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Impact of Human Resource Investment on Labor Productivity in Indonesia

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Abstract

This study examines the impact of human capital on productivity of labor in Indonesia, using the ARDL analysis data method. This study uses the variable of human capital with a proxy level of labor education, the health status of labor and labor productivity. The data used are sourced from World Bank publications in the period of 1981-2014. The outputs of the analysis with the method of ARDL show that the short-run analyses of primary, secondary, tertiary education variables and health variables have a significant positive impact on labor productivity. In contrast, the long-run analysis including only primary and secondary educations showed a significant positive influence on labor productivity while tertiary education variables have a significant negative effect. The labors' health variable has a positive but not significant effect. This shows that the quality of human capital in Indonesia is still a problem for labor productivity.

Keywords

Human capital, Education, Health, Labor productivity, ARDL.

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Introduction

Human capital is a never-exhausted issue experienced by all developing countries, including Indonesia. As a country, developing Indonesia requires an adequate quality of human resources; of course, human resources that are skillful and ready to welcome development need standards. If human resources are well-managed, Indonesia will become a country full of qualified labor. However, if not, Indonesia has to bear a population burden. High-quality labor will increase labor productivity and to have a high productivity, workers should have high skills and knowledge along with healthy physical and mental conditions (Schultz, 1961; Becker, 1962).

The important factors of human capital include education and health conditions. Many economists present the results of their research on human capital that said human capital is the key to a nation's economic accretion and it is even the key to the success of the development. Two aspects of human capital that are often discussed are the education and health quality. In the view of contemporary economists such as Schultz (1961), Becker (1965) and Uzawa (1965), education and health are important aspects in developing human resources.

According to the economists above, two things encourage the workforce to have high productivity. The first is qualified education and skills. The second is good physical and mental health of workers, which is very influential on the performance of workers in carrying out work tasks. The good conditions of workers' health make productivity increase. In addition, workers who are equipped with high education and skills and have good physical health will easily adapt to new technologies, compared to workers who are low educated and physically unwell. High productivity will have an impact on wages gained by workers to fulfill their personal and family welfare.

In table 1, the income of workers in Indonesia illustrates the productivity of workers in Indonesia. This data comes from the publication of the Indonesian Central Bureau of Statistics (BPS). Data are classified according to the level of education that matches the definition of the World Bank, namely primary, secondary and tertiary. The primary definition in the Indonesian context is also called 9-year basic education (Elementary School/SD and Middle School/SMP). The secondary level is high school (SMA) or equivalents such as Madrasas, vocational schools

or public schools. The tertiary level is university or equivalents such as a diploma or graduate. The data does not mention the classification of secondary or high education whether it is vocational or not.

Table 1. Average hourly wage of a worker in different education groups

Education Group	Average hourly wages (Rupiah)	
	Year	
	2015	2016
<=Elementary School	8,662.10	8,198.60
Junior High School	7,663.97	9,256.70
Senior High School	10,849.48	13,441.84
Graduate	21,574.08	25,073.97

Source: Central Bereau of Statistics, Indonesia, 2018

Table 1 provides a simplistic explanation that the hourly average income of workers in Indonesia is still categorized as low compared to the minimum wage of neighboring countries such as Malaysia, which has a minimum wage of 4.2 million rupiahs, equivalent to RM 1200, even the Philippines at 3.8 million pesos, equivalent to US $ 256.

Indonesia strives to develop the human resources' quality continuously by investing in education and health, and continues to focus and be consistent in meeting the basic needs of its people such as adjusting the costs of education and health to be more affordable to its people. In addition, the Indonesian government has also made efforts to improve the welfare of its people through social service investments. The Figure 1 below shows the government's budget allocation for education, health, social protection, and housing and public facilities.

Conditions of the Indonesian Education Sector

In Indonesia, the education investment policy as human capital investment can be seen as far as the implementation of the mandate of the 1945-Constitution's fourth amendment, which mandates that the education budget must be 20% of the state budget. This is to see the commitment of the Indonesian government to provide quality education. Figure 2 can be examined as a comparison of the Government of Indonesia's expenditure on education, compared to the total state budget.

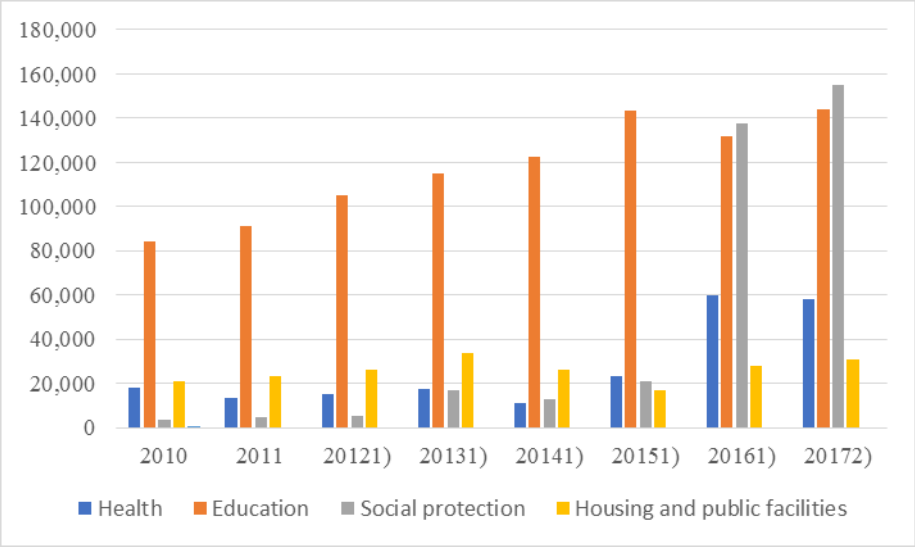

Fig. 1. Central government expenditures by function (billion rupiahs), 2010-2017
Note: 1). Government Goods / Services Procurement Policy Agency (LKPP) 2). (State Expenditure Budget – amendment (APBN-P)
Source : Financial Ministry of the Republic of Indonesia, 2018

