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Analysing the Structural Relationship between Labor Productivity and Investments in Indonesia: An Application of Two-Stage Least Square

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Investments play an important role in driving an economy to produce goods and services and also create jobs. For those, to attract the investors, we need to improve the quality of human resources measured through labour productivity especially in Indonesia. In line with the issue, Indonesia as a country that has many labour forces reported low productivity compared with Singapore, Malaysia and Indonesia. Thus, this study aims to analyse the relationship between labour productivity with investment and regional economic growth in Indonesia. This quantitative study designed using the simultaneous equation model. The data analysed by utilising the Two-Stage Least Square Approach. A total of three simultaneous equation models were proposed and the data consist of 33 provinces and six-year starting 2013 to 2018 that collected from the central bureau of Statistic. The results of this study found that investment has significant in increasing labour productivity, and it is boosting investments. Next, an increase in human development index, provincial minimum wage and investments are significant in increasing labour productivity, while increasing the significant health complaints in decreasing workforce productivity. Also, an increase in labour productivity and human development index is significant in increasing investments while the increasing provincial minimum wage significantly in decreasing the investment. Lastly, labour productivity has been positive and significant against gross regional domestic product per capita. Foreign direct investment and domestic capital investment does not

significantly affect Gross Regional Domestic Product per capita. In conclusions, the investment, human development index, provincial minimum wage have positively significant affecting labour productivity and its effect on gross regional domestic product. In contrast, investments (foreign direct and domestic capital) do not have a relationship with gross regional domestic product.

Key words: *Labour productivity, gross regional domestic product, foreign direct investment, domestic capital investment, two-stage least square.*

Introduction

The human resources as the main production factor in the role of spur economic growth compared to natural resources (land). It corresponds to the fact that a production system always requires human resource intervention. In a strict competition situation, as now requires the intervention to come from qualified human resources, not enough only large in terms of number. One concept that can be used to measure the quality of human resources is labour productivity. This concept measures the ability of manpower in producing goods and services where the ability is highly dependent on education and labour skills (Muhammad et al., 2018). From the other side of labour productivity can improve the investment climate, because when the ability of workers in a particular area high, will lead to the confidence of the investors to invest their capital.

Investment formation is one of the crucial factors for the growth and economic development of a country through foreign direct and domestic capital investments (Syaparuddin et al., 2019). Keynes also stated that investments play an important role in the process of economic growth. When entrepreneurs or governments make investments, there will be many invested capital aimed at production activities so that it can spur productivity to produce goods and services. Harrod-Domard said that the investment has a double influence for long-term. On the one hand, the investment affects the development of a country's national production because of the availability of capital stock that is an essential factor in business continuity (Musnadi et al., 2019). On the other hand, investments have an impact on aggregate demand because it can encourage employment creation and suppress poverty, so there are improvements in the level of people's welfare overall and evenly. Based on data from the Asian Productivity Organization report of 2017, it shows that labour productivity in Indonesia is not optimal because it is ranked 11th out of 20 Member States (Asian Productivity Organization, 2017) but Trend indicating an ascending and stable condition.

