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Modeling Economic Growth in Papua Province Using Panel Data

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ABSTRACT

This study aims to determine and analyze simultaneously the effect of Average Years of Schooling, and School Participation Rate on GRDPHB in Papua Province, the type of research used is the panel data regression model. This study uses panel data regression methods, the data used involves a combination of time series and cross-section data. The results showed a positive and significant effect of RLS and TPAK on GRDPHB in Papua Province with an adjusted R Square value of 0.998016 or 99.80%. This finding confirms the importance of focusing on improving the quality of education along with maintaining a high labor force participation rate as a strategy to strengthen Papua's economic base. Thus, human development and strengthening human resources will be the key to sustainable economic growth in Papua.

Keywords *Average Years of Schooling, Labor Force Participation Rate, GRDPHB*
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INTRODUCTION

There are 278,696.2 million people in Indonesia and it will be the fourth most populous country in the world by 2023. As a result, Indonesia's labor resources are now larger. Ultimately, the labor market determines labor supply (Khoirun & Nurhayati, 2023). Economic development and economic growth are closely related, but they have different focuses and concepts. Economic growth emphasizes more on the long-term increase in per capita output, which is reflected in the increase in Gross Domestic Product (GDP) and national income. On the other hand, economic development encompasses more than just economic growth. It involves efforts to create conditions that support sustainable, inclusive, and equitable economic growth.

Economic development includes aspects such as income equality, improved quality of life, job creation, better access to basic services such as education and health, and environmental sustainability. Thus, while economic growth is an important indicator, economic development broadens its scope to achieve

broader goals for social welfare and progress. In the Indonesian context, national development often integrates these two concepts, with a focus on sustainable and inclusive economic growth to improve the welfare of the entire society. (Raziqiin & Falian, 2018).

In the context of Papua, a region that has special challenges in economic development and economic growth, a deep understanding of the relationship between factors such as average years of schooling and school enrollment rates with population growth can provide valuable insights into planning effective development policies. Therefore, this study aims to model economic development and growth in Papua Province using panel data, considering key variables such as average years of schooling and school enrollment rate as the main predictors of population growth. Thus, this study has relevant practical implications for policy-making in Papua to improve people's welfare and promote sustainable and inclusive development.

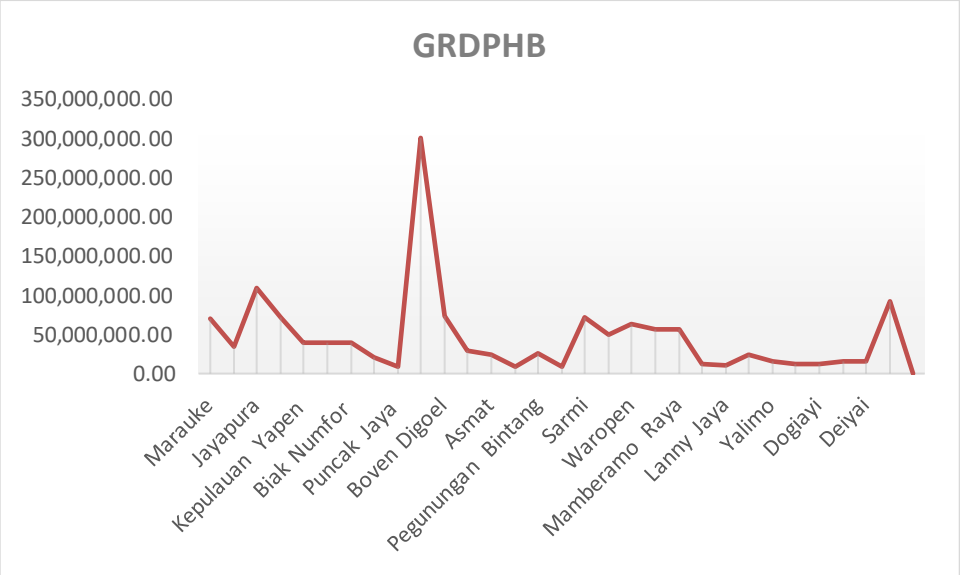

Figure 1.
Movement of GRDPHB of Papua Province

Analysis of GRDPHB data in Papua shows variations in economic growth across districts and cities over the 2018-2022 period. Districts such as Merauke, Mimika, and Jayapura City show relatively stable and positive growth from year to year, reflecting strong economic potential in certain sectors such as mining and trade. However, some regions such as Puncak Jaya, Nduga, and Pegunungan Bintang show significant fluctuations in growth, possibly influenced by factors such as political instability, lack of investment, or infrastructure limitations. The comparative analysis between regions also highlights the disparity in economic growth between urban and rural areas in Papua. In addition, data outliers such

