | 108,462 |
| | Urban | 54,162 | 49.94 | |
| 2000 | Rural | 44,946 | 42.27 | 106,332 |
| | Urban | 61,386 | 57.73 | |
| 2001 | Rural | 36,586 | 35.58 | 102,820 |
| | Urban | 66,234 | 64.42 | |
| 2002 | Rural | 35,417 | 32.75 | 108,141 |
| | Urban | 72,724 | 67.25 | |
| 2003 | Rural | 35,834 | 34.47 | 103,961 |
| | Urban | 68,127 | 65.53 | |
| 2006 | Rural | 49,844 | 39.45 | 126,356 |
| | Urban | 76,512 | 60.55 | |
| 2007 | Rural | 136,663 | 50.33 | 271,510 |
| | Urban | 134,847 | 49.67 | |
| 2008 | Rural | 31,500 | 47.15 | 66,806 |
| | Urban | 35,306 | 52.85 | |
| 2009 | Rural | 30,872 | 46.47 | 66,428 |
| | Urban | 35,556 | 53.53 | |
| 2010 | Rural | 31,163 | 47.19 | 66,042 |
| | Urban | 34,879 | 52.81 | |
| 2012 | Rural | 60,239 | 36.18 | 166,512 |
| | Urban | 106,273 | 63.82 | |
| 2013 | Rural | 176,039 | 51.15 | 344,183 |
| | Urban | 168,144 | 48.85 | |
| 2014 | Rural | 235,024 | 54.46 | 431,536 |
| | Urban | 196,512 | 45.54 | |

Appendix 2 Descriptive Statistics: Gender

| Year | Gender | Freq. | Percent | Total Obs. |
|------|--------|---------|---------|------------|
| 1998 | Male | 77,677 | 70.17 | 110,691 |
| | Female | 33,014 | 29.83 | |
| 1999 | Male | 75,432 | 69.55 | 108,462 |
| | Female | 33,030 | 30.45 | |
| 2000 | Male | 72,764 | 68.43 | 106,332 |
| | Female | 33,568 | 31.57 | |
| 2001 | Male | 72,288 | 70.31 | 102,820 |
| | Female | 30,532 | 29.69 | |
| 2002 | Male | 75,264 | 69.60 | 108,141 |
| | Female | 32,877 | 30.40 | |
| 2003 | Male | 72,504 | 69.74 | 103,961 |
| | Female | 31,457 | 30.26 | |
| 2006 | Male | 87,232 | 69.04 | 126,356 |
| | Female | 39,124 | 30.96 | |
| 2007 | Male | 187,701 | 69.13 | 271,510 |
| | Female | 83,809 | 30.87 | |
| 2008 | Male | 44,545 | 66.68 | 66,806 |
| | Female | 22,261 | 33.32 | |
| 2009 | Male | 43,941 | 66.15 | 66,428 |
| | Female | 22,487 | 33.85 | |
| 2010 | Male | 43,693 | 66.16 | 66,042 |
| | Female | 22,349 | 33.84 | |
| 2012 | Male | 109,919 | 66.01 | 166,512 |
| | Female | 56,593 | 33.99 | |
| 2013 | Male | 231,458 | 67.25 | 344,183 |
| | Female | 112,725 | 32.75 | |
| 2014 | Male | 282,090 | 65.37 | 431,536 |
| | Female | 149,446 | 34.63 | |

Appendix 3 Descriptive Statistics: Education

| 1998 | education | Freq. | Percent |
|-------------|---------------------------|--------------|----------------|
| 0 | No School | 14,506 | 13.10 |
| 1 | Elementary Level | 28,694 | 25.92 |
| 2 | Junior High School | 15,648 | 14.14 |
| 3 | Senior High School | 38,105 | 34.42 |
| 4 | One to Three Year Diploma | 6,557 | 5.92 |
| 5 | Undergraduate Degree | 6,894 | 6.23 |
| 6 | POSTGRADUTE LEVEL | 287 | 0.26 |

| 1999 | education | Freq. | Percent |
|-------------|---------------------------|--------------|----------------|
| 0 | No School | 15,719 | 14.49 |
| 1 | Elementary Level | 29,183 | 26.91 |
| 2 | Junior High School | 15,402 | 14.20 |
| 3 | Senior High School | 35,121 | 32.38 |
| 4 | One to Three Year Diploma | 6,289 | 5.80 |
| 5 | Undergraduate Degree | 6,453 | 5.95 |
| 6 | POSTGRADUTE LEVEL | 295 | 0.27 |