Figure 1. The Achievement of Labour productivity in Indonesia 2013-2018

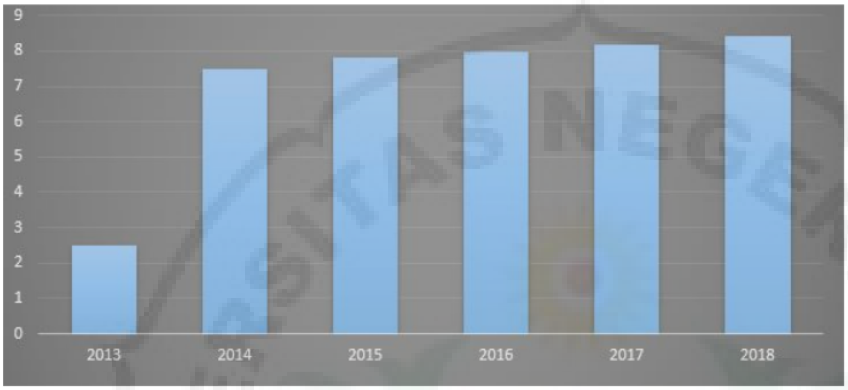
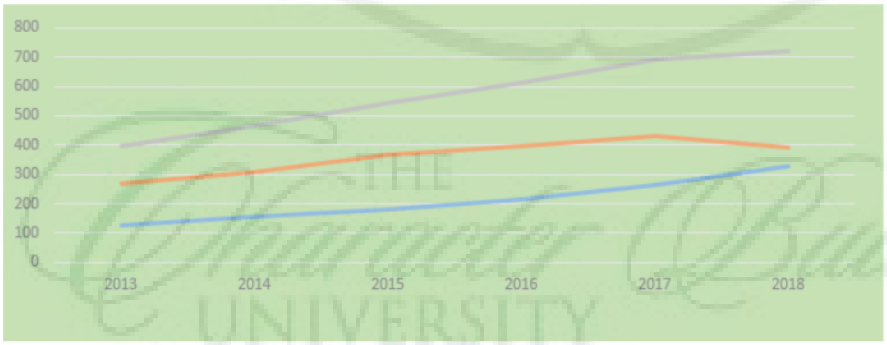


Figure 1 shows that the average growth of 0.62% in Indonesia's workforce. In the period of observation from the year 2013 – 2018 the highest growth took place from 2013 to 2014, which amounted to 1.98%.

According to the World Bank report, the Indonesian Ease of Doing Business (EoDB) category is ranked at 72 from 190 countries. The signal growth of investments in Indonesia can be referenced from the World Investment Report 2018 report, depicting foreign direct investment (FDI) to Indonesia shows significant growth (Sugiarto, 2019). In the case of the uncertain global economy, the realisation of investment in Indonesia, both foreign direct investment, and domestic capital investment shows the increasing trend as in the following Figure 2.

Figure 2. Total Investment, Foreign direct and Domestic Investments in Indonesia 2013-2018

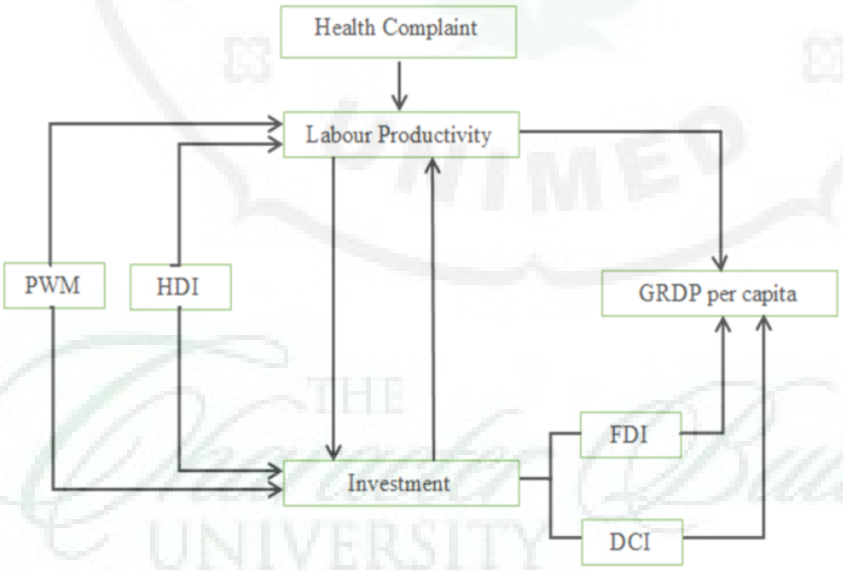


Note: blue colour is domestic investment, the orange colour is foreign direct investment and grey colour is total investments (domestic and foreign direct investments). Source: Investment Coordinating Board (2018)

Figure 2 shows a trend of total investment, foreign direct and domestic capital investments in Indonesia in the year of 2013-2018 showed a rising trend. In 2018 foreign direct investment decreased from IDR 430.5 trillion to IDR 392.7 trillion, while domestic capital investment (PMDN) increased from IDR 262.3 trillion in 2017 to IDR 328.6 trillion in 2018. Similarly, the total investments (domestic and foreign direct investments), from IDR 692.8 3 trillion in 2017 to IDR 721.3 trillion in 2018.

