

# Projection of Gross Regional Domestic Product (GRDP) Indonesia-Malaysia of North Kalimantan Using the Least Squares Method

Herlina Herlina<sup>1</sup>, Arkas Viddy2

<sup>1,2</sup> Business Administration Department, Politeknik Negeri Nunukan, Nunukan, Indonesia herlinanawir@pnn.ac.id

*Abstract*— The purpose of this study is to determine the projected value of Regional Domestic Product (GRDP) for the Indonesia-Malaysia (Nunukan) border region and also the difference in the value of GRDP for the Indonesia-Malaysia (Nunukan) border region for 2020-2022 with the projected GRDP value for 2023-2025 using least squares method. Data analysis used different test analyses in the SPSS 25 statistical application. The data used in this study is GRDP data at current prices and constant prices in the Indonesia-Malaysia border area (Nunukan) in 2012-2022. As for the results of this research, the projected GRDP value in 2023 is 35,984,230; in 2024, it is 38,382,804, and in 2025, it is 40,781,378 (GRDP data based on current prices). The projected value of GRDP in 2023 is 17,952,185; in 2024, it is 18,618,070; in 2025, it is 19,283,955 (GDP data at constant prices). The results obtained after conducting the t-test using the SPSS statistics 25 application are a significance value (2-tailed) of 0.227 > 0.05 (for GDP data at current prices) and a significance value (2-tailed) of 0.019 > 0.05 (for GRDP data at constant prices). So, according to the independent sample decision-making basis of the t-test, H0 is accepted, and Ha is rejected. It means there is no significant difference between the actual and forecast values (GRDP data based on current/constant prices). It happened because, in that year, a worldwide disease outbreak resulted in economic instability. It is because the government has made a policy regarding social distancing.

Keywords: Projection, GRDP, Trend, Least Squares Method.

#### I. INTRODUCTION

Nunukan is one of the regencies in North Kalimantan Province, located at the northern tip of the island of Kalimantan, which borders directly with Malaysia, especially the states of Sarawak and Sabah. Nunukan, as a border area, has the potential for natural resources to improve community welfare, especially in the agriculture, forestry, fisheries, and mining sectors, which are economic growth sectors.

It can be seen from the economic growth of Nunukan Regency in the last two years, which tends to increase, namely in 2021 amounting to 4.11 and in 2022 amounting to 5.24 (percent). It proves that the regional income of Nunukan Regency is getting better.

*Regional income* is the result obtained from natural and other sources of wealth owned by an area, which is collected based on applicable regional and statutory regulations. The value of a region's income can be seen from various sources, one of which is by looking at the Gross Regional Domestic Product (GRDP) Value. Gross Regional Domestic Product (GRDP) is a form of data released by the Central Bureau of Statistics (BPS) which usually contains the value of goods and services or sources of income for a region (province, regency, or city) from various sectors in a specific time (1 year). GRDP is one of the crucial factors in the economic development of a region. Therefore, GRDP is an essential reference in economic development. To find out the economic development of the Nunukan district in the next few years, we can do forecasting or what is known as a projection.

Projection is a prediction or mathematical calculation to estimate something in the future. It can be done using data that has been obtained or collected in previous years. The projection aims to estimate how much value will be obtained for the coming year. In making projections, we can use several methods such as Least Square/Linear Trend Line, Double Exponential, and Exponential Smoothing, but in this study, we will use the Least Square/Linear Trend Line method. Forecasts or projections are essential things that companies and government organizations must do in making decisions in the future.

In forecasting or projecting the economic growth of a region, the government can calculate the policy actions to be taken in the future. These actions include determining future resource requirements in an area, determining regional development, and determining the budget earned/spent by a region. Forecasting or projections are also helpful in knowing how the previous year's performance results have been carried out. So, in the coming year, we can plan policies that are more effective and efficient. These projections will help make accurate predictions about business performance and help make important decisions regarding

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investments, sources of financing, control strategies, and inventory management. The forecasting function will be known at the time of decision-making. A good decision is based on considering what will happen when the decision is executed. If the predictions that have been prepared are not accurate, forecasting problems are also a problem that is often encountered (Gingting, 2007).

With forecasting carried out by companies or government agencies, it will be easier to determine various policies in the following years, both on the amount of production, finance and budget, and others. The reality is that many companies or agencies make policies without using proper data and data analysis, especially without forecasting data, resulting in various policy errors that result in company losses or activity inefficiencies in government agencies. Thus, studying the Nunukan Gross Regional Domestic Product (GRDP) Projection is essential, especially using the Least Square Method.

#### II. LITERATURE REVIEWS

## A. National Income

National income is a measure of the standard of living or wealth owned by a country (Fauzan, Muhtadi, et al., 2023). It is potential income that society can receive according to the source of income, which is influenced by demand and supply factors and is the net result directly consumed that year (Hapsari, Muniarty et al. 2022; Muttaqin, Riyanto et al. 2023). The function of national income is to compare the economic level achieved between one country and other countries. Besides that, it can also counter the achievements obtained for services provided to other parties.

#### B. Gross Regional Domestic Product

Gross Regional Domestic Product/GRDP is the value of all goods and services produced within a certain period, usually within one year in a specific region, usually within one year in a region, without distinguishing the ownership of the production factors used in the production process (Sofyan, 2021).