as in 2021 for Puncak Jaya and Nduga require further investigation to understand their causes. Taking this analysis into account, appropriate strategies can be formulated to support inclusive and sustainable economic growth across Papua, with a focus on developing key sectors and strengthening infrastructure and policies that support local economic growth.

RESEARCH METHODE

This study uses panel data obtained from the North Sumatra Central Bureau of Statistics (BPS) and the satudata website. It consists of cross-section data from 33 districts/cities in North Sumatra Province and *a time series* for the period 2018-2022. The data went through a preprocessing stage, including the removal of incomplete or irrelevant data and data cleaning to reduce potential bias in the analysis.

In choosing the most suitable regression model, based on the results of the Chow test and Hausman test, the best model in this study is FEM (*Fixed Effect Mode*). The data is tested against relevant assumptions. Since the total number is > 100, the assumption test conducted will focus on two assumptions, namely multicollinearity and heteroscedasticity. After ensuring that the data meets the relevant assumptions, regression analysis is conducted using the *Panel Least Squares* method. The independent variables studied are the Open Unemployment Rate (X1), Regional Minimum Wage (X2), and Inflation (X3) while the dependent variable is the number of poor people (Y). The formula for the panel *least squares regression* analysis equation applied is :

$$\mathbf{GRDPHB = \beta_0 + \beta_1 XI + \beta_2 X2 + e_{it} .....(1)}$$

PDRBHB = Gross Regional Domestic Product at Current Prices

β_0 = Constant

$\beta_1, \beta\beta_{2,3}$ = Regression Coefficient

X1 = Average Years of Schooling (RLS)

X2 = Regional Minimum Wage (TPAK)

e_{it} = Standard Error

RESULT AND DISCUSSION

Papua Province, as a region rich in natural resources and cultural diversity, has been a major focus of economic development efforts in Indonesia. However, the unique challenges faced by Papua, ranging from difficult geography to socio-

economic problems, require a comprehensive approach to formulating effective development policies. In this context, research using panel data regression becomes relevant in analyzing the factors that influence economic growth in Papua. This study aims to explore the relationship between various variables, including Average Years of Schooling (RLS), Labor Force Participation Rate (TPAK), and Gross Regional Domestic Product at Current Prices (GRDPHB) in Papua Province. The panel data regression approach allows for a more in-depth analysis, taking advantage of the combination of time series and cross-section data to overcome data limitations. Thus, this study is expected to provide more comprehensive insights for policymakers in formulating sustainable and inclusive development strategies in Papua. In the following sections, the results and discussion of this study will be presented in detail, including significant findings relating to the factors affecting GRDPHB in Papua Province.

Table 1.
Selection of the Best Panel Data Model

Testing	Results	Decision
Chow Test	Prob. > 0.05	CEM
	Prob. < 0.05	FEM
Hausman Test	Prob. > 0.05	REM
	Prob. < 0.05	FEM
Rangrae Multiplier Test	Prob. > 0.05	CEM
	Prob. < 0.05	REM

Chow Test

Table 2.
Data processing results of the Chow Test

Redundant Fixed Effects Tests			
Equation: Untitled			
Test cross-section fixed effects			
Effects Test	**Statistic**	**d.f.**	**Prob.**
Cross-section F	1.819263	(4,17)	0.1716
Cross-section Chi-square	8.551636	4	**0.0733**

According to (Napitupulu, 2021) probability value (Prob.) Cross-section random, if the value is > 0.05 then the selected model is CEM, but if < 0.05 then the selected model is FEM. According to the analysis conducted, the Prob value is 0.0733 > 0.05, so the selected model is the CEM model.

