

Implementation of the Panel Model on Investment Determinants in Indonesia in 2018-2022

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Diterima	Direvisi	Disetujui
21-07-2023	04-09-2023	04-09-2023

Abstract - Investment plays an essential role in the economic growth of a country. A country's ability to attract investment in various sectors can positively impact infrastructure development, job creation, and improving people's welfare. This study aims to determine the effect of the Gross Regional Domestic Product (GRDP), Regional Income, and Human Development Index (HDI) on investment in Indonesia. The variables of Domestic Investment and Foreign Investment measure investment. Data is sourced from the BPS-Statistics Indonesia for the 2018-2022 period—the statistical method used with multiple linear regression with panel data. Based on panel model testing, the PCSE model is the best. Simultaneously, all variables affect investment in Indonesia. Partially, GRDP, Regional Income, and HDI have a significant positive effect on investment in Indonesia. Based on the results of this study, comprehensive policies related to macro-social economics are needed so that the level of investment continues to increase.

Keywords: GRDP; HDI; Income; Investment

INTRODUCTION

Investment is one of the essential aspects of economic growth and development. It is the process of allocating resources in hopes of making a profit or return in the future. Investment in a country can come from within the country or from abroad. Various factors can affect the success or failure of an investment.

One factor that affects investment is a country's economic condition. The size of the regional economy can be in the form of Gross Domestic Product (GDP) and Gross Regional Domestic Product (GRDP) (Utma & Rakhman, 2019). An increase in GDP can positively influence investment (Asri et al., 2018). When a region or country experiences significant economic growth, this can create a more attractive climate for investors (Wulandar & Maulana, 2014). An increase in GDP can indicate more significant market potential, increased demand, and better economic stability. This result can give confidence to investors to invest their capital in long-term investments, such as infrastructure development, factory establishment, or the development of specific industrial sectors.

Another factor that can affect the entry of investment is the Human Development Index (HDI) (Desmintari & Lina Aryani, 2022). HDI is an indicator used to measure a country's level of human welfare and development. HDI includes life

expectancy, education, and per capita income—investment in Response to Welfare. As people's welfare levels increase, per capita income increases, access to education and health care increases, and life expectancy is longer, creating a more attractive investment climate. Improving the Quality of Human Resources: High HDI indicates investment in education and public health (Wulandari, 2019). Better quality human capital can increase productivity and innovation, which in turn can attract investment. Investors look for locations with a skilled and trained workforce and healthy communities, which can provide a competitive advantage in the long run.

Another factor that affects investment is Regional Income (Astikawati & Sore, 2021). Regional income is a source of revenue obtained by a region through revenues from various sectors, such as taxes, levies, natural wealth products, etc. The influence of regional income on investment is essential to study to understand the relationship between the availability of regional financial resources and investment decisions (Setyaningsih & Kusuma, 2019). Regional Income can use infrastructure improvement through sufficient Regional Income to develop infrastructure that supports investment, such as highways, ports, airports, and other transportation facilities. The availability of good infrastructure can increase the

attractiveness of a region for investors because it can facilitate accessibility, logistics, and mobility of goods and services.

Based on the background above, it is important to know the factors that influence investment to create a good investment climate in an area. Some studies still do not combine the influence of the three variables above. Apart from that, research generally only looks at the influence on investment in general without distinguishing whether the investment originates from domestic or foreign investment. Therefore, this study aims to determine the Gross Regional Domestic Product (GRDP), Regional Income, and Human Development Index (HDI) to investment in 34 provinces in Indonesia in 2018-2012.

METHOD

This research method uses quantitative methods. The study looked at the influence between variables (Sugiyono, 2019). The data used in this study came from publications from the Central Statistics Agency. This research focuses on all provinces in Indonesia with a research period of 2018-2022. The dependent and independent variables in this study can be seen in Table 1.