The low ranking of Indonesian labour productivity and the declining foreign direct investment rate in Indonesia encourages researchers to identify the factors that affect the phenomenon through simultaneous models of equations. Human development Index, provincial minimum wage and investments are assumed can increase the workforce productivity, and health complaints of residents can lower labour productivity. Human development Index, labour productivity and provincial minimum wage can affect the investment in Indonesia. Lastly, researchers want to investigate the influence of labour productivity and investments of both foreign direct and domestic capital investments on gross regional domestic product per capita which is a community welfare proxy. The linkages between variables described as follow

Figure 3. Conceptual Framework



Literature review

Labour productivity is part of the economy's measurement of productivity. Productivity is the best concept to measure competitiveness as the result of Snowdon & Stonehouse's interview with Porter in 2006. Based on the definitions expressed by Samuelson and Nordhaus (2007), productivity is a concept that measures the ratio of the total output to the weighted average of the inputs. From the defendant, it can be noted that productivity consists of labour productivity, which calculates the number of outputs per unit of labour and productivity of the total factor that measures the output per unit of the total input consisting of capital and Labor. Labour productivity is important because a production system always requires human resource intervention. To increase the productivity of manpower needed qualified human resources.

According to Schultz (1961), the transformation of raw human resources into highly productive human resources through educational, health and moral inputs. So human capital according to Schultz is human beings who have competence, knowledge, skills, skills, ideas, health, and so on that is the result of expenditure or spending in education, treatment programs and Health care, being Becker (2002) is a human capital that is in line with Schultz's knowledge, information, ideas, expertise and health from individuals. Human capital can lead to sustainable growth (Cohen & Soto, 2007). The increase in quality of human capital must be carried out continuously because according to Andreosso & O'callaghan (2002) Accumulation of human capital which then passes through a series of economic development process impacts on macroeconomic productivity and on also influence the income distribution.

This opinion is strengthened by the research results of Cohen & Soto (2007), stated that human capital could lead to sustainable growth. Research on human capital, human development index, and labour productivity have extensively researched. A study conducted by Arshad & Malik (2015) found that the quality of human capital (higher level of education and better health status) has a positive and significant influence on increased workforce productivity in Malaysia. De la Fuente (2011) and Bergheim (2005) argue that the quality of human capital is crucial in increasing labour productivity. Ranis Research (2004) reveals that education on Labour as one of several components of human development index has a very strong influence on productivity. Georgescu & Herman (2019) also stated that for measuring productivity, human development index is one of the things that is the indicator. Labour will be more productive in using equipment or activities that are better and efficient when they receive a lot of education or training.

Investments are one of the macro variables that can stimulate the wheels of the economy. Referring to the Solow model, if a country set aside most of its revenue to savings and

investments, the country will have a capital supply of established conditions and a high level of income. In established conditions, the goal of policymakers is to maximise the welfare of individuals who form prosperous communities (Mankiw, 2007). The indicator, in this case, is per capita GDP which gives an overview of the income and the average living standard of the individual population. It is one indicator for measuring a country's economic growth (Syahril et al., 2019). GDP per capita is the share of individual members of the population against annual GDP. It mathematically calculated by dividing real or nominal GDP by the number of people per year. The per capita income is also a measure used to describe the standard of living. Countries with a high per capita income generally have a high standard of living. The difference in revenue reflects the difference in quality of life, rich countries (indicated by high per capita income) have a better quality of life (reflected by, among others, life expectancy, level of health, and education level) compared to poor countries (Mankiw, 2007).

Investment holds a dual role that is from the investment demand and supply aspects. The first role, investment in creating income, in this case, is the impact of investment demand, and secondly, investing in increasing the capacity of economic production by enhancing capital stocks where this is the impact of the bidding Investment (Arsyad, 2010) further increased capital stock will increase productivity as well as production capacity and quality, which in turn can promote economic growth and increase labour absorption. According to the study of Liu et al., (2001), the foreign investment concerning higher labour productivity. Besides Liu et al., (2001) also found that the amount of foreign investment with productivity has a very strong relationship. Ramirez (1996) finds that investment spending, both government and private, has a positive and significant influence on the level of productivity.

