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The Linkage of Physical and Human Investments in Affecting Gross Domestic Product in Indonesia

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Abstract:

This study draws the influence between linkage of physical and human investments, to gross domestic product (GDP) in Indonesia. Therefore, the panel data regression model was used to explain this influence at the national level and in accordance with data classification into Java and Outside Java. The National and, Java and Outside Java classifications were clarified through a Chow test. As confirmed by the Hausman test, estimation results using the fixed-effect model indicated that direct domestic investment, direct foreign investment, and the human development index influence GDP at the national level and outside Java regions. By contrast, human development exerted no significant effect on GDP for regions located in Java Island. Thus, the contribution of this paper is to explain the role of regional development in examining the nexus among physical investment, human investments and gross domestic products.

Keywords: gross domestic product; direct domestic investment; direct foreign investment; human investment

JEL Classification: E22; F21; P45

Introduction

Possible factors affecting economic growth include natural resources, capital accumulation, organization, technological progress, production scale, human resources, politics, and administration. Some economists have claimed that capital accumulation is the most important factor in explaining economic growth variability. Human capital investments in developing countries can increase economic growth by assuming the suitability between formal education and the labor market (Mehrara and Musai 2013, Mikhaylova 2016, Sumaryoto 2016, Whalley and Zhao 2013).

On the other hand, physical investment can take the form of direct domestic investment (DDI) and direct foreign investment (DFI), whereas human investment is measured by human development index (HDI). Through the Indonesia Investment Coordinating Board, the government of Indonesia seeks to promote direct investments, DDIs, and DFIs (Direct foreign investment) as economic growth drivers. Along with stable economic growth targets, efforts to attract direct investment are also pursued by the central and local governments. Such efforts were evident in the increase in total DDI and DFI realization during 2010–2015, in the midst of a weakening global economy. However, a disproportionate level of direct investments existed between regions located in Java and those outside it. For example, in 2014, the investment rate in Java was 131.1 trillion (58.8% of total direct investment in Indonesia), whereas that in regions outside Java was only 91.7 trillion (41.2% of total direct investment). In 2015, the rates were 55.6% for Java and 44.3% for regions outside Java. The same inequality appeared in HDI in Indonesia. In 2010–2015, the average HDI of the six provinces in Java was 70.29, whereas that for regions outside Java was only 65.45. Furthermore, the regional gross domestic product (RGDP) of the six provinces in Java was 60% of the national gross domestic product (GDP), whereas the 27 other provinces outside Java Island contributed to less than 40% of the national GDP.

Investment can be made through purchasing capital goods and production equipment to increase the ability to produce goods and services, which in turn will increase real GDP and economic growth. Foreign investment performs an pivotal role in economic performance in Ghana (Djulius 2017b, Kwakye 2013) and China (Jin, Yin, and Hamori 2012), respectively. Foreign investment is also complementary to DI in promoting economic growth in China (Tang, Selvanathan and Selvanathan 2008). Some Organization for Economic Cooperation and Development (OECD) reports (OECD 2002) and previous scientific research have acknowledged that DFI is useful to development and economic growth (Acaravci and Ilhan 2012, Liu and Sarfraz 2015, Reiter and Steensma 2010). However, other empirical evidence imply that DFI positively affects economic growth by triggering technological spillovers and physical capital accumulation in developing countries but not in developed countries (Johnson 2006).

Another research finding suggests that the impact of DFI on growth and development may differ between developed and developing countries because they have distinct institutional and economic structures. In addition, poor institutional quality may increase pressure on growth and development (Jude 2015). DFI and direct domestic investment (DDI) can complement each other and positively influence economic growth only if a sound macroeconomic policy is implemented (Dasgupta 2015, Mahmood 2016). Therefore, DFI will positively impact DDI and economic growth if foreign companies provide domestic companies with new investment opportunities (Salim, Bahattab and Gavrila 2016, Ibrahim 2014).

Human capital can be viewed from perspectives of living standard, health, and education. The well-known measuring index for this composite is HDI that provides an assessment of achievements of a country in various areas of human development. Many economists have continually researched several determinants of economic growth. The Harrod–Domar model is based on the accumulation of physical capital stock (Azeez, Kolapo and Ajayi 2012). New growth theory developed in the 1990s, the initial prominence of which on the aggregation of physical capital turned to human capital (Javed *et al.* 2013, Maria Fedorovna Mizintseva, Anna Romanovna Sardarian and Tatiana Nikolaevna Yakubova 2016). Human and physical capital investments are significant determinants of growth in African countries (Oketch 2006).