Table1. Variable Research

Dependent Variables	Unit	Data Scale	Data Formation
Domestic Investment	Billion Rp	Ratio	Natural logarithms
Foreign Investment	Million US	Ratio	Natural logarithms
Independent Variables	Unit	Data Scale	
Gross Regional Domestic Product (GRDP)	Trillion Rp.	Ratio	Natural logarithms
Regional Income	Trillion Rp	Ratio	Natural logarithms
Human Development Index (HDI)	Points	Ratio	

The regression model used is panel data regression analysis. There are three types of modeling in panel data regression, namely the common/pooled Model, fixed-effect Model, and random effect model (Baltagi, 2005). Model selection tests are performed to determine the best Model that informs the

relationship between variables. Panel selection tests can be seen in Table 2.

Table2. Panel Model Selection Test

Panel Test	Model	Null Hypothesis	Alternative Hypotheses
LM BP Tests		<i>Pooled/common Model is better than Fixed</i>	<i>Fixed Model is better than Pooled/ common Model</i>
Chow Test		<i>Pooled/common Model is better than a Random</i>	<i>Random Model is better than Pooled/Common Model</i>
Hausman test		<i>A random Model is better than Fixed</i>	<i>A fixed Model is better than a Random</i>

After selecting the best Model, a classic assumption test is carried out. This test ensures that the Model can be used to see the influence between variables and predict the dependent variable's value

from the independent variable's known value (Gujarati, 2004). The classical assumption test can be seen in Table 3.

Table3. Classical Assumption Test

Assumption Test	Null Hypothesis	Alternative Hypotheses
Shapiro Wilk Test	Normally distributed data	Data is not normally distributed
Breusch Pagan Test	Homokedastis data variants	Heterokedastis data variants
Wooldridge Test	Non-Autocorrelation Model	Autocorrelation Model

Once the best Model has been selected and meets the classical assumptions, the next step is to test the Model's goodness (Walpole, 2012). The merits of model tests can be seen in Table 4. After

all the test criteria of the Model are met, the interpretation of the formed regression equation is carried out.

Table4. Goodness Test Model

The goodness of Fit Test	Null Hypothesis	Alternative Hypotheses	Reject Ho
Test Coefficient of Determination / adjusted R square	R square > 0.5		
Simultaneous Test / Chi-square test	Model Not fit/ All variables have no effect	Model fit / at least one variable has a significant effect	Prob. value < 0.05
Partial Test / T Test	Certain independent variables have no effect	Influential independent variables	Prob. value < 0.05

The regression equation in this study is as follows:

$$\begin{aligned} \ln Domestic Investment &= \beta_0 + \beta_1 \ln GRDP \\ &+ \beta_2 \ln Regional Income \\ &+ \beta_3 HDI + \varepsilon_1 \end{aligned}$$

$$\begin{aligned} \ln Foreign Investment &= \beta_0 + \beta_1 \ln GRDP \\ &+ \beta_2 \ln Regional Income \\ &+ \beta_3 HDI + \varepsilon_2 \end{aligned}$$

The hypotheses in this study are:

- H1: GRDP has a significant effect on positive investment in Indonesia
- H2: HDI has a significant effect on positive investment in Indonesia
- H3: Regional Income has a significant effect on positive investment in Indonesia

The discussion begins by using descriptive Analysis to determine the characteristics of each variable in the study during the research period. Table 5 shows a descriptive analysis. The average Domestic Investment is 12520.42 billion rupiahs, with the lowest value of 50.90 billion rupiahs in West Papua Province in 2018, with the highest value of 89223.60 billion rupiahs in DKI Jakarta Province in 2022. The average Foreign Investment is 2583.54 million dollars, with the lowest value of 12.00 million dollars in West Papua Province in 2018, with the highest value of 37854.00 million dollars in DKI Jakarta Province in 2022. The average GRDP is 326.57 trillion rupiahs, with the lowest value of 25.03 trillion rupiahs in North Maluku Province in 2018, with the highest value of 1953.46 trillion rupiahs in DKI Jakarta Province in 2022. The average Regional Income is 2085.17 trillion rupiahs, with the lowest value of 0.30 trillion rupiahs in West Sulawesi Province in 2018, with the highest value of 55661.19 trillion rupiahs in DKI Jakarta Province in 2022. The average HDI is 71.17 points, with the lowest value of 60.06 points in Papua Province in 2018, with the highest value of 81.65 points in DKI Jakarta Province in 2022.