Neoclassical theory suggests that in order to maximise the benefits of each entrepreneur using production factors such that each production factor used to receive or be rewarded for value-added Marginal from the production factor (Sumarsono, 2009). Wages are the most significant source of motivation, so someone wants to do a job. Any labour that does the job will receive the reward or reply of service following the contribution of the achievement he gave. The services that are often referred to as compensation include: can be either wages or salaries, goods allowances, or other services. The minimum wage is regionally appointed.

Regional minimum wage (UMR) is a minimum standard used by entrepreneurs to pay salaries to employees, employees, or labour in a business environment or its work. The UMR in question is the Regency/city/Provincial Minimum wage (BPS, 2016). There are 3 (three) components that affect the minimum wage are Minimum physical requirements, consumer price index (CPI) and regional economic growth (Sumarsono, 2009). Prasch (1996) reveals that the minimum wage can drive high productivity in the workforce. Research conducted by Dobija (2011) shows the results that the minimum wage level is influenced and conditioned by labour productivity. Increased total productivity factors related to minimum wage increase

(Riley and Bonhated, 2015). However, on the other hand, Alvarez & Fuentez (2018) hypothesised and found that the minimum wage increase was negatively affecting the total productivity of the factor.

For performing the activity, the workforce must be in a healthy condition. Units of measurement that are often used in viewing health status are negative, such as mortality rates and pain numbers (Wisana, 2001). According to the law No. 23 (1992), health covers 4 aspects, namely: physical (body), mental (soul), social, and economic.. This means that one's health is measured not only by physical, mental, and social aspects but also measured by its productivity in the sense of having a job or generating something economically. The high burden of disease can impede development goals, so it needs to be prevented through strategic planning investments in the healthcare sector. Health investments through health programs conducted by the Government can create a quality increase workforce. Gross regional domestic product per capita describes the developments caused by changes in the production volume of goods and services produced and changes in the price level and represents the revenue that can be enjoyed by productivity. Healthy and educated human beings will sustain productivity by diligently working to generate income to support themselves and the family, thereby alleviating poverty and supporting the achievement of national development Goals (Sagir, 2009).

Methodology

This research uses a model of simultaneous equations where there is more than one equation that will form a system of equations. The unique feature of the simultaneous equation model is that the dependent variables in one equation could appear again as independent variables in other equations of the system. To analyse the relationship between the exogenous variables and the endogenous variables, where the endogenous variables in the study consist of 3 (three) pieces i.e. labour productivity, investment and GRDP per capita using the Two-Stage Least Square method. TSLS is a method used to estimate simultaneous equations. Before the estimation should be fulfilled before the prerequisite must be filled with the Order condition (order condition), which is based on the rules of calculation of variables that inserted into the equation. The grouping consists of a group of endogenous variables which are the total number of equations referred to as G; The number of variables in the model (endogenous and predetermined variables) symbolised as K, and the number of variables in the equation identified (endogenous and exogenous) or M. Assumptions used in the identification of simultaneous models is as follows:

Table 1. The summary of the simultaneous equation model identifications

Threshold(s)	Conclusion(s)
(K-M) < (G-1)	Under identified
(K-M) = (G-1)	Just identified
(K-M) > (G-1)	Over identified

Notes: G is the number of equations; K is the number of variables in the model (endogenous and predetermined variables), and M is the number of variables in the equation identified (endogenous and exogenous).

The variables in the simultaneous models are as follows: Endogenous variables consist of Labour productivity (LPROD), investments (INV) and Economic Growth (GRDP) per capita. The predetermine variable is a variable whose value is defined outside the model consisting of Human Development Index (HDI), provincial minimum wage (PMW), health complaints (HCP), foreign direct investment (FDI) and domestic capital investment (DCI).