Research has been conducted to investigate the relationship between economic growth and human development and found that the expansion of capacity and freedom leads to enhanced economic performance, and that human development significantly affects economic development (Bandara and Dehejia 2014, Ezeabasili, O. Isu and Mojekwu 2011, Korobanicova 2016). Other researchers have also explored the link between human capital development and economic performance (Aurangzeb 2003, Bloom, Canning and Sevilla 2001, Muhammad Imran *et al.* 2012, Samimi, Madadi and Heydarizadeh 2014). However, their findings vary. Some of them found the positive impact of health spending on economic growth (Piabuo and Tieguhong 2017). Other researcher determined the contribution of education to economic growth (Sbaouelgi 2017).

There are several studies of the relationship between direct investments and human capital. The idea is based on an augmented Solow growth model, which incorporates human capital, together with physical capital determines the performance of the economy. FDI has a positive impact on economic performance, whose impact is reinforced by existing human capital. That is, human capital contribute to the performance of the economy as a facilitator for technological spillover derived from FDI (Djulius 2017a, Su and Liu 2016). FDI and DDI are mostly absorbed into the manufacturing sector, where the main benefits of these physical investments were captured by the company. The increase in total factor productivity due to physical investments suggests that technological spillovers provided by FDI and DDI are positively related to absorption capacity, generated by human capital (Alarcon Osuna 2016). In this context, human capital is in the form of skilled workers trained for technical, managerial and professional positions, all of which are generated by human investment (Muhammad Azam, Saleem Khan, Zalina binti Zainal, Namasivayam Karuppiah 2015).

The above discussion highlights that the impact of physical and human investments on economic growth results in diverse findings, the variations in which are due to variation in the socio-economic circumstances of various countries. Therefore, investigating this issue in each specific aspect of Indonesia is important. The GDP was assumed to be determined solely by investment (*i.e.*, physical investments and human investment). Thus, the impact of each variable on GDP was analyzed. In addition to analyzing these variables at the national level, the same variables in by triggering side and outside Java were also investigated. The possible differences among the three types of investment relationships with GDP are expected to exert different policy impacts. This study determines whether the economic achievement represented by gross domestic product (GDP) in Indonesia is influenced by physical and human investments and how the linkage among these variables to GDP.

1. Methodology

The data used were obtained from Statistics Indonesia, the Indonesia Investment Coordinating Board, and the World Bank in 2007–2015. The research variables are the DDI, DFI, and HDI in 33 provinces in Indonesia. The basic model in determining the effects of DDI, DFI, and HDI on economic growth is as follows:

$$RGDP_{it} = \alpha + \beta_1 FDI_{it} + \beta_2 DDI_{it} + \beta_3 HDI_{it} + \varepsilon_{it} \quad (1)$$

where: RDRP - Regional Gross Domestic Product; DFI - Direct foreign investment; DDI - Direct domestic investment; HD I- Human Development Index; i = Provinces (33); t - Year (2002–2015); α = Intercept; $\boldsymbol{\beta_2}$ - Regression parameters; $\boldsymbol{\varepsilon_{it}}$- Error term.

Firstly, the data were classified into three groups: national-level data, data from regions in Java Island which represent developed regions, and data from regions outside Java Island which represent relatively underdeveloped regions. Six provinces in Java Island are assumed to be developed areas: Jakarta, Banten, West Java, Central Java, Yogyakarta, and East Java. The 27 other provinces in Java Island were all assumed to be relatively underdeveloped regions.

Model (1) was implemented on data in all groups to obtain residual sum square statistics, the results of which were used in a Chow test to examine whether the grouping was valid.

Chow test Procedure. F-statistics was obtained using the following formula:

$$F = \frac{S_5 / k}{S_4 / (N_1 + N_2 - 2k)} \tag{2}$$

where: S1 - Residual sum square of model (1) for the overall data sample (*i.e.,* national-level data); S2 - Residual sum square of model (1)) for samples in group java; S3 - Residual sum square of model (1) for samples other than those in S2 (*i.e.*, outside-Java data); S4 - S2 + S3; S5 - S1 − S4; N1= Sample size in S2; N2= Sample size in S3; k = Number of parameters to be estimated

All residual sum square values obtained through regression according to model (1) in each grouping, which are: national group, Javanese group and group outside Java. Thus, three times the estimated static model for each grouping was performed. If the F-statistics obtained was sufficiently high to reject H0, then the Java and outer Java groupings are statistically different from the national group.