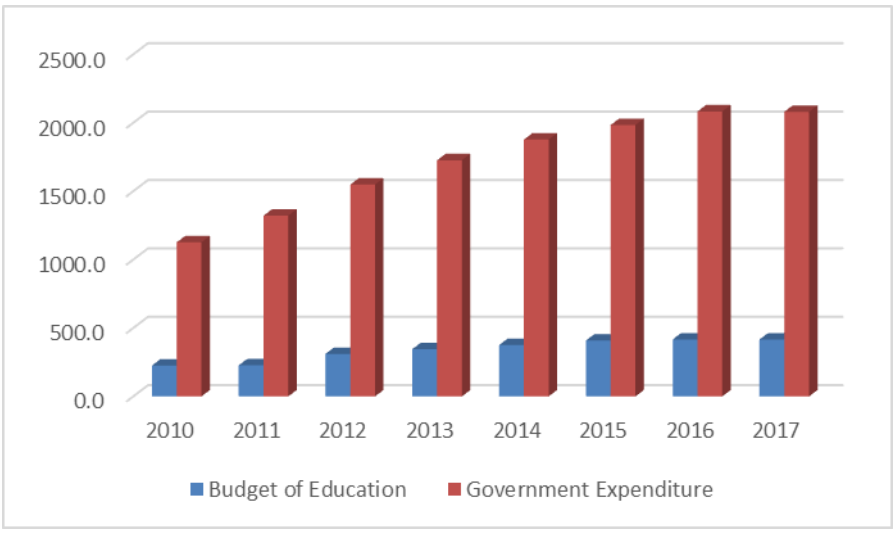

Fig. 2. Expenditure on education by trillion rupiahs total government expenditure in Indonesia
Source: Ministry of Finance, Republic of Indonesia, 2018

Indonesian government's spending on education is programmed in schools without a levy. The school education program without levies in Indonesia has been running for 13 years since the policy was introduced. The aim of the Indonesian government in implementing education policies without levies is to open access to all school-aged children to get a good education.

What are the implications of policy implementations? The Indonesian Central Bureau of Statistics defines the Net Enrollment Rate (NER). This figure represents the percentage of the population in certain groups of age, who are still attending school, to the population in that group. According to 2017 Central Bureau of Statistics (BPS), the net enrollment rate showed a percentage of 97.14 percent in elementary schools (SD), 78.30 percent in junior high schools (SMP) and 60.19 percent in high schools (SMA) and vocational high schools (SMK).

It is obviously stated in table 2 below that the Elementary School's NER was 96.37 percent in 2014, 0.77 percent higher than the Elementary School's NER in 2017. Likewise, the 2014 Junior High School's NER was 77.43 percent while it was 78.30 percent in 2017. It is seen as an increase of 0.87 percent. However, the 2014 high school and vocational high school's net enrollment rate accounted for 59.24 percent, 1 percent higher than the rate in 2017.

Table 2. Net enrollment rate in four different educational levels (2011-2017)

Net Enrollment Rate (NER)	Year						
	2011	2012	2013	2014	2015	2016	2017
Elementary School	90,98	92,47	95,52	96,37	96,2	96,71	97,14
Junior High School	68,22	70,82	73,73	77,43	77,45	77,89	78,3
Senior High School	47,93	51,77	54,12	59,24	59,46	59,85	60,19
Bachelor	12,56	13,48	18,08	20,18	17,34	17,91	18,62

Source: Central Bereau of Statistics, Indonesia, 2018

Along with the facts about the proportion of national expenditure shown in Figure 2, this fact is quite alarming. In numbers, the national budget (APBN) is equivalent to 45 trillion rupiahs annually. The budget is used for the School Operational Assistance (BOS) program. Apart from the BOS budget, the government also issued a special budget for programs such as the Indonesia Smart Card (KIP), which

began in the era of President Joko Widodo in 2015, and allocated funds around 9 trillion rupiahs.

The Conditions of Indonesia's GDP

Indonesia is one of the developing countries in Asia. Indonesia's economic growth has very good prospects in the long run. Indonesia's GDP per capita has experienced a sharp increase for a decade, although it had experienced a slowdown in growth between 2011 and 2015. Table 3 below shows Indonesia's GDP development in overview.

Table 3. Indonesia's GDP growth per quarter, 2009-2018 (annual change in percent)

Year	QI	QII	QIII	QIV
	Percent			
2009	4.60	4.37	4.31	4.58
2010	5.99	6.29	5.81	6.81
2011	6.45	6.52	6.49	6.50
2012	6.29	6.36	6.17	6.11
2013	6.03	5.81	5.62	5.72
2014	5.14	5.03	4.92	5.01
2015	4.71	4.66	4.74	5.04
2016	4.92	5.19	5.01	4.94
2017	5.01	5.01	5.06	5.19

Source: Central Bereau of Statistics, Indonesia, 2018

Is GDP per capita a proper measure for Indonesia? Indonesia has a high characteristical inequality in income distribution (Prabowo, 2015). What the data shows is a result of the fact that the wealth of 43,000 richest people in Indonesia is equal to that of the entire 260 million Indonesian people. This means that only 0.02 percent of the population represents the total Indonesian population, whose proportion is 25 percent of GDP. So the gap is reflected in the fact that the wealth of the 40 richest people in Indonesia is equivalent to 10.3 percent of GDP, equivalent to the wealth of 60 million poor people in Indonesia.

Furthermore, the other important information is the rapid increase in Indonesia's GDP in the 2000s. The World Bank projected that Indonesia will reach the level of 3000 USD (per capita) in 2020. In fact, Indonesia has been able to reach it for a decade earlier. This achievement is considered an important step since it has implications

for development acceleration in a number of sectors such as the retail, automotive and property sectors.

The Condition of Indonesia's HDI

The human development index is a summary measure of the long-term progress of human development. The human development index is measured in three dimensions, namely life expectancy and health, ingress to knowledge and purchasing power or living standard. Report on the development of human development made by the United Nations Development Program (UNDP) informed that the value of Indonesia's HDI in 2017 amounted to 0.694 in the human development category at a moderate level. It means Indonesia still ranked 113 out of 189 countries. The UNDP report provides information that HDI in Indonesia experienced an increase from 0.661 in 2010 to 0.694 in 2017. The table 4 below shows Indonesia's HDI between 2010 and 2017.