Table 2. The Threshold for identifying the simultaneous equation model

Equation(s)		M	K– M		G -1	Conclusion
$LPROD = \alpha_1 + \alpha_2 HDI + \alpha_3 PMW + \alpha_4 HCP + \alpha_5 INV + e_1$	(1)	5	8– 5	>	3– 1	Over Identified
$INV = \alpha_6 + \alpha_7 LPROD + \alpha_8 HDI + \alpha_9 PMW + e_2$	(2)	4	8– 4	>	3– 1	Over Identified
$GRDP = \alpha_{10} + \alpha_{11} LPROD + \alpha_{12} FDI + \alpha_{13} DCI + e_3$	(3)	4	8– 4	>	3– 1	Over Identified

In the simultaneous system of equations to detect simultaneity between variables carried out with test simultaneity that is with the Hausman test. The condition of simultaneity on a system of simultaneous equations needs to be carried out test simultaneity to determine whether a bias simultaneity occurs or not. The rule of decision in this Hausman test is to compare between the probabilities values of the residual inserted in the equation if the probability value is < 0.05 then Ho is rejected and suggests that in simultaneous system modal equations reveal simultaneous problems. Test results simultaneity on the model of this study can be seen in the Table 3.

Table 3. The result for testing the simultaneous equation model

Variable(s)	Probability	Conclusion
Residual (INV)	0.0307	Simultaneous
Residual (LPROD)	0.0000	Simultaneous

From the test, simultaneity found significant residual investments at α = 5% means this variable has a simultaneous relationship with the labour productivity variable. While the labour productivity variable to investment has a probability value of 0.9425 > 0.05 means residual labour productivity occurs simultaneous bias towards investment. Residual Labour productivity has a simultaneous relationship to the GRDP per capita researchers continue to use the method of estimation of TSLS because of the test result of identification tests of Order Condition, all equations identified Over Identification so that estimates can be done using the Two-Stage Least Square technique. The Model used to analyse factor factors affecting labour productivity in Indonesia is the development of the Rommer equation (2012)

$$\ln\left(\frac{Yi}{Li}\right) = a + bSi + ei \quad (1)$$

Where Si is a social infrastructure that is proxies from the average number of old-school expectations, while $\frac{Yi}{Li}$ is proxies with labor productivity data. Based on the equation (1) model of this research equation is as follows:

$$LPROD = \alpha_1 + \alpha_2 HDI + \alpha_3 PMW + \alpha_4 HCP + \alpha_5 INV + e_1 \quad (2)$$
$$INV = \alpha_6 + \alpha_7 LPROD + \alpha_8 HDI + \alpha_9 PMW + e_2 \quad (3)$$
$$GRDP = \alpha_{10} + \alpha_{11} LPROD + \alpha_{12} FDI + \alpha_{13} DCI + e_3 \quad (4)$$

Where LPROD is labour productivity (%), HDI is Human development index, PMW is provincial minimum wage, HCP is Health complaints, INV is investments, FDI is foreign direct investment, DCI is domestic capital investment, and GRDP is a gross regional domestic product.

Results and Discussion

The results of analysis showed that almost all equations in the model have a significant parameter on the trust level between 80% up to 99%. To identify the influence between labour productivity and investment through the estimated results of the first and second equations. Investments have a positive and significant impact on labour productivity as well as vice versa.

Table 4 displayed that the Human Development Index has a positive and significant relationship on labour productivity (LPROD). Labour will be more productive when they use a workforce that receives a lot of education or training. This results in line with the research of Bergheim (2000); Andreosso & O'callaghan (2002), De la Fuente (2011) and Arshad & Malik (2015). The value of labour productivity in Indonesia is lowest at the time of observation is IDR 2.25 billion located in South Kalimantan province in 2015, while the

maximum amount of IDR 53.46 billion is labour productivity in DKI Jakarta Province in 2017. The lowest IPM figure in Indonesia is 56.25 is the HDI number of the Papua province in 2013, while the maximum value of 80.47 is the HDI number of DKI Jakarta province in 2018.

Table 4. The result for testing 1st simultaneous equation model

	Coefficient	Std. Error	Prob.
Constant	-96.00545	13.72012	0.0000*
HDI	0.697935	0.141228	0.0000*
Log(PMW)	7.347142	1.702068	0.0000*
HCP	-0.457342	0.091281	0.0000*
Log(INV)	2.051919	0.540319	0.0002*
R-square	0.47		

Note: Dependent Variable: Labour Productivity (LPROD), *Significant at 10%, **significant at 5%, ***significant at 1%

Indonesia's highest provincial Minimum wage of IDR 3,648,036 is data in DKI Jakarta in 2018, being the lowest in Central Java Province in 2013 with the value of IDR 830,000. Empirical findings show the Provincial Minimum Wage has the most significant influence on labour productivity where the nature of the impact is positive and significant at $\alpha = 1\%$. The provincial minimum wage can encourage labour productivity figures where these results are in line with the research conducted by Prasch (1996).