Secondly, three Hausman tests were performed for each group to determine whether to select the fixed-effect or random-effect model to estimate model (1) in each grouping.

2. Results and discussion

2.1. Results

Firstly, the three tables in Appendix A present the estimation of the common effect of the relationship model among DDI, DFI, and HDI on economic growth in the three data classifications (*i.e.*, national, Java, and outside Java).

In the tables, the statistics appears as follows:

S1=9.47E+18; S2=4.85E+18; S3=2.56E+18; S4=7.41E+18; S5=2.06 E+18

N1= 54; N2= 243; k = 4.

The calculation of Equation (2) resulted in an F-statistic of 20.1. Therefore, H0 was rejected, meaning that a regression result difference existed between the National and Java and Outside Java groups. In other words, significant differences existed in the effects of DDI and DFI on GDP between National and Java and Outside Java classifications.

Secondly, the hausman test. The Hausman test result summary of the three groups is shown in Table 1.

Table 1. Hausman Test results

No	Classification	*Chi-Sq. Statistic*	
1	Java	13.554362	***
2	Outside Java	30.192394	***
3	National	105.954604	***

Note: *p<0,1 **p<0,05 ***p<0,01

According to the Hausman test results, the p-values for the Java, outside Java, and National groups were smaller than 0.05. H0 was rejected, meaning that the best method for estimating the relationship between DDI, DFI, and HDI and GDP for the three classifications is the fixed-effect model. In addition, fixed effect model was used to anticipate time-invariant covariates, *ie* technology. The explanatory variables in this research model are "capital" which translated into physical investments (DDI and DFI) and human capital. Another possible explanatory time invariant variable was technology.

The summary of panel data regression results using the fixed-effect model for the three classifications is shown in Table 2, and all estimation results are presented in Appendix B.

Table 2. Summary of panel data regression results

Variable	National Level		Java		Outside Java	
	Coeff	*p-value*	Coeff	*p-value*	Coeff	*p-value*
Intercept	-3.99E+08	***	-2.80E+08		-2.88E+08	***
DDI	15001.88	***	21842.83	***	7902.074	***
DFI	24257.55	***	59570.33	***	55273.19	***
HDI	8463813	***	9209499		5738486.	***
	R^2 = 0.92		R^2 = 0.95		R^2 = 0.91	
	F stat = 89.0; Prob = 0.00		F stat = 120.62; Prob = 0.00		F stat = 70.32; Prob = 0.00	

Note: *p<0,1 **p<0,05 ***p<0,01

At the national level, p-values indicated that DDI, DFI, and HDI variables exerted significant effects on GDP. High R2 values and large F-statistics also indicated that the estimation had proper goodness of fit.

Slightly different regression results were obtained for the developed regions located in Java Island, as DIs (*i.e.,* DDI and DFI) significantly affected the RGDP. By contrast, HDI indicated that the quality of human development presented no significant effect on GDP. As with the previous results, we obtained the values of R^2 and F-statistics that illustrated the goodness of fit of the estimation results.

The last estimate was obtained to classify regions outside Java that were assumed to be relatively underdeveloped. Similar to the estimates obtained at the national level, all DDI, DFI, and HDI variables significantly influenced GDRP.

3. Discussion

Overall, the DDI and DFI variables in regions inside and outside Java and at the national level exerted positive and significant influences on GDP. This finding is consistent with those of Cheung (Cheung, Dooley and Sushko 2012) which indicate that investment positively affects the economic growth of low-income countries and negatively affects that of high-income countries. This finding is also in line with those of Lumbila (Lumbila 2005) which prove that DFI and DDI can complement each other and even positively impact economic growth if supported by a sound macroeconomic policy and environment.

The Indonesian government continues to spread investments outside Java and to reduce concentration in the center of economic growth in the island. The investment spread throughout Indonesia will be able to further national economic growth. Investment activities will impact job creation, thereby enabling communities to increase their economic activities and living standards, which are also accompanied by increased revenues. Therefore, the existence of investments increases economic activity and ultimately results in economic growth, as conveyed by many researchers *(e.g.* Adams and Opoku 2015, Aizenman, Jinjarak and Park 2013, Amin, Khalid and Yao 2014, Zouhaier and Fatma 2014).