Table 4. Indonesia's HDI trend (2010-2017)

Year	Life Expectancy at birth	Expected Years of schooling	Mean years of schooling	GNI per capita (2011 PPP$)	HDI Value
2010	66.2	12.2	7.4	8,210	0.661
2015	69.0	12.7	7.9	10,037	0.686
2016	69.2	12.8	8.0	10,437	0.691
2017	69.4	12.8	8.0	10,846	0.694

Source : UNDP human development report, 2018

Table 5. Indonesia's HDI and indicators for 2015, relative to selected countries

	HDI Value	HDI Rank	Life expectancy at birth	Expected years of schooling	Mean years of schooling	GNI per capita (PPP US$)
Indonesia	0.689	113	69.1	12.9	7.9	10,053
China	0.738	90	76.0	13.5	7.6	13.345
Philippines	0.682	116	68.3	11.7	9.3	8.395
East Asia and Pasific	0.720	-	74.2	13.0	7.7	12,125
Medium HDI	0.631	-	68.6	11.5	6.6	6.281

Source: UNDP human development report, 2018

The fundamental problem with Indonesia's HDI is that it is still lower than that of the other countries except one country in ASEAN, namely the Philippines. It is also lower than that of China and the East Asian and Pacific countries. The overview of the 2018 UNDP

statistics gave Indonesia a warning and suggested that Indonesia focus more on developing its human resources.

This background description provides the importance of this study to see the long-term relationship between the quality of human resources and labor productivity in Indonesia. We consider the education level of workers and health status to be proxies for the quality of human resources. This study has limitations on the categorization of education levels. In education level data, vocational education is not separated from general (non-vocational) education because this study is done in general to see the long-term and short-term effects of human capital on labor productivity. Thus, it does not explain in detail the specific effects of vocational education output on labor productivity. Therefore, the main purpose of this study is to determine the effect of the contribution of human capital, namely education and workforce health, on labor productivity in Indonesia. Therefore, the question in this study is whether human resources affect labor productivity in Indonesia. The hypothesis for this question is that human resources have an impact on labor productivity in Indonesia.

This study is very important because there is still a very limited number of studies in Indonesia that examine the relationship between human resources and labor productivity in Indonesia based on the latest data sets. This research question refers to how Indonesia's human resources contribute from a long-term and short-term model to labor productivity. This study will also provide pieces of advice and recommendations on potential policy implications as a solution to the policies that have been made. After the description of this background, the remaining parts of this paper will be arranged as follows; part two is a theoretical review of the correlation between human capital and productivity. Part 3 describes the methodological framework and econometric techniques. Part 4 is reporting on empirical results and Part 5 is presenting findings and making suggestions on policy implications.

Literature Review

Research on human resource investment as a development tool has been supported by world economists. For example, Schultz (1961, 1988), Becker (1965, 1975 & 1992) & Becker, Murphy & Tamura (1990) emphasized the importance of investing in human resources.

Their concept describes that human capital is an asset that is as important as physical capital in creating wealth. Investment in human capital affects future income and consumption through school attainment and improves medical care and skills through training. Achieving a higher education level encourages individuals to earn higher wages. When individual workers get higher wages, their health and fitness improve. They can afford more nutritious diets as an effort to increase endurance and work productivity.

Empirically, Barro (1991) clearly explained that the theory of endogenous growth prioritizing human capital investment is related to GDP per capita. Likewise, in research on the sources of economic growth carried out by Barro & Lee (1994), variables of infant mortality and life expectancy are used as proxies for workers' health variable. Relevant to that, Renelt (1992) found that the level of school enrollment was positively correlated with economic growth. Another finding by Hanushek & Kimko (1993) stated that the quality of education has an effect on productivity and the degree of economic growth in the nation. Similar to these findings, Barro & Sala-i-martin (1995) described that the average school year for both men and women at the higher education level significantly influences the growth rate of GDP per capita.

Empirical studies of the scope of human capital investment in productivity have been carried out by scholars in various parts of the world. A study was conducted by Arshad & Malik (2015) in Malaysia with the fixed effects generalized least square (GLS) method to see the relationship between human capital and labor productivity. Proxies for education variables were school year average, education level, school enrollment rate, government expenditure for education and literacy rates. The health variables were measured by life expectancy, government spending on health and the survival rate of adults. The study led to a conclusion that the quality of human resources (higher education and health status) positively and significantly increased the labor's productivity in Malaysia.

Meanwhile, a study by Chansarn (2015), that is obtained from data sources during 1981-2005 (24 years) and sourced from 30 countries, examined the effect of education, health and technological progress on the level of labor productivity growth. The proxies used are Gross

Domestic Product, Gross Fixed Capital formation, labor force, school year, life expectancy at birth and total growth rate of productivity factors. Using the OLS method (Ordinary Least Square), it pointed to the conclusion that education and technology are significant determinants of the level of labor productivity growth.

A different study was conducted by Wang & Liu (2016) using panel data in 55 countries from 1960 to 2009, which involved basic education, secondary education, and higher education proxies as educational variables, proxies of life expectancy as health variables, and GDP as the proxy of economic growth. It concluded that the positive impact of higher education on economic growth is very significant, but secondary education does not have a significant impact on economic growth. Moreover, human capital and life expectancy (health) show a significant positive correlation to economic growth.

Another study involving educational variables and health variables as advocates of human resource theory to see its effect on labor productivity is Forbes (2010). The study took survey data from Households, Income and Labor Dynamics in Australia (HILDA). The findings of this study say that increasing educational attainment has a significant positive effect on hourly wages. The study also measured the effects of five health problems every hour and concluded that all health problems significantly reduced hourly wages.

Other empirical evidence from a study in Nigeria by Umoru & Yacub (2013) found that health capital investment increases labor force productivity. Another finding in his research is that, statistically, the education of labor force increases labor force productivity.

