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Analysis of Simultaneous Models of GRDP and Investment In Lampung Province Using The Two Stage Least Square Method

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Abstract

The perpose of this study is to analyze the relatiohship between GRDP and investment in Lampung Province; the influence of labor, wages, and investment on GRDP in Lampung Province; and inflation, interest rates, and GRDP on investment in Lampung Province. This study uses secondary data and uses quarterly data from 2008 – 2022. Data analysis uses a simultaneous equation model with the Two- Stage Least Square (TSLS) method. The results of this study indicate that the simultaneous regression analysis shows that there is a relationship between GRDP and investment in Lampung Province; the independent variables of labor, wages, investment have a positive and significant effect on GRDP in Lampung Province; the independent variables of inflation, interest rates have a negative and significant effect on investment in Lampung Province. Meanwhile, GRDP has a positive and significant effect on investment in Lampung Province.

Keywords: GRDP, Investment, Labor, Wages, Inflation, Interest Rates.

INTRODUCTION

Economic development is a process that causes an increase in the per capita income of a country's population over a certain period of time. One of the main indicators for assessing the economic development of a region or country is Gross Regional Domestic Product (GRDP) (Yoel, 2019). Gross Regional Domestic Product (GRDP) is the total value of all final output produced by the economy in a region, whether produced by

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local residents or residents from outside the region who reside in the region (Todaro, 2002).

Labor is one of the crucial factors that plays a role in increasing aa region's GRDP (Todaro, 2000). To support work productivity, compensation is done with wages received by workers. According to the National Wage Research Council, wages are defined as a receipt in return for the provision of a person's work results to tha recipient of the work results for a job or service that has been or will be done.

Investment plays an important role in driving economic growth. To support economic development, the government needs to establish policies that encourage investment that provides mutual benefits for the government, the private sector, and the community. The creaction of a healthy and competitive investment climate is expected to encourage the development of mutually beneficial investment in the development process (Muhammad, 2016).

In order to create a healthy investment climate, the government often implements policies to encourage economic growth, wages and pay attention to inflation and interest rates. In encouraging economic growth, investment is needed, both from the government and the private sector. Because investment is an expenditure that will increase the number of means or production in society, which will ultimately increase income so that economic growth can be achieved (Dahlan, 2019).

RESEARCH METHODS

Simultaneous equations are equations in which the dependent variable in one or more equation is also an independent variable in another equation (Ajija, 2011). This study uses time series data from the Central Statistics Agency (BPS) of Lampung Province for the quarterly period (Q1 – Q4) form 2008 – 2022 with the simultaneous equation method and the Two Stage Least Square (TSLS) estimation technique with Eviews v.12 software. The following are 2 equation models determined in this study, namely :

$$\mathbf{GRDP}_{it} = \pi_0 + \pi_1 L_{it} + \pi_2 W_{it} + \pi_3 I_{it} + \pi_4 i_{it} + v_{it} \quad \text{.....(3.1)}$$

$$\mathbf{I}_{it} = \pi_5 + \pi_6 L_{it} + \pi_7 W_{it} + \pi_8 I_{it} + \pi_9 i_{it} + w_{it} \quad \text{.....(3.2)}$$

Where :

$GRDP_{it}$ = gross regional domestic product per capita of province *i* in year *t*

I_{it} = domestic investment in province *i* in year *t*

L_{it} = labor force level of province *i* in year *t*

W_{it} = provincial minimum wage *i* in year *t*

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I_{it} = provincial inflation *i* in year *t*
iI_{it} = deposit interest rate provinsi *i* in years *t*
e_{it},u_{it} = error term

form the two equations above, an identification test was carried out which showed the following results :

Table 1. Identification Test Results

Equality	Identification Test Results	Conclusion
(1)	K – k > m – 1	*Over Identified*
(2)	K – k > m – 1	*Over Identified*

where :
K = the number of predetermined exogenous variables in the model
m = the number of predetermined exogenous variables in the equation
k = the number of endogenous variables in the equation

criteria :
K – k < m – 1 : called *under identification*
K – k = m – 1 : called *exact identification*
K – k > m – 1 : called *over identification*

From the results of the identification test, it is know that the model equation in this study produces an identification that is identified with the criteria K – k > m – 1 ; 2 > 1 so that it can be continued with the TSLS (*Two Stage Least Square*) estimation technique for simultaneous equations. *Two stage least square* (TSLS) is called the *Two Stage Least Square* method and this method is used in structural equations that are easier to identify (Ajija, 2011).