International Journal of Education, Social Studies, And Management (IJESSM)
Volume 4, Issue 2, June 2024
Page 412-422

Hausman Test

Table 3.
Data Processing Results of the Hausman Test

Correlated Random Effects – Hausman Test			
Equation: Untitled			
Test cross-section random effects			
Test Summary	**Chi-Sq. Statistic**	**Chi-Sq. d.f.**	**Prob.**
Cross-section random	0.029599	2	**0.9853**

According to (Napitupulu, 2021) probability value (Prob.) Cross-section random, if the value is> 0.05 then the selected model is REM, but if < 0.05 then the selected model is FEM. According to the analysis conducted, the Prob value is 0.9853 > 0.05, so the REM model was chosen.

Language Multiplier Test

This is done to compare/select which model is best between CEM and REM. First, make sure that the model window has displayed the CEM model.

Table 4.
Data Processing Results of the LM test

Lagrange multiplier (LM) test for panel data			
Date: 03/27/24 Time: 21:03			
Sample: 2018 2022			
Total panel observations: 24			
Probability in ()			
Null (no rand. effect)	**Cross-section**	**Period**	**Both**
Alternative	**One-sided**	**One-sided**	
Honda	0.563049	-0.345080	0.154127
	(0.2867)	(0.6350)	(0.4388)
King-Wu	0.563049	-0.345080	0.154127
	(0.2867)	(0.6350)	(0.4388)
SLM	0.761305	0.234717	--
	(0.2232)	(0.4072)	--
GYM	--	--	0.317024
	--	--	(0.5001)

According to (Napitupulu, 2021) If the value is> 0.05, the selected model is CEM, but if < 0.05, the selected model is REM. According to the analysis carried out, the Prob value is 0.2867 < 0.05, so the REM model was chosen. Based on the Chow Test, Hausman Test, and LM Test, the best model to use is the REM Model.

Classical Assumption Test

Multicollinearity Test (*still problematic*)

Table 5.
Data Processing Results of Multicollinearity Test

	RLS	TPAK
RLS	1	0.8022878
TPAK	0.8022878	1

According to (Napitupulu, 2021) The pairwise correlation method to detect multicollinearity will be more useful because by using this method researchers can find out in detail what independent variables have a strong correlation. Decision-making for the pairwise correlation method is done when:

a) The correlation value of each independent variable <0.85 does not reject Ho or there is no multicollinearity problem.
b) The correlation value of each independent variable > 0.85 then reject Ho or there is a multicollinearity problem.
c) The correlation coefficient of X1 and X2 is 0.8022878 < 0.85. So it can be concluded that it is free of multicollinearity or passes the multicollinearity test.

Heterocendasticity Test

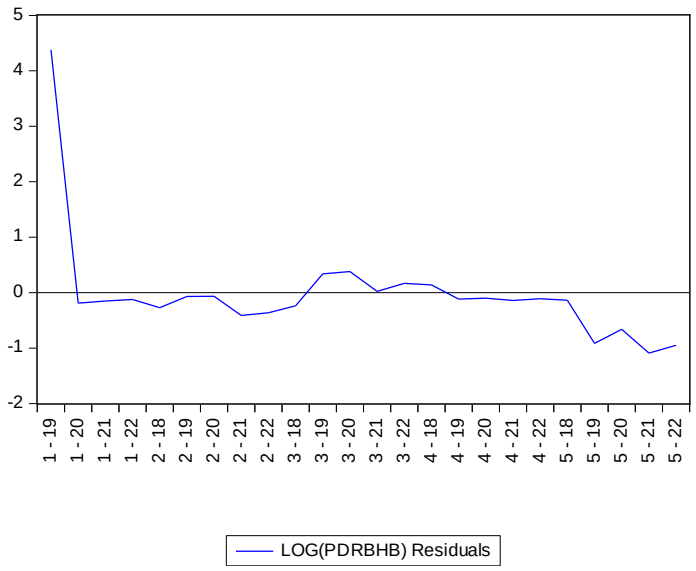

Figure 2.
Heteroscedasticity Test Chart

According to (Napitupulu, 2021) From the graph on the fluctuating blue line, it can be seen that it does not pass (500 and -500), meaning that the residual variance is the same. Therefore, there are no symptoms of heteroscedasticity or

pass the heteroscedasticity test. From the graph above, the slope of the graph is still between (-2 and 5) so it has not passed (500 and -500), meaning that the residual variance is the same. Therefore, there are no symptoms of heteroscedasticity or pass the heteroscedasticity test.