| 2000 | education | Freq. | Percent |
|-------------|---------------------------|--------------|----------------|
| 0 | No School | 18,340 | 17.25 |
| 1 | Elementary Level | 25,868 | 24.33 |
| 2 | Junior High School | 15,243 | 14.34 |
| 3 | Senior High School | 34,349 | 32.30 |
| 4 | One to Three Year Diploma | 5,632 | 5.30 |
| 5 | Undergraduate Degree | 6,679 | 6.28 |
| 6 | POSTGRADUTE LEVEL | 221 | 0.21 |

| 2001 | education | Freq. | Percent |
|-------------|---------------------------|--------------|----------------|
| 0 | No School | 10,014 | 9.74 |
| 1 | Elementary Level | 23,639 | 22.99 |
| 2 | Junior High School | 16,465 | 16.01 |
| 3 | Senior High School | 37,597 | 36.57 |
| 4 | One to Three Year Diploma | 6,908 | 6.72 |
| 5 | Undergraduate Degree | 7,826 | 7.61 |

| | | | |
|---|-------------------|-----|------|
| 6 | POSTGRADUTE LEVEL | 371 | 0.36 |
|---|-------------------|-----|------|

| 2002 | education | Freq. | Percent |
|-------------|---------------------------|--------------|----------------|
| 0 | No School | 9,383 | 8.68 |
| 1 | Elementary Level | 24,443 | 22.60 |
| 2 | Junior High School | 17,571 | 16.25 |
| 3 | Senior High School | 38,882 | 35.95 |
| 4 | One to Three Year Diploma | 8,291 | 7.67 |
| 5 | Undergraduate Degree | 9,094 | 8.41 |
| 6 | POSTGRADUTE LEVEL | 477 | 0.44 |

| 2003 | education | Freq. | Percent |
|-------------|---------------------------|--------------|----------------|
| 0 | No School | 10,505 | 10.10 |
| 1 | Elementary Level | 21,479 | 20.66 |
| 2 | Junior High School | 16,746 | 16.11 |
| 3 | Senior High School | 39,142 | 37.65 |
| 4 | One to Three Year Diploma | 7,281 | 7.00 |
| 5 | Undergraduate Degree | 8,389 | 8.07 |
| 6 | POSTGRADUTE LEVEL | 419 | 0.40 |

| 2006 | education | Freq. | Percent |
|-------------|---------------------------|--------------|----------------|
| 0 | No School | 9,937 | 7.86 |
| 1 | Elementary Level | 24,479 | 19.37 |
| 2 | Junior High School | 20,378 | 16.13 |
| 3 | Senior High School | 46,912 | 37.13 |
| 4 | One to Three Year Diploma | 10,197 | 8.07 |
| 5 | Undergraduate Degree | 13,595 | 10.76 |
| 6 | POSTGRADUTE LEVEL | 858 | 0.68 |

| 2007 | education | Freq. | Percent |
|-------------|---------------------------|--------------|----------------|
| 0 | No School | 37,232 | 13.71 |
| 1 | Elementary Level | 75,208 | 27.70 |
| 2 | Junior High School | 48,417 | 17.83 |
| 3 | Senior High School | 76,574 | 28.20 |
| 4 | One to Three Year Diploma | 13,256 | 4.88 |
| 5 | Undergraduate Degree | 19,518 | 7.19 |
| 6 | POSTGRADUTE LEVEL | 1,305 | 0.48 |

| 2008 | education | Freq. | Percent |
|-------------|---------------------------|--------------|----------------|
| 0 | No School | 11,215 | 16.79 |
| 1 | Elementary Level | 17,452 | 26.12 |
| 2 | Junior High School | 11,158 | 16.70 |
| 3 | Senior High School | 18,889 | 28.27 |
| 4 | One to Three Year Diploma | 3,118 | 4.67 |
| 5 | Undergraduate Degree | 4,657 | 6.97 |
| 6 | POSTGRADUTE LEVEL | 317 | 0.47 |

| 2009 | education | Freq. | Percent |
|-------------|---------------------------|--------------|----------------|
| 0 | No School | 10,630 | 16.00 |
| 1 | Elementary Level | 17,393 | 26.18 |
| 2 | Junior High School | 10,940 | 16.47 |
| 3 | Senior High School | 18,951 | 28.53 |
| 4 | One to Three Year Diploma | 3,153 | 4.75 |
| 5 | Undergraduate Degree | 4,994 | 7.52 |
| 6 | POSTGRADUTE LEVEL | 367 | 0.55 |