The HDI variable exerted a positive effect on GDP for regions outside Java and at the national level. This finding is in line with that of Whalley and Zhao (Whalley and Zhao 2013) which demonstrate that human capital has a significant role in GDP. Different conditions occur in Java Island, where HDI demonstrates a positive but insignificant relationship with GDP. This finding contradicts that of Costantini and Monni (Costantini and Monni 2008) which emphasize that economic growth is positively influenced by human development, trade openness, institutional quality, and natural resources. The finding contradicts those of Fleisher (Fleisher et al. 2007) as well, which imply that human capital investments in underdeveloped regions in China can provide economic efficiency and growth.

Unlike in regions outside Java, the HDIs of developed regions were already at high levels. The HDI comprises three basic dimensions: healthy living, knowledge, and decent living standards. The qualitative development of human life in Java has already reached a high level. Therefore, these regions do not require specific policies to increase HDI in relation to GDP. By contrast, the HDIs of regions outside Java still require a sound policy to help in their improvement, thereby enabling them to influence GDP.

Concluding remarks

The above findings and discussion led to the following conclusions:

1. Panel data regression results indicated that with a common intercept, all variables, namely, DDI, DFI, and HDI, exerted positive and significant influences on GDP;
2. Upon the influence of investments, differences in GDP characteristics existed among the different data groups (*i.e.*, National, Java, and Outside Java);

3. The best method for the panel data regression of all data classifications was the fixed-effect model;
4. The determinants of GDRP in Java regions were DDI and DFI; HDI exerted no significant effect. Finally;
5. The determinants of GDRP in regions outside Java and at the national level were DDI, DFI, and HDI.

A policy to be drawn is the discretion to improve human development index in outside Java. In Java areas, market forces had brought about the human development index to its optimum level, but not so for outside Java areas.

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APPENDIX A: Chow Test

Table A1. Common Intercept-National Level

Cross-sections : 33; Total pool (balanced) observations: 297			
Dependent Variable: RGDP			
Variable	Coeff	t-Stat	
Intercept	-6.16E+08	-3.576423	***
DDI	26942.50	13.74152	***
DFI	111998.6	11.23460	***
HDI	10376963	3.936322	***
Sum squared resid	9.47E+18		

Table A2. Common Intercept-Regions in Java

Cross-sections: 6; Total pool (balanced) observations: 54			
Dependent Variable: RGDP			
Variable	Coeff	t-Stat	
Intercept	24442655	0.036322	
DDI	34756.78	7.406893	***
DFI	84507.23	3.985124	***
HD?	2502993.	0.255048	
Sum squared resid	4.85E+18		

Table A3. Common Intercept-Regions outside Java

Cross-sections included: 27; Total pool (balanced) observations: 243			
Dependent Variable: RGDP			
Variable	Coefficient	t-Stat	
Intercept	-6.46E+08	-5.607619	***
DDI	11759.29	6.540936	***
DFI	106941.0	6.104465	***
HDI	10892871	6.134024	***
Sum squared resid	2.56E+18		

APPENDIX B: Panel Data Regression-Fixed Effect Model

Table B1. Fixed effect panel data for national level

Dependent Variable: PDRBB			
Sample (adjusted): 2007 2015, Cross-sections included: 33			
Variable	Coeff	t-Stat	
Intercept	-3.99E+08	-9.62***	
PMDN	15001.88	6.59***	
PMA	24257.55	2.93***	
IPM	8463813.	13.78***	
R-squared	0.922697	Durbin-Watson stat	0.975349
F-statistic	89.00875	Prob(F-statistic)	0.000000

Table B2. Fixed effect panel data for regions in Java (developed regions)

Dependent Variable: PDRBB			
Sample (adjusted): 2007 2015, Cross-sections included: 6			
Variable	Coeff	t-Stat	
Intercept	-2.80E+08	-0.61	
PMDN	21842.83	4.99***	
PMA	59570.33	4.61***	
IPM	9209499.	1.35	
R-squared	0.955446	Durbin-Watson stat	1.185031
F-statistic	120.6253	Prob(F-statistic)	0.000000

Table B3. Fixed effect panel data for regions in outside Java (less developed regions)

Dependent Variable: PDRBB			
Sample (adjusted): 2007 2015, Cross-sections included: 27			
Variable	Coeff	t-Stat	.
C	-2.88E+08	-7.041932***	
PMDN	7902.074	5.578450***	
PMA	55273.19	12.20854***	
IPM	5738486.	8.960984***	
R-squared	0.905436	Durbin-Watson stat	0.987704
F-statistic	70.32568	Prob(F-statistic)	0.000000