The results of an empirical study in Indonesia conducted by Wahyuni & Monika (2016) showed evidence that the influence of education on income is higher for a more skilled workforce. The study also describes that education can reduce income inequality. Furthermore, the study illustrates that the influence of education on male income is lower than that of women. The results of the study by Brezis and Brand (2016), which looked at the contribution of education to human resources, provide differences in labor productivity between tradable and non-tradable industries, although the increase in human capital in the two industrial sectors was not significantly different.

The studies above are similar to the study conducted by Dukec and

Mirosla (2017) regarding the effect of human capital on agricultural production. The study was conducted on workers in livestock companies in Poland. Their research shows a conclusion that output elasticity of labor factors is significantly higher in farm groups managed by farmers with higher levels of education. The research by Qutb (2017) in Egypt is different. He used a total productivity factor proxy to measure the level of labor productivity. In addition, he considered that the quality of education in human resources is caused by the educational achievement of labor. Data processing using the Autoregressive Distributed Lag (ARDL) approach concludes that only slightly does the quality of education in higher education alone improve the quality of education in the whole human resources. Likewise, Research by Bokana & Akinola (2017) stated that high level of education in human resources must be supported by the strong implementation of state policies, for it can have a positive impact on productivity growth.

A recent study in Indonesia conducted by Mendy (2018) shows the results that long-term and short-term relationships of various levels of education in the structure of human resources in Indonesia are still at the level of expanding economic growth and identifying education at the third level as the main evolving factor. This study empirically collapsed to find a considerable correlation between school level and economic growth.

Theoretical framework and methodology

Theoretically, to check the influence of long-term model of human capital on economic productivity in Indonesia, it is first obligatory to look at linear functions based on the fundamental principles of the Cobb-Douglas production function (Sieng & Yussof, 2014). There are two approaches commonly used in analyzing the relationship between human resources and labor productivity. Most empirical studies examine the relationship of education to production by using income function framework (Becker, 1965; Mincer, 1974). In this conventional approach, the profit factor is used as a proxy for productivity, which then the profit function can estimate the effect of education on productivity. Aggrey, Eliab, and Joseph (2010) mentioned that the second approach is to estimate the relationship between variables of human capital and labor productivity carried out by using production analysis. This method has

been carried out by Cörvers (1996). The use of production analysis has advantages compared to the income function framework. This function can be written as follows:

$$Y_t = AK_t^{\alpha} L_t^{\beta} \quad (1)$$

In equation 1, Y is output, K defines physical capital and L is labor. The attribute t in variables indicate the time and A, α, β are positive constants. The production function does not consider the quality of work and presumes that labor is homogeneous. In Romer's endogenous growth theory (1990), human capital is modeled as a factor of production which can increase aggregate production and the marginal physical product of capital. It is this thought that causes the hypothesis to hold that the quality of labor is the main clincher variable in production growth. Therefore, the quality of work can be mathematically written as follows:

$$Y_{1t} = ak_t^{\alpha} LP_t^{\beta} \quad lny_{1t} = lna_1 + \alpha_1 lnk_{1t} + \beta_1 lnLP_t \quad (2)$$

$$Y_{2t} = ak_t^{\alpha} LS_t^{\beta} \quad lny_{2t} = lna_2 + \alpha_2 lnk_{it} + \beta_1 lnLS_t \quad (3)$$

$$Y_{3t} = ak_t^{\alpha} LT_t^{\beta} \quad lny_{3t} = lna_3 + \alpha_3 lnk_{it} + \beta_1 lnLT_t \quad (4)$$

Y_{1t}, Y_{2t}, and Y_{3t} are the productions of labors from primary, secondary and tertiary education, respectively. From the description of the equation above, the sum of all production by workers with primary, secondary and tertiary education levels can be achieved (Sieng & Yussof, 2014).

The experimental estimation model that accompanies the proxy on independent variables is the life expectancy at birth that describes government spending on health and the survival rate of adults.

Then we will use a mathematical equation that includes the percentage of workers with health states in the time period t.

$$Y_t = AK_t^{\alpha} (uhL)_t^{\beta} \quad (5)$$

To analyze the accumulation of human capital associated with the function of production, effective labor, then L*, represents the labor at

three educational stages and mental and physical health conditions. Mathematically, it can be formulated as below:

$$Y_t = AK_t^{\alpha}(L_t^*)^{\beta} \tag{6}$$

In the condition of the labor with different years of educational levels (j = 1, 2, 3) according to the level, it can be said that

$$L^* = L_t^{\theta_j} L_t^{\gamma} \ , \ j = 1, 2, dan\ 3 \tag{7}$$

After knowing the result of equation (7), the result can be substituted in equation (5). Therefore, the newest equation is as follows:

$$Y_t = AK_t^{\alpha}\left(L_t^{\theta_1} L_t^{\theta_2} L_t^{\theta_2} L_3^{\theta_3} L_t^{\gamma}\right)^{\beta} \tag{8}$$

To get the labor productivity function, equation (5) needs to be divided with Lt to produce the equation as follows:

$$\frac{Y_t}{L_t} = \frac{AK_t^{\alpha}(L_t^{\theta_1} L_t^{\theta_2} L_t^{\theta_3} L_t^{\gamma})^{\beta}}{L_t}$$

Alternatively, it can be written

$$\frac{Y_t}{L_t} = A\left(\frac{K_t}{L_t}\right)^{\alpha} L_t^{\beta\theta_1} L_t^{\beta\theta_2} L_t^{\beta\theta_3} L_t^{\beta_\gamma} \tag{9}$$

The Equation will be used to link labor productivity with the ratio of labor input at the level of primary, secondary and tertiary education along with good labor health conditions for a certain period of time. Before directing this formula to the analysis formation process with Auto-regressive Distributed Lag (ARDL), it is best to look first at the logarithmic model:

$$lnGDP_t = \delta_0 + \delta_1 lnLP_t + \delta_2 lnLS_t + \delta_3 lnLT_t + \delta_4 lnHL_t + \varepsilon_t \tag{10}$$

The equation above explains that the GDP logarithm is a constant Gross Domestic Product (GDP) per worker. The worker's education is symbolized by LP (primary education), LS (second level of education) and LT (third level of education). HL symbolizes the life expectation

of workers while e is a symbol of error, i attribute is the number of statuses (i = 1, 2, 3 ..., n) and t shows the year period.