Two Stage Least Square (TSLS) is one of the regression methods included in the structural equation analysis group. This method is a development of the OLS (*Ordinary Least Square*) method which is commonly used in regression analysis calculations. TSLS is used in conditions where there is a correlation between the errors generated in the correlated model and its independent variables (Huang, 2019). The TSLS estimation results can be presented in the following table.

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Table 2. TSLS Estimation Results

Estimation Method : Two-Stage Least Square **Sampel : 2008Q1 2022Q4** **Included observations : 60**				
	Coefficient	Std. Error	t-Statistic	Prob.
GRDP	0.258975	0.103001	2.514312	0.0148
Investment	0.771256	0.184824	4.172930	0.0001
Labor	1060.458	407.6984	2.601085	0.0119
Wages	0.007468	0.001225	6.097321	0.0000
Inflation	-268.2605	109.1781	-2.457091	0.0171
Interest Rate	-821.6910	286.3937	-2.869096	0.0058
Determinant residual covariance				
Equation : $GRDP_{it} = \pi_0 + \pi_1 L_{it} + \pi_2 W_{it} + \pi_3 I_{it} + \pi_4 i_{it} + v_{it}$ Instrument : C, L, W, I, i, e Observations : 60				
	R-squared	0.841427	Mean dependent var	23526.42
	Adjusted R-squared	0.832932	S.D. dependent var	5071.576
	S.E. of regression	2072.955	Sum squared resid	2.41E+08
	Durbin- Watson stat	0.171513		
Equation : $I_{it} = \pi_5 + \pi_6 L_{it} + \pi_7 W_{it} + \pi_8 I_{it} + \pi_9 i_{it} + w_{it}$ Instrument : C, L, W, I, i, u Observations : 60				
	R-squared	0.594659	Mean dependent var	3555.083
	Adjusted R-squared	0.572944	S.D. dependent var	3346.811
	S.E. of regression	2187.125	Sum squared resid	2.68E+08
	Durbin- Watson stat	2.476572		

Sorce : processed data (2025), Eviews v.12

$GRDP_{it} = (-57922.15) + (1060.458L_{it}) + (0.007468W_{it}) + (0.771256I_{it}) + (-821.6910i_{it}) + v_{it}$

Based on the estimation results above, the R^2 value is 0.841 or 84.1%, this indicates that the dependent variable of gross regional domestic product can be explained by the independent variables of investment, labor, and wages by 84.1% while the remaining 15.9% is explained by other factors outside the model in the study. R^2 of 0.8414

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indicates that there is a fairly strong relationship between the independent variables and the dependent variable because it has a coefficient value of more than 0.5. Based on the table above, the F count value is 99.05 with a significance level of 0.000. F count > F table (99.05 > 2.77) and the research significance is 0.000 <0.05, so H_0 is rejected and H_a is accepted. Thus, investment, labor, and wages together have a significant effect on gross regional domestic product.