RESULT AND DISCUSSION

Table5. Descriptive Analysis

Variable	Mean	Max	Min	Std
Domestic Investment	12520.42	50.90	89223.60	1260.09
Foreign Investment	2583.54	12.00	37854.00	390.63
GRDP	326.57	25.03	1953.46	5.09
Regional Income	2085.17	0.30	55661.19	6286.04
HDI	71.17	60.06	81.65	0.30

The regression model requires no high multicollinearity between independent variables, as seen from the Variant Inflation Factor (VIF) value of less than 10. In Table 6, all independent variables

had a VIF value of less than ten in this study. This result means all independent variables are used in the Model.

Before further analyzing modeling in panel data regression analysis, panel model selection is carried out. The authors used the tests mentioned in the methodology section through three Regional Income Table 7 tests. Fixed effect models are considered the best for describing relationships between research variables

Table6. Multicollinearity Test

Variable	VIF
GRDP	1.33
Regional Income	1.14
HDI	1.27

Table7. Panel Model Test

Test	Type	Test Value	Prob. Value	Conclusion
Chow	Domestic Investment	4.82	0.00	Fixed Model is better than Common Model.
	Foreign Investment	5.50	0.00	Fixed Model is better than Common Model.
LM BP	Domestic Investment	55.08	0.00	The Random Model is better than Common Model.
	Foreign Investment	0.12	0.36	The Common Model is better than Random Model.
Hausman	Domestic Investment	6.35	0.10	The random Model is better than the Fixed Model.
	Foreign Investment	124.80	0.00	Fixed Model is better than Random Model

Once the panel model is selected, then the selected panel model is not interpreted directly but tested for classical assumptions. This test is intended so that the selected Model can be used to see the effect of prediction. The assumptions used are the assumptions of normality, heteroscedasticity, and

autocorrelation. Regional Income Table 8, normality assumptions met. The probability value is more significant than 0.05. On the other hand, there is still a violation of heteroscedasticity and the assumption of autocorrelation. The probability value of each test is less than 0.05.

Table8. Classical Assumption Test

Test	Type	Test Value	Prob. Value	Conclusion
Shapiro Wilk	Domestic Investment	1.27	0.53	Normality
	Foreign Investment	0.07	0.47	
Breusch Pagan	Domestic Investment	24.16	0.00	Heteroscedasticity
	Foreign Investment	4.78	0.03	
Wooldridge	Domestic Investment	24.741	0.00	Autocorrelation
	Foreign Investment	109.20	0.00	

Due to heteroscedasticity violations and autocorrelation assumptions, fixed models are transformed using Panel Corrected Standard Error / PCSE models (Greene, 2018). The final mode used can be seen in Regional Income Table 9.

can explain the variation in Domestic Investment by 77.54 percent and Foreign Investment by 72.03; Other variables outside the Model influence the rest. The Regional Income Chi-square test shows that all independent variables affect Domestic Investment and Foreign Investment. These results are identified by a statistical probability value Chi-square = 0.00, more diminutive than alpha = 0.05. These results mean that the modeling done is appropriate.