| 2010 | education | Freq. | Percent |
|-------------|---------------------------|--------------|----------------|
| 0 | No School | 10,195 | 15.44 |
| 1 | Elementary Level | 17,111 | 25.91 |
| 2 | Junior High School | 10,955 | 16.59 |
| 3 | Senior High School | 19,294 | 29.21 |
| 4 | One to Three Year Diploma | 2,985 | 4.52 |
| 5 | Undergraduate Degree | 5,163 | 7.82 |
| 6 | POSTGRADUTE LEVEL | 339 | 0.51 |

| 2012 | education | Freq. | Percent |
|-------------|---------------------------|--------------|----------------|
| 0 | No School | 11,584 | 6.96 |
| 1 | Elementary Level | 28,738 | 17.26 |
| 2 | Junior High School | 25,036 | 15.04 |
| 3 | Senior High School | 61,002 | 36.64 |
| 4 | One to Three Year Diploma | 11,204 | 6.73 |
| 5 | Undergraduate Degree | 26,584 | 15.97 |
| 6 | POSTGRADUTE LEVEL | 2,364 | 1.42 |

| 2013 | education | Freq. | Percent |
|-------------|------------------|--------------|----------------|
| 0 | No School | 51,961 | 15.10 |

| | | | |
|---|---------------------------|--------|-------|
| 1 | Elementary Level | 94,965 | 27.59 |
| 2 | Junior High School | 58,099 | 16.88 |
| 3 | Senior High School | 96,573 | 28.06 |
| 4 | One to Three Year Diploma | 11,562 | 3.36 |
| 5 | Undergraduate Degree | 28,335 | 8.23 |
| 6 | POSTGRADUTE LEVEL | 2,688 | 0.78 |

| 2014 | education | Freq. | Percent |
|------|---------------------------|---------|---------|
| 0 | No School | 70,074 | 16.24 |
| 1 | Elementary Level | 123,266 | 28.56 |
| 2 | Junior High School | 74,969 | 17.37 |
| 3 | Senior High School | 115,707 | 26.81 |
| 4 | One to Three Year Diploma | 12,196 | 2.83 |
| 5 | Undergraduate Degree | 32,260 | 7.48 |
| 6 | POSTGRADUTE LEVEL | 3,064 | 0.71 |

Appendix 4 Descriptive Statistics:

4a. Earnings

| Year | Mean | Std. Dev. | Obs |
|------|----------|-----------|---------|
| 1998 | 307427.8 | 1515903 | 110,691 |
| 1999 | 399859.1 | 2292654 | 108,462 |
| 2000 | 427689.9 | 1322024 | 106,332 |
| 2001 | 653792.5 | 2449312 | 102,820 |
| 2002 | 711572.6 | 1329021 | 108,141 |
| 2003 | 785435.8 | 1343246 | 103,961 |
| 2006 | 1028049 | 1484487 | 126,356 |
| 2007 | 933572.2 | 928658.6 | 271,510 |
| 2008 | 1017229 | 1186823 | 66,806 |
| 2009 | 1073952 | 1211722 | 66,428 |
| 2010 | 1172768 | 1263465 | 66,042 |
| 2012 | 1825145 | 2020156 | 166,512 |
| 2013 | 1678683 | 2195270 | 343,994 |
| 2014 | 1680803 | 2316581 | 431,536 |

4b. Age

| Year | Mean | Std. Dev. | Obs |
|------|----------|-----------|---------|
| 1998 | 33.73305 | 11.21139 | 110,691 |
| 1999 | 34.0672 | 11.38109 | 108,462 |
| 2000 | 34.74698 | 11.85775 | 106,332 |
| 2001 | 33.45297 | 10.94877 | 102,820 |
| 2002 | 33.88162 | 11.05321 | 108,141 |
| 2003 | 34.45443 | 11.17422 | 103,961 |
| 2006 | 34.405 | 11.04295 | 126,356 |
| 2007 | 36.51533 | 12.39844 | 271,510 |
| 2008 | 36.04976 | 12.19955 | 66,806 |
| 2009 | 36.87008 | 12.33272 | 66,428 |
| 2010 | 37.47066 | 12.41986 | 66,042 |
| 2012 | 35.64442 | 11.36564 | 166,512 |
| 2013 | 39.71645 | 12.97937 | 343,994 |
| 2014 | 40.27869 | 13.22694 | 431,536 |

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PAGE 3

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PAGE 6

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PAGE 8

PAGE 9

PAGE 10

PAGE 11

PAGE 12

PAGE 13

PAGE 14

PAGE 15

PAGE 16

PAGE 17

PAGE 18

PAGE 19