Time series data from 1981 to 2014 were from World Bank data collections. The data will be analyzed by the Autoregressive Distributed Lag (ARDL) method introduced by Pesaran (1995). Pesaran explains the co-integration relationship in the ARDL model. The ARDL model approach was chosen because this model is able to accommodate a large number of variables and is possible to use for long-term and short-term estimates under the control of co-integration procedures and is also strongly used in small samples. According to Shin, Smith, and Pesaran (2001), ARDL can also be applied regardless of pure regressor I (0), I (l) or reciprocal integration. Then the operationalization step can be continued to see short-term relationships among variables. After that, it will be continued to see the existence of long-run relationships among variables as a closing. The stationary test results presented in Table 6 told that all the variables studied were stationary at Level I (I).

Table 6. Result of the stationary test: The ADF unit root test

Variable	ADF Intercept & Trend				Decision
	Level		At First Difference		
	ADF Statistic	Level Probability	ADF Statistic 1st Difference	Difference Probability	
lnGDPt	-4.5247	0.0063***	-4.2833**	0.0122	I(I)
lnHLt	-2.6502	0.2628	-3.8007***	0.0005	I(I)
lnLPt	-3.4136	0.0668*	-4.6699***	0.0038	I(I)
lnLSt	-2.5750	0.2932	-4.5015***	0.0064	I(I)
lnLTt	-2.6360	0.2680	-6.8974***	0.0000	I(I)

Source : Estimates using Eviews 10.0.
Note : GDP (Gross Domestic Product), HL (Healt of Labour), LP (Primary Of Education Labour), LS (Secundary of Education Labor), LT (Tertiary of Education Labor)
MacKinnon (1996) one-side p-values. The ADF statistics were generated from a random walk model with drift and trend. The lag length was determined through the Akaike Information Criterion (AIC). *** P < 0.01, ** P < 0.05, * P < 0.1

Table 6 provides an overview of stationary values from the data that are the source of analysis in this study. The following shows the error correction version of the formula studied by Pesaran and Shin (1995) and a mathematical formula that represents short-term dynamics with Bound Test estimation:

$$\Delta lnGDP_t = \beta_0 + \sum_{i=1}^{n}\beta_1 \Delta lnGDP_{t-1} + \sum_{t=1}^{n}\beta_2 \Delta lnLP_{t-1} + \sum_{t-1}^{n}\beta_3 \Delta lnLS_{t-1} + \sum_{t-1}^{n}\beta_4 \Delta lnLT_{t-1} + \sum_{t-1}^{n}\beta_5 \Delta lnHL_{t-1} + \delta_1 \Delta lnGDP_{t-1} + \delta_2 \Delta lnLP_{t-1} + \delta_3 \Delta lnLS_{t-1} + \delta_4 \Delta ln + \delta_5 \Delta lnHL_{t-1} + \delta_t \quad (11)$$

Δ symbolizes the level of differentiation while *β1, β2, β3, β4,* and *β5* are a sequence of models l (l) on the short-run model dynamics. Whereas to test the long-run model amongst the variables examined the F-test is used, it is necessary to submit a hypothesis to see cointegration. The hypothesis proposed is as follows:

H0: $\delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = 0$ (no cointegration between the variables)

H1: $\delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq \delta_5 \neq 0$ (cointegration exists between the variables)

There are three conclusions from this hypothesis. First, if the condition on the statistical number of F is higher than the critical number of the upper limit, then the conclusion is that no cointegration is rejected, which means there is a long-term relationship between variables. Second, if F results are less than the critical lower limit, the null hypothesis cannot be rejected. This shows that there is no long-term relationship among variables. Third, if statistic F results far between the critical value of the lower limit and the upper limit, then the test cannot be concluded. The following is a long-term model estimate:

$$\Delta lnGDP = \beta_0 + \sum_{t=1}^{n-1}\beta_1 \Delta lnGDP_{t-1} + \sum_{t=0}^{n-1}\beta_2 \Delta lnLP_{t-1} + \sum_{t=0}^{n-1}\beta_3 \Delta lnLS_{t-1} + \sum_{t=0}^{n-1}\beta_4 \Delta lnLT_{t-1} + \sum_{t=0}^{n-1}\beta_5 \Delta lnHL_{t-1} + \beta_6 ECT_{t-1} + \varepsilon_t \quad (12)$$

β1, *β2*, *β3*, *β4*, *β5*, and *β6* are short-run coefficients. *ECT* symbolizes the adjustment coefficient rate to achieve a long-term balance after a short-term surprise. This model is run to see how long the economic dynamics correct the long-term balance through short-term adjustments. Furthermore, the ARDL model needs to be examined further in the state of the diagnostic test and stability test. The function of a diagnostic test is to check serial relationship, functional model conditions, normality, and heteroskedasticity. The

structural stability test is useful to see cumulative residues with indicators named CUSUM (cumulative residues) and CUSUMSQ (square number of recursive cumulative residue).

Outputs and Discussion

This part will describe the outputs and discuss the discoveries in three parts. The first part describes the results of the unit root test. The second part discusses the results of co-integration tests and simultaneously interprets them. The last part discusses the results of the diagnostic test.

Unit Root Test

A summary of root test results to see stationary data conditions based on Augmented Dicley-Fuller (ADF) shows that GDPt, HLt, LPt, LSt, and LTt are stationary at the first difference l (l). After all, stationary variables are confirmed; the next is looking at the long-term relationship between RGDP and examining its independent variable (IV) by using the ARDL model. However, the lag length should be first determined with the Akaike Information Criterion (AIC). Figure 1 depicts a recursive search of the ARDL model which uses a general-to-specific approach (Gets). The outputs revealed by ARDL are [2,2,2,1,2]. This is an appropriate model of the process of generating data (GDP).