From Table 9 above, the coefficient of determination value is 0.7754 Regional Income model Domestic Investment and 0.7203 Regional Income model Foreign Investment. The value of this coefficient means that all independent variables

Table 9. Hypothesis Test

Variable	Domestic Investment	Foreign Investment
GRDP	.7779**	.6143***
Regional Income	.0307***	.2075*
HDI	.0778**	.0812***
_cons	6.94***	-11.46***
r2	0.7754	0.7203
chi2	858.1231	1219.9830
p	0.0000	0.0000

Legend: * p<0.05; ** p<0.01; p<0.001

From the partial test identified with the probability value, the t-test shows all significant, influential variables where the probability value is 0.000 < alpha 0.05. The regression equation is formed:

$$\widehat{\text{Domestic Investment}} = 6.94 + 0.7779\text{LGRDP} + 0.0307\text{Regional Income} + 0.0778\text{HDI}$$

$$\widehat{\text{Foreign Investment}} = 11.46 + 0.6143\text{LGRDP} + 0.2075\text{Regional Income} + 0.0812\text{HDI}$$

Discussion:

GRDP has a significant positive effect on Domestic Investment and Foreign Investment, with coefficients of 0.7779 and 0.614, respectively. This result means that every 1 percent increase in GRDP will increase Domestic Investment by 0.779 percent and Foreign Investment by 0.614 percent, assuming other variables are constant. This study's results align with Asri et al. (2018) and Wulandar & Maulana (2014) (Wulandar & Maulana, 2014). The high level of regional GDP can be a pull factor for investment. Areas with large GDPs tend to have more substantial financial resources to support investment projects. This result can create an attractive environment for investors to invest long-term (Suwandika & Yasa, 2012). Successful investment can create sustainable economic growth, which in turn will increase regional GDP. Thus, there is a synergy between investment and regional GDP, where investments can contribute to increasing regional incomes while sufficient regional GDP can create a conducive environment for investment.

Regional Income with coefficients of 0.0307 and 0.2075, respectively. This result means that every 1 percent increase in Regional Income will increase Domestic Investment by 0.0307 percent and Foreign Investment by 0.2075 percent, assuming other variables are constant. This study's results align

with Setyaningsih & Kusuma (2019). A high level of regional Income can be a pull factor for investment. Areas with large PAD tend to have more substantial financial resources to support investment projects. Regional Income can create an attractive environment for investors to make long-term investments. Local governments have an essential role to play in encouraging investment. By optimizing PAD management, the government can provide attractive incentives and facilities for investors to invest in the area. For example, the government can provide ease of licensing, adequate infrastructure, and legal certainty needed to support investment.

HDI with coefficients of 0.0778 and 0.0812, respectively. This result means that every increase of 1 HDI point will increase Domestic Investment by 0.0778 percent and Foreign Investment by 0.0812 percent, assuming other variables are constant. This study's results align with Wulandari's (2019) and Atiskawati and Sore's (2021) results (Astikawati & Sore, 2021). High HDI can also be a pull factor for investment. Countries or regions with high HDI tend to have a more stable environment, access to good infrastructure, and quality human resources. HDI can attract investors to make long-term investments as they see the potential for better economic growth and the sustainability of their investments. Investment can be in the form of physical capital investment, such as infrastructure and production equipment, and human capital investment, such as education and health (Sjafii, 2009). In this context, HDI can influence investment by improving human capital quality and access to better education and health.

Conclusion

Based on panel model testing, the PCSE model is the best. The use of PCSE modeling in overcoming autocorrelation and heteroskedastic problems Determinant of Investment models are used. Simultaneously, all variables affect investment in Indonesia. Partially, GRDP, Regional Income, and HDI significantly positively affect investment in Indonesia. Increasing GRDP, Regional Income, and HDI will increase Indonesia's investment level.

Based on the results of this study, comprehensive policies related to macro-social economics are needed so that the level of investment in Indonesia continues to increase. Based on research results, the development of quality human resources is one of the keys to increasing investment and economic development. For further research, adding other potential independent variables that affect investment rates, such as unemployment, poverty, economic stability, and others, may be possible. At

the same time, subsequent modeling can use other panel models by using random effects, named panels, or spatial effects in panel models.

Sektor Riil: Studi Kasus di Indonesia. *Jurnal Ekonomi Dan Pembangunan*, 19(2), 275–289.

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