Panel Data Regression Equation

$$LOG(PDRBHB) = 3.2148318924 + 0.00417180279758*RLS + 0.0141660581608*TPAK$$

1. The constant value of 3.2148318924 means that, without the variable RLS (X1). TPAK (X2) is zero, then PDRBHB (Y) will increase by 53.22%.
2. The beta coefficient value of the RLS variable (XI) is 0.0041 if the value of other variables is constant and variable XI has an increase of 0.0041%, then the GRDPHB variable (X1) will increase by 0.0041%. Vice versa, if the value of other variables is constant and variable XI decreases by 0.0041%, then variable Y will decrease by 0.0041%.
3. The beta coefficient value of the TPAK (X2) variable is 0.0141, if the value of other variables is constant and the X2 variable increases by 0.0141%, the GRDPHB (Y) variable will decrease by 0.0141%. Vice versa, if the value of other variables is constant and the X2 variable decreases by 6.5%, the Y variable will increase by 0.0141%.

Hypothesis Test Results

1. Results of the t-test

Table 6.
Results of the t-test

Dependent Variable: LOG(GRDPHB)				
Method: Panel Least Squares				
Date: 04/08/24 Time: 13:11				
Sample: 2018 2022				
Periods included: 5				
Cross-sections included: 5				
Total panel (unbalanced) observations: 24				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	3.214832	0.026095	123.1951	0.000s0
RLS	0.004172	0.001132	3.685835	0.0014
TPAK	0.014166	0.000240	58.95465	0.0000

The effect of the independent variables on the dependent variable partially is as follows:

a) The results of the t-test on the RLS variable (XI) obtained a calculated value of 3.685835> t table, namely 1.976692198 and sig value. 0.0014 <0.05, then Ha is accepted and Ho is rejected, meaning that the RLS variable (XI) has a significant effect on PDRBHB (Y).

b) The t-test results on the TPAK (X2) variable obtained a value of 1 count of 58.95465> t table, namely 1.976692198 and sig value. 0.0000 <0.05, then Ho is accepted and Ha is rejected, meaning that the TPAK variable (X2) has no significant effect on GRDPHB (Y).

F test

Table 7.
Results of the F test

R-squared	0.998188
Adjusted R-squared	0.998016
S.E. of regression	0.004898
Sum squared resid	0.000504
Log-likelihood	95.20234
F-statistic	5785.379
Prob(F-statistic)	0.000000

The calculated F value of 5785.379> F table is 8.54568478 and sig value. 0.000000 <0.05, then Ho is rejected din Ha is accepted, meaning that the variables RLS (X1), and TPAK (X2), have a simultaneous effect on PDRBHB (Y).

Test Coefficient of Determination $(R)^2$

Table 8.
Results of Data Analysis of
the Coefficient of Determination Test $(R)^2$

R-squared	0.998188
Adjusted R-squared	0.998016
S.E. of regression	0.004898
Sum squared resid	0.000504
Log-likelihood	95.20234
F-statistic	5785.379
Prob(F-statistic)	0.000000

The adjusted R Square value of 0.998016 or 99.80% The coefficient of determination shows that the independent variables consisting of TPT (X1), UMR (X2), and Inflation (X3) can explain the variable number of poor people (Y) in the 5 largest cities in North Sumatra by 95.280%. The remaining 0.20% (100 adjusted R Square value) is explained by other variables that are not included in this research model.

Average Years of Schooling Against GRDPHB

This research was conducted using the panel data regression method on the variables of Open Unemployment Rate, Regional Minimum Wage, and Inflation on Poverty. The data used is a combination of time series data and cross-section data, the results of data processing obtained LOG (PDRBHB) = 3.2148318924 + 0.00417180279758 *RLS + 0.0141660581608 *TPAK. From the panel data regression model equation for Average years of schooling (X1), it can be stated that the variable coefficient value of the RLS variable beta coefficient (XI) is 0.0041

if the value of other variables is constant and variable XI has increased by 0.0041%, then the PDRBHB variable (X1) will increase by 0.0041%. Vice versa, if the value of other variables is constant and variable XI decreases by 0.0041%, then variable Y will decrease by 0.0041%. So it is concluded that RLS on PDRBHB has a positive and significant effect, this is by the hypothesis which states that the average length of schooling has a positive and significant effect.