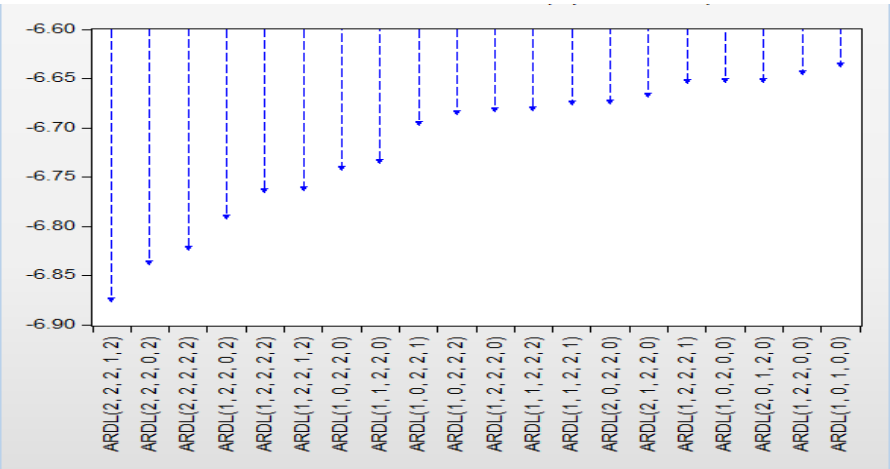

Fig. 3. ARDL Model Selection by Akaike Information Criteria (top 20 Models)
General to Specific Approach (Gets)
Source: From Estimate using Eviews 10.0

Co-integration

Table 7 presents the results of the co-integration test between variables using Bounds test. The results show that the F-statistic calculated for the model (equation 11) is bigger than the critical value of the upper limit at the level of 10%. Therefore, the null hypothesis is rejected. The conclusion implies that human capital in Indonesia and productivity has a long-term relationship.

Table 7. F-statistic of co-integration relationship

F Statistic	Lag	Significant level	Bound Critical Values (unrestricted intercept and no trend)	
			I(0)	I(I)
3.7867	4	10%	2.45	3.52
		5%	2.86	4.01
		1%	3.74	5.06

Source: From Estimate using Eviews 10.0
K denotes the number of independent variables.

Short-Run and Long-Run Coefficient

Short-Run

After confirming the existence of a co-integration relationship with F statistics, we can get reasons to estimate long-run and short-run elasticity. Table 8 shows that the diagnostic test of all models supports the goodness of this model with quite convincing significance. The ARDL model with estimates (2,2,2,1,2) can be recognized as a sufficient GDP calibration model.

Table 8. The short-run elasticity of the ARDL model

ARDL (2,2,2,1,2) based on AIC (Akaike Information Criterion) Dependent variable: lnGDP				
Variable	**Coefficient**	**Std. Error**	**t-statistic**	**Prob.**
DC	2.202939	0.453053	4.862427	0.0002
DLnHL(-1)	34.98560	9.143481	3.826289	0.0015
DLnLP	0.642793	0.120785	5.321810	0.0001
DLnLS	0.075803	0.033129	2.288107	0.0361
DLnLT(-1)	0.076862	0.021393	3.592711	0.0024
ECT(-1)	-1.085343	0.223096	-4.864923	0.0002
R^2	0.886			
R^{-2}	0.834			
F	17.28006***			

Note : HL (Healt of Labour), LP (Primary of Education Labour), LS (Secondary of Education Labor), LT (Tertiary of Education Labor)
Source: From Estimates using Eviews 10.0
The Asterisk denotes rejection *** P<0.01 **P<0.05. *P<0.1

Looking at Table 8 which shows a short-term relationship, all variables of human capital show a significant positive relationship with productivity. This fact is relevant when we look at endogenous growth theory that says human resources are a factor of production escalating aggregate production and capital's marginal, physical products. Table 8 explains that in Indonesia the labor health variable significantly has a positive effect on the 0.01 significance level on labor productivity. An increase in life expectancy of 1 percent will increase labor productivity by 34.9 percent in the conditions of cateris paribus. The findings of the results – when compared to research in Malaysia about the same thing – show that the contribution of variable life expectancy in Indonesia more becomes an influencing factor on productivity (Arshad & Malik, 2015). Similar results were also generated by empirical studies of 55 countries using data from the years 1960-2009. Their study concluded that the relationship between labor health and economic growth was 4 percent (Wang & Liu, 2016).

Judging from the education variables, all levels of education have an influence on labor productivity. Tertiary-education labor (LnLT) is an essential component of human capital as well as primary (lnLP) and secondary education (LnLS). Knowledge and skills for simple and advanced technologies are obtained by the labor as long as they get an education so that they become high-quality workers. These conditions affect their life quality and have an impact on their income at the same time. The result is that workers with quality will have an impact on productivity which directly results in an increase in real GDP per capita. This research is also in accordance with the research conducted by Mendy (2018), that Lucas's (1988) growth model reveals a long-term and short-term relationship between education and economic growth. Studies conducted using education data in Indonesia reveal that the level of education is essential for economic growth in Indonesia.

Again, looking at the results of the short-run, the ECM equilibrium correction coefficient of (-1.08) which is significant at 1 percent has the correct sign. The condition of (ECT-1) = -1.08 according to the findings of the study by Loayza and Ranciere (2005) is called dynamically unstable, meaning that the speed of adjustment to conditions of resource quality is less than one unit of time period (one year) or, to be exact, 0. 92 years to return to balance.

Long-Run

After knowing how the condition of short-term elasticity is, the next is seeing the results of long-term elasticity. The results of long-term elasticity are presented in table 9 below.