Health complaints negatively and significantly effect on labour productivity. Health factors play an important role to do the activity. The emergence of health complaints resulted in decreased labour productivity. This finding similar to empirical results reported by Muhammad et al., (2019) whereas the budget allocated for education and health significantly reduce the poverty rate in Indonesia. According to Wisana (2001) When someone complained about health, then there are 3 (three) things that may happen, first death; that can lower the amount of labour. Both incapacities do work and all three defects that can eliminate the working capacity. These three potentials reduce labour productivity. From the research results of Nahar et al., (2015), it was found that health factors are more likely to affect labour productivity than education factors. Using the descriptive statistics, the lowest health complaint level in North Maluku province in 2013 is 15.49% while the highest of 42.28% occurred in the province of Yogyakarta in 2014.

In this research, the investment value is the sum of the realization of domestic capital and foreign direct investment in Indonesia. The empirical findings showed that the investments positively and significantly effect on Labour Productivity. The study was in line with Liu et al. (2000) Where Foreign Direct Investment (FDI) has a positive impact on labour

productivity. The minimum investment value of IDR 81.5 billion was in West Sulawesi in 2013, while the maximum amount of IDR 120.520.60 billion was the investment value in DKI Jakarta in 2017. From the regression result of this first equation acquired R-Square amount of 44%; there are 56% that can affect the productivity of labour in Indonesia that does not enter the model of this research.

Table 5. The result for testing 2nd simultaneous equation model

	Coefficient	Std. Error	Prob.
Constant	8.158310	3.864084	0.0352**
LPROD	0.095878	0.023840	0.0001*
HDI	0.085554	0.028467	0.0028*
Log(PMW)	-0.960232	0.0.39001	0.0141**
R-square	0.259		

Note: Dependent Variable: Investments (INV), *Significant at 10%, **significant at 5%, ***significant at 1%

From table 5 can be seen the regression coefficient of productivity is positively and the influence of this variable is significant at $\alpha = 1\%$. The Human Development Index has also been positive and significant to the investment of $\alpha = 1\%$. Both variables can be used as indicators of human resource quality. If the number of labour productivity is high, then the ability of manpower in generating goods and services is also high. Likewise, the high HDI signifies that the workforce has a high quality of education and skills as well as in good health conditions. The quality of labour is an important consideration for investors to invest. While the third exogenous variable which is the provincial minimum wage is negatively influential and significant to the investment at $\alpha = 5\%$.

The minimum wage is the lowest wage that will be made standard, by employers to determine the actual wages of workers/labourers working in his business. This minimum wage is generally determined by the government which is the governor by noting the recommendation of the Provincial Wage Council or the Regent/ Mayor). High provincial Minimum wage can reduce the interest of investors because it can increase the cost of production of the business world. The findings are in line with the research results (Sukmana & Masaru, 2014) stated that the total investment will decrease if the minimum wage increases. One of the causes of foreign investment to the country of Vietnam is the minimum wage rate of IDR 2.3 million per month, while in Indonesia, IDR 3,648,036. The R-square value of the second equation is 26%.

Table 6. The result for testing 3rd simultaneous equation model

	Coefficient	Std. Error	Prob.
Constant	2239.670	1601.166	0.1624
LPROD	4180.557	154.5497	0.0000*
FDI	0.111317	0.069777	0.1112
DCI	-1.460205	2.844432	0.6508
R-square	0.943425		

Note: Dependent Variable: Gross Regional Domestic Product (GRDP), *Significant at 10%, **significant at 5%, ***significant at 1%.