The t-statistic value of labor is positive at 2.601 with a significance level of 0.000 t count > t table (2.601 > 2.003) and a research significance of 0.000 < 0.05, then H_0 is rejected and H_a is accepted. Thus, labor has a positive and significant effect on gross regional domestic product. The t-statistic value of wages is positive at 6.097 with a significance level of 0.000 t count > t table (6.097 > 2.003) and a research significance of 0.000 < 0.05, then H_0 is rejected and H_a is accepted. Thus, wages have a positive and significant effect on gross regional domestic product. And the t-statistic value of investment is positive at 4.173 with a significance level of 0.000 t count > t table (4.173 > 2.003) and research significance of 0.000 < 0.05 then H_0 is rejected and accepts Ha. Therefore, investment has a positive and significant effect on gross regional domestic product.

$$\mathbf{I_{it} = (4149.085) + (1060.458L_{it}) + (0.007468W_{it}) + (-268.2605I_{it}) + (-821.6910i_{it}) + w_{it}}$$

Based on the estimation results above, the R^2 value is 0.595 or 59.5%, this shows that the dependent variable investment can be explained by the independent variables of gross regional domestic product, inflation, and interest rates by 59.5% while the remaining 40.5% is explained by other factors outside the model in the study. R^2 of 0.595 shows that there is a fairly strong relationship between the independent variables and the dependent variables because it has a coefficient value of more than 0.5. Based on the table above, the F count value is 27.38 with a significance level of 0.000. F count > F table (27.38 > 2.77) and the research significance is 0.000 <0.05, so H_0 is rejected and H_a is accepted. Thus, gross regional domestic product, inflation, and interest rates together have a significant effect on investment.

The t-statistic value of inflation is negative at -2.457 with a significance level of 0.000 t count < t table (-2.457 < 2.003) and a research significance of 0.000 < 0.05, then H_0 is accepted and H_a is rejected. Therefore, inflation has a negative and significant effect on investment. The t-statistic value of interest rates is negative at -2.869 with a significance level of 0.000 t count < t table (-2.869 < 2.003) and a research significance of 0.000 < 0.05, then H_0 is accepted and H_a is rejected. Therefore, interest rates have a

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negative and significant effect on investment. And the t-statistic value of gross regional domestic product is positive at 2.514 with a significance level of 0.000 t count > t table (2.514 > 2.003) and research significance of 0.000 <0.05 then H_0 is rejected and accepts H_a. Therefore, gross regional domestic product has a positive and significant effect on investment.

DISCUSSION

Based on the research results, the workforce has a positive and significant effect on gross regional domestic product. This means that the higher or lower the level of labor, the higher or lower the GRDP will be. Based on this analysis, this is in line with the research results of Eddy (2022) that the workforce has a positive effect on GRDP.

Wages have a positive and significant effect on gross regional domestic product. This means that the higher or lower the wages will affect the high or low GRDP. Based on this analysis, this is in line with the results of Etik's research (2023) that wages have a positive effect on GRDP.

Investment has a positive and significant effect on gross regional domestic product. This means that the higher or lower the investment, the higher or lower the GRDP. Based on this analysis, this is in line with the results of Nurtalia's research (2021) that investment has a positive effect on GRDP.

Inflation has a negative and significant effect on investment. This means that higher or lower inflation will not affect investment. Based on the results of this analysis, this is in line with the results of Jumaedi's research (2023) that inflation has a negative effect on investment.

Interest rates have a negative and significant effect on investment. This means that higher or lower interest rates will not affect investment. Based on the results of this analysis, this is in line with the results of Belinda's research (2024) that interest rates have a negative effect on investment.

Gross regional domestic product has a positive and significant effect on investment. This means that the higher or lower the GRDP will affect investment. Based on the results of the analysis, this is in line with the results of Novarli's research (2019) that GRDP has a positive effect on investment.

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CONCLUSION AND SUGGESTIONS

1. Labor has a positive and significant effect, wages have a positive and significant effect, and investment has a positive and significant effect on gross regional domestic product in Lampung Province.
2. Inflation and interest rates have a negative and significant effect on investment in Lampung Province. Gross regional domestic product has a positive and significant effect on investment in Lampung Province.

Recommendation: Lampung Provincial Government needs to prioritize improving the quality of human resources through vocational education and job training to strengthen the contribution to GRDP. Price stability needs to be maintained through coordination of monetary policy with Bank Indonesia to create a conducive investment climate. In addition, fiscal incentives, infrastructure improvements, and simplification of administrative services need to be optimized to attract domestic and foreign investment.

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