Table 9. The long-run elasticity of the ARDL model

ARDL (2,2,2,1,2) based on AIC (Akaike Information Criteria) Dependent variable: lnGDP				
Variable	**Coefficient**	**std. Error**	**t-statistic**	**Prob.**
C	2.202943	3.109220	0.78520	0.4888
LnHL	0.073852	0.578419	0.127679	0.9000
LnLP	0.472365**	0.165453	2.854972	0.0115
LnLS	0.110518**	0.038293	2.886081	0.0107
LnLT	-0.108436**	0.043891	-2.470557	0.0251

Note : HL (Healt of Labour), LP (Primary of Education Labour), LS (Secondary of Education Labor), LT (Tertiary of Education Labor)
Source; From Estimates using Eviews 10.0'
The asterisk denotes rejection ***P < 0.01 **P < 0.05 *P<0.1

The results of long-term elasticity confirm that primary education (LnLP) and secondary education (LnLS) statistically have a significantly positive effect on productivity (lnGDP). Differently, tertiary education (LnLT) appears to have significant statistics, yet it is negative to productivity. On contrary, the labor health variable (LnHL) appears to have a positive effect on productivity but is not statistically significant. Higher education in Indonesia has not maximally contributed to labor productivity. Indonesia needs to increase the role of highly educated workers in encouraging labor productivity. The education budget contribution of 20% must be allocated to consider higher education reform related to education and training by observing the educational model that was successfully adopted by developed countries. As proposed by endogenous growth theory, government institutions, the private sector, and markets foster innovation and play an important role in developing incentives. In addition, that the variable health of labor (LnHL) has a positive but not statistically significant influence on productivity means that in the aspect of human resources, in the long-term analysis, educational factors are very dominant in influencing labor productivity. This is not like a health variable that has no significant effect.

Diagnostic Test

Table 10 describes the ARDL model diagnostic tests. The outcomes in the table display the numbers of the models that do not have problems related to autocorrelation, heteroskedasticity, Ramsey test and normality. Likewise, the number of recursive residual cumulative (CUSUM) and the number of square cumulative of the residual recursive (CUSUMSQ) test show the absence of misspecification evidence and expected instability.

Table 10. Diagnostic test result

Test	Value	Explanation
Breusch-Godfey serial correlation Lagrange Multiplier test	F-statistics (1.354) prob. (0.289) Chi-square prob. (0.0878)	No serial correlation
Heteroskedasticity test: Breush-Pagan-Godfey	Chi-square prob. (0.9700) f-stat. Prob. (0.34)	No heteroscedasticity
Ramsey (RESET) test	f-stat. prob. (0.334)	No misspecification
Histogram: normality test Jarque-Bera	Prob (0.428)	Normal
Stability CUSUM	S	Stable
Stability CUSUMSQ	S	Stable

P values in parentheses

Discussion of Results

The findings of the short-run and long-run models above are very interesting to discuss in the context of Indonesia in the Reformation era. The spirit of Indonesian political economy which prioritizes the education budget as a development priority is truly tested for its consistency in the management of the budgets annually. This is not without clear economic argumentations. The answers to the results of the analysis above indicate that the endogenous growth theory should be of concern to the Indonesian government. The challenge – as well as critique – for us is the finding that tertiary education variables have a significant, negative effect on labor productivity in long-run conditions. In comparison, this is different from the findings of Mendy (2018) which found that secondary education had no effect on growth.

The evaluation-demanding fact is that the tertiary education quality factors in Indonesia are not yet at the stage of fulfilling the right criteria in employment that demands a high level of skills and knowledge. This condition can be seen from the inaccurate targeting of the Indonesian education budget voiced since 2002 regarding the education reform.

Primary and secondary education has influenced Indonesia's labor productivity in the end significantly and positively. What needs to be examined more closely is that there are still many jobs in Indonesia, the majority of which require labor at the level of primary and secondary education. Spectrums of work are supplied by labor with low education and low skill. Hence, the allocation of their work is to the scope of agricultural laborers, production workers or laborers of low-skill-demanding service sectors. This means that tertiary-education labor will be brought in from outside the country to meet the needs of high-skilled labor. This is different from the findings of the study of Singh, Sieng & Saukani (2018) which states that in Malaysia, in the long run, primary and tertiary educations are important contributors to growth. Likewise, the research of Yussof and Zakariya (2009) stated that, in the long run, in Malaysia, workers with a higher education level have a positive effect on GDP. The labor with a low education level has a non-significant, positive effect. The analysis is reasonable since Malaysia is a developed country with high income due to the influence of skilled and qualified labor from the tertiary education. So it seems obvious that, according to the 2018 UNDP report, qualitatively, Indonesia's HDI is still below that of its neighboring country, Malaysia.

The long-term negative influence of tertiary-education labor is also worrying for Indonesia. The future demand for skilled labor cannot be met by the output of the country's higher educational institutions. This condition reminds us of the prediction that Indonesia in 2030 needs 113 million semi-skilled workers, which currently are still around 55 million.

In the long-term elasticity, the health variable has a positive effect even though it is not significant at any level. This shows that in Indonesia the health variable is not an absolute determinant of labor productivity in long-term conditions. This can be seen from the results

of the long-run analysis that labor health variables only contribute seven percent, which is not quite significant. It can be interpreted that physical safety and life expectancy are not the main factors in productivity because long-term awareness of health tends to be low due to low education.

Conclusion and Recommendation

This paper – investigating the correlation between the quality of human resources and productivity of labor in Indonesia by using Autoregressive Distributed Lag (ARDL) method in processing the data – concluded that the quality of human resources is cointegrated with labor productivity. In the short run, all variables including the variables of health, primary, secondary and tertiary education of the labor have a positive effect. This finding suggested that these variables need to be safeguarded by government policies. However, in the long run, the tertiary-education variable needs to be prioritized by the government in order to produce high-skilled college graduates. This means that college graduates need to be equipped with further skills to turn into high-skilled workforce. As a result, they will become a potential supply in the labor market. Meanwhile, the health variables need to be focused more so that the labor health becomes the concern of the workers, the companies or employee-hiring institutions. In the end, it appears to be true that the human resource quality is the causative factor of labor productivity in Indonesia.

References

Aggrey, N., Eliab, L., & Joseph, S. (2010). Human capital and labor productivity in East African manufacturing firms. *Current Research Journal of Economic Theory*, *2*(2), 48–54. Retrieved from http://core.kmi.open.ac.uk/download/pdf/5564813.pdf

Arshad, M. N. M., & Malik, Z. A. (2015). Quality of human capital and labor productivity: A case of Malaysia. *International Journal of Economics, Management and Accounting*, *23*(1), 37–55. https://doi.org/10.5430/rwe.v4n2p43

Barro, R. J. (1991b). Economic growth in a cross section of countries. *The Quarterly Journal of Economics*, 106(2), 407. https://doi.org/10.2307/2937943

Barro, R. J., & Lee, J. W. (1994). Sources of economic growth. Carnegie-Rochester Confer. Series on Public Policy, 40(C), 1–46. https://doi.org/10.1016/0167-2231(94)90002-7

Barro, R. J., & Sala-i-martin, X. (1995). *Economic Growth* (2nd ed.). London: MIT Press.