The value of GRDP per capita is a reflection of the welfare of society (Sukono et al., 2019). An area that has a high per capita GRDP generally has a high standard of living that is reflected from the high HDI figures (Muhammad et al., 2018), covering aspects of economics, education and health. From the estimated labour productivity variable estimates are positive and significant at α = 1%. For the GRDP variable per capita, the results in line with the study conducted by Escosura (2017) stated that per capita GDP is a donation of the development of labour productivity. Foreign capital investment and domestic capital investment do not affect GRDP per capita. It is due to the distribution of less equitable investments in various Indonesian provinces so as not to improve the welfare of the Indonesian population; Investment still concentrated on Java Island. In the years 2014 and 2015, the value of Domestic Capital Investment in Maluku was zero, being the highest in East Java in 2018 is IDR 1.679 trillion.

Likewise, the Foreign Direct Investment, the highest is in DKI Jakarta for 1.198 trillion and the lowest in West Sulawesi province is IDR 73 million the lowest Gross Regional Domestic Product per capita rate in Indonesia amounted to IDR 123,790,200 in the East Nusa Tenggara province on the year 2013, while the maximum value of IDR 232,342,280 is the GRDP per capita of DKI Jakarta province in 2017. Empirical findings are not in line with Mankiw (2007) that investments can deliver the economy to that can improve individual welfare. The results were also not in line with the research results of Gökmenoğlu et al., (2018) where Foreign Direct Investment (FDI) has a positive influence on Human Development Index (HDI) in Nigeria. The R-square value of the third equation is 94%. The hallmark of the use of a simultaneous model is that the policy simulation can be applied, aimed at seeing the impact of a policy on variable changes – endogenous variables. To perform this simulation required a reduced form equation that will result in an equation where no other endogenous predetermined variable is present, all are predetermined exogenous. Its estimated result is:

LPROD = 0.495843737192*HDI+ 0.828908669962*LOG(PMW) + 0.0436308096398*HCP + 0.000102151767081*FDI - 0.00267771370273*DCI - 31.5405943081

INV= -3.81870475959e-10*HDI + 3.4479683122e-09*LOG(PMW) + 2.35169494437e-11*HCP + 1*FDI + 1*DCI + 0

GRDP = -5848.26874279*HDI + 20698.9983957*LOG(PMW) - 442.368699664*HCP + 0.363722930487*FDI - 9.82637496526*DCI + 305645.359271

To form a reduced form equation that will be used as a policy simulation, the predetermined Exogenous variable is selected based on the significance level at α = 1% and the result as follows:

LPROD = 0.000102151767081*FDI - 0.00267771370273*DCI - 31.5405943081

INV= -3.81870475959e-10*HDI + 3.4479683122e-09*LOG(PMW) + 2.35169494437e11*HCP+1*FDI +1*DCI +0

GRDP = 0.363722930487*FDI + 305645.359271

The equation above showed only one exogenous variable could explain the entire endogenous equation that exists in the system; the variable in question is the PFDI or foreign investment. Meanwhile, the DCI (domestic capital investments) variable can only affect the investment variable, because on the labour productivity equation, the DCI variable has a negative influence so it does not correspond to the theory. Likewise, in the third equation, the DCI variable does not affect the GRDP per capita it means that if there is a change in the number of FDI in the economy, then the entire endogenous variable will be changed, namely labour productivity, investment and GRDP per capita. All of these endogenous variables are positively influenced; In this respect in accordance with the theory. If the DCI variable changes then that will change only 1 endogenous variable namely investment (INV)

Conclusion

Based on the estimated results of the simultaneous equation model, the study concluded that labor productivity and investments have positively influenced each other. Human development Index, provincial Minimum wage and investments are significant in increasing labour productivity, Indonesian health complaints should be a government concern because it significantly lowers labour productivity. Based on the estimated second equation, the government must be cautious in establishing the provincial minimum wage because most of its influence and the significant decrease of investment in Indonesia, on the other hand, is the most influential factor in Increase workforce productivity. Human development index must be improved because of positive effect on investment to enhance the welfare of Indonesian population in this case per capita is by increasing labour productivity while planting Foreign

capital and domestic capital investment do not significantly influence due to the spread of less equitable investments between provinces in Indonesia. From the resulting reduced form equation to create a policy simulation, to increase labour productivity, investment and GRDP per capita is to increase the amount of foreign direct investment

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