Labor Force Participation Rate to GRDPHB

From the panel data regression model equation for Labor Force Participation Rate (X2), it can be stated that the beta coefficient value of the TPAK (X2) variable is 0.0141, if the value of other variables is constant and the X2 variable has increased by 0.0141%, the GRDPHB (Y) variable will decrease by 0.0141%. Vice versa, if the value of other variables is constant and the X2 variable decreases by 0.0141%, the Y variable will increase by 0.0141%, in this study it can be stated that TPAK has a positive effect on GRDPHB in Papua Province. The t-test results on the RLS (XI) variable obtained a calculated value of 3.685835> t table, namely 1.976692198 and sig value. 0.0014 <0.05, then Ha is accepted and Ho is rejected, meaning that the RLS variable (XI) has a significant effect on GRDPHB (Y). So it is concluded that TPAK on GRDPHB has a positive and significant effect, this is by the hypothesis which states that the Labor Force Participation Rate (TPAK) has a positive and significant effect.

From 2018 to 2022, Papua experienced an interesting phenomenon in the relationship between the Labor Force Participation Rate (TPAK) and Average Years of Schooling (RLS) with Gross Regional Domestic Product at Current Prices (GRDPHB). Although the TPAK and RLS only increased by 1%, the impact on GRDPHB remained positive and significant. Papua, with its abundant natural resources, should have strong economic potential. However, its low labor force participation rate and education constraints limit its economic ability to develop optimally.

During this period, despite the increase in TPAK, the poverty rate in Papua was still high. This suggests that there are other factors influencing the relationship between TPAK and GRDPHB, which may be related to limited access to education, lack of infrastructure, or even social and cultural issues. Meanwhile, the low RLS suggests that efforts to improve the quality of education need to be significantly enhanced to support more inclusive and sustainable economic growth in Papua.

Thus, while Papua's economic potential is large, challenges related to the labor force and education highlight the need for special attention from the government and other stakeholders to increase investments in education, job training, and infrastructure, as well as to address social and cultural issues that may be limiting Papua's economic progress. This reinforces the argument that improving education quality and labor force participation rates are important steps in strengthening Papua's economic base for sustainable growth.

CONCLUSION

From the results of this study, it can be concluded that the Average Years of Schooling (RLS) and Labor Force Participation Rate (TPAK) have a positive and significant influence on the Gross Regional Domestic Product at Current Prices (GRDPHB) in Papua Province. A 1% increase in RLS is followed by a 0.0041% increase in GRDPHB, while a 1% increase in TPAK will increase GRDPHB by 0.0141%. Therefore, special attention is needed from the government to increase investment in education and employment policies in Papua to achieve more inclusive and sustainable economic growth. This phenomenon suggests the need to focus on improving the quality of education while maintaining a high labor force participation rate as a strategy to strengthen Papua's economic base. Thus, human development and strengthening human capital will be key to sustainable economic growth in Papua.

Based on the results of research on the effect of Average Years of Schooling (RLS) and Labor Force Participation Rate (TPAK) on Gross Regional Domestic Product at Current Prices (GRDPHB) in Papua Province, some suggestions are:

1. Deeper analysis of the impact of education: Examine in more detail the relationship between education quality and economic growth. Research can focus on investment in education, curriculum, and access to quality education.
2. Evaluation of employment policies: Examine the effectiveness of labor policies in Papua and how they support economic growth. Consider a study on workforce training and skills.
3. Influence of other factors: In addition to RLS and TPAK, factors such as infrastructure, investment, and fiscal policy may also affect GRDPHB. Exploring the scope of this research can provide a more complete picture.
4. Comparative analysis between regions: Comparing regions in Papua to understand differences in economic and demographic conditions and how certain factors play a role in local economic growth.
5. Human capital development: Examining training programs, vocational education, and health investments that can improve labor force productivity.
6. Collaboration with stakeholders: Involving local governments, educational institutions, and the private sector in research can provide deeper insights and more relevant recommendations.
7. Comparison with other provinces: Comparing the results with other provinces in Indonesia to provide a broader context for interpretation of the results.

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