Becker, G. S. (1962). Investment in human capital : A theoretical analysis. *The Journal of Political Economy*, LXX (5), 9–49.

Becker, G. S. (1965). A theory of the allocation of time. *The Economic Journal, Vol. 75*(299), 493–517.

Becker, G. S. (1975). Human capital: A theoretical and empirical analysis, with special reference to education, chapter pages in book (p.-22-0). *National Bureau of Economic Research.*

Becker, G. S. (1992). The economic way of looking at life. *Working Paper* No. 12, Department of Economics, University of Chicago.

Bokana, K. G., & Akinola, G. W. (2017). Productivity effects of higher education human capital in selected countries of Sub-Saharan Africa. Zbornik Radova Ekonomskog Fakulteta u Rijeci: Časopis Za Ekonomsku Teoriju i Praksu/Proceedings of Rijeka Faculty of Economics: *Journal of Economics and Business*, *35*(1), 173–198. https://doi.org/10.18045/zbefri.2017.1.173

Brezis, E. S., & Brand, G. (2016). The effects of education on labor productivity : Differences between tradable and non-tradable industries. *Preminary version, September*.

Chansarn, S. (2015). Labor productivity growth , education , health and tchnological progress : A cross-country analysis. *Economic Analysis & Policy, 40*(2), 249–262.

Cörvers, F. (1996). the impact of human capital on labour productivity in manufacturing industries in Enugu and Anambra States, *Faculty of Economics and Bussines Adminitrasion, University of Limburg*. ISBN 90-5321-169-1

Dukec, D., & Mirosla, S. (2017). The effect of human capital on labour productivity. *Obrazovanje Za Poduzetništvo / Education for Entrepreneurship, vol.7*.(NR1), 9–19.

Forbes, M. (2010). The effects of education and health on wages and productivity. Productivity. Communsion. *Staff Working Paper*. Commonwealtth. ISBN 978-1-74037-309-8.

Becker, G. S., Murphy, K. M. & Tamura, Robert (1990). Human capital , fertility , and economic growth. *Journal of Political Economy, Vol. 98*(3), S12-S37.

Yussof, I., & Zakariya, Z. (2009). Economic Growth and Higher Education Dewamnd in Malaysia. *Malaysian Journal of Economics, Vol 43(2009), 85-105.*

Singh, N. K. H., Sieng, L. W., & Saukani, M. N. M. (2018). Impact of education levels on economic growth in Malaysia : A gender base analysis. *Malaysian Journal of Society and Space, 4*(4), 13–26.

Hanushek. E. A., & Kimko, D. D. (1993). Schooling , labor-force quality , and the growth of nations. *The American Economic Review, Vol. 90*(5), 1184-1208.

Loayza, N., & Ranciere, R. (2005). Financial development, financial fragility , and growth. *Working Paper*. No. 05/170. ISBN/ISSN 9781451861891/1018-5941

Lucas, R. E. (1988). on The Mechanics of Economic Development. *Journal of Monetary Economics*, *22*(February), 3–42.

Mendy, D. (2018). Do education levels matter on Indonesian economic growth? *Economics & Sociology, 11*(3), 133–146. https://doi.org/10.14254/2071-789X.2018/11-3/8

Mincer, J. A. (1974). Schooling, experience, and eraning. Columbia Univesity Press, pp. 1–4. Volume ISBN 0-870-14265-8. Volume URL: http://www.nber.org/books/minc74-1

Pesaran, M. H., & Shin, Y. (1995). An autoregressive distributed lag modeling Approach to Co-integration Analysis. In Symposium at the Centennial of Ragnar Frisch. The Norwegian Academy of Science and Letters. Oslo, Mach 3-5. https://doi.org/10.1016/S0025-5564(99)00018-8

Prabowo, Prayudi S & Bidiono (2015). An Overview of Income Inequality in Indonesia in Preparation for the 2015 Asean Economic Community. *Journal of Research in Economic and Management, 15*(1), 182–189.

Qutb, R. (2017). How education does at all levels influence total factors productivity growth? *International Research Journal of Finance and Economics*, 159(1). 58-75

Renelt, R. L. D. (1992). A sensitivity analysis of cross-country growth regressions. The *American Economic Review, 82*(4), 942–963.

Romer, P. M. (1990). Endogenous technological change. *Journal of Political Economy, 98*(5), S71-102.

Schultz, T. W. (1961). Investment in human capital. *The American Economic Review*, Vol 51.(1), 1-17.

Schultz, T. W. (1988). Education investmen and return. *Handbook of development Economics.Volume I.* Edited by H. Chenery and T.N. Srinivasan. Science Publisher B.V. ISSN. 15734471.DOI. 10.1016/S1573-4471(88)01016-2

Shin, Y., Smith, R. J., & Pesaran, M. H. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics, 16*:289–326. https://doi.org/10.1002/jae.616

Sieng, L. W., & Yussof, I. (2014). Human capital accumulation and economic growth in Malaysia - Investigating the long run nexus. *Malaysian Journal of Economics, 48*(1), 155–165. https://doi.org/10.17576/JEM-2014-4801-13

Umoru, D., & Yacub, J. O. (2013). Labour productivity and health capital in Nigeria : The empirical evidence. *International Journal of Humanities and Social Science, 3*(4), 199–221.

Uzawa, H. (1965). Optimum technical change in an aggregative model of economic growth. *International Economic Review, 6*(1), 18–31.

Wahyuni, R.N.T., & Monika, A.K. (2016) The impact of education on income inequality among Indonesian workers. The Journal of Indonesian *11*(1), 110–125. https://doi.org/10.1016/j.chieco.2015.12.009

Wang, Y., & Liu, S. (2016). Education, human capital and economic growth: Empirical research on 55 countries and regions (1960-2009). *Theoretical Economics Letters*, vol.6 347–355. https://doi.org/10.4236/tel.2016.62039