Gross Regional Domestic Product (GRDP) is an important indicator to determine the economic conditions in a region in a certain period, both based on current and constant prices. (Reynaldo, Susilastuti, & Meirinaldi, 2023) It is the amount of added value produced by all business units in a specific area or the total value of final goods and services produced by all regional economic units. GRDP based on current prices describes the added value of goods and services, calculated using prices in the current year. In contrast, GRDP based on constant prices shows the added value of these goods and services, calculated using prices in effect in a particular year as the base year.

GRDP at current prices is used to determine a region's economic resource capacity, shifts, and economic structure. Meanwhile, constant GRDP determines real economic growth from year to year or economic growth that is not influenced by price factors. GRDP can also determine price changes by calculating the GRDP deflator (implicit index change). The implicit price index is the ratio between GRDP at current prices and GRDP at constant prices. The calculation of Gross Regional Domestic Product conceptually uses three approaches: production, expenditure, and income.

#### C. Projection using the Least Square Method

Projection or Forecasting is an art or science that can be used to predict future events using data from the past to the future in mathematical form (Rosyada, 2023). Forecasting is needed to determine when an event will occur or a need will arise so that policies or actions that need to be taken can be prepared To know or see developments in the future. It is an integral part of management decision-making activities. (Permatasari, Mariani et al. 2022)

When forecasting using periodic data (trends) or time series, three methods can be used: free-hand, semi-average, and least squares. However, in this research, the author will use the least squares method because this method is one of the methods for carrying out projections by minimizing the number of projection errors.

The least squares method is a forecasting method that uses linear equations to find the most suitable line for an old data set to find future data (Ridwan, Faisol, et al. 2020). It is the method most widely used to determine data trend similarities (Herry et al. in Lestari, Andriani et al. 2019). In carrying out this method, past sales data is needed to forecast future sales to determine the results. *Least Square* is a forecasting method used to see trends in time series data. (Pamungkas 2016)

#### D. Hypothesis

In this research, the hypothesis is prepared based on understanding the framework of thought and literature explained previously. The hypothesis will be tested using a partial significance test (t-test) or difference test. The hypothesis can be developed as follows.

There is a difference between the GRDP values in 2020 until 2022 and 2023, until 2025.

#### III. METHODOLOGY

This quantitative research consists of dependent and independant variable where the research was done in Central Statistic Agency (BPS) of Nunukan Regency. The research started in June-July 2023.

#### A. Data Source

In this research, the author obtained secondary data, namely data obtained from existing sources at Central Statistic Agency (BPS) of Nunukan Regency and available on the website https://nunukankab.bps.go.id/ using data from 2012-2022.

#### B. Research Data

The data used for the analysis is GRDP based on current prices and GRDP based on constant prices in Nunukan Regency from 2012 to 2022. In the case of the time series, the data in the year variable is made in order of years 1, 2, and so on, in the future referred to as variable X.

#### C. Technique of Collecting Data

The author used the literary study method as a data collection technique in this research. The literature study method used in this research is government databases/documents. This data is usually data issued by government agencies.

## D. Trend Analysis

The Least Square Method

This method is the method most often used in forecasting. Using this method, the trend equation obtained is the best for forecasting, as this equation will produce a forecast with the slightest square error. The linear trend line equation that will be used is:

Y' = a + bX

Which states that:

Y': the value of the variable to be analyzed a: Y value if X is equal to zero b: slope of the trend line, or change in Y value each period X: time

#### E. Data Analysis Method

The data analysis method used in this research is a quantitative data analysis method. The data analysis method used is hypothesis testing.

#### IV. RESULTS AND DISCUSSIONS

#### A. Research Data

In conducting this research, researchers used secondary data, namely GRDP data obtained from the BPS Nunukan office. The following is the data that will be used in conducting this research.

<b>T</b> 1	v	PDRB ADHB				
Tanun		(Dalam juta rupiah)				
2012	1	Rp 12.151.826,10				
2013	2	Rp 13.488.875,00				
2014	3	Rp 15.502.783,00				
2015	4	Rp 15.517.931,80				
2016	5	Rp 16.501.994,40				
2017	6	Rp 20.040.898,40				
2018	7	Rp 22.576.028,60				
2019	8	Rp 25.430.864,40				
2020	9	Rp 26.300.564,40				
2021*	10	Rp 29.779.871,60				
2022**	11	Rp 40.229.006,30				

# Table 1. GRDP data based on current prices for Nunukan Regency on 2012-2022

# Table 2. GRDP data based on constant prices for Nunukan Regency on 2012-2022

~ •		PDRB ADHK
Tahun	x	(Dalam juta rupiah)
2012	1	Rp 10.373.324,60
2013	2	Rp 11.183.817,90
2014	3	Rp 12.299.816,30
2015	4	Rp 12.630.456,60
2016	5	Rp 13.088.620,80
2017	6	Rp 13.976.750,90
2018	7	Rp 14.854.588,00
2019	8	Rp 15.861.820,20
2020	9	Rp 15.708.370,70
2021*	10	Rp 16.345.374,10
2022**	11	Rp 17.202.680,30

B. Trend Analysis

# 1) Least Square Method

# Table 3. The GRDP result using the Least Square Method

n Tahun		PDRB ADHB (Dalam		kode waktu		VV	va	VI		
п	Tanun		juta rupiah)	(X)	л		A2	I.		
1	2012	Rp	12.151.826,10	-5	-Rp	60.759.130,50	25	Rp 9.599.916,23		
2	2013	Rp	13.488.875,00	-4	-Rp	53.955.500,00	16	Rp 11.998.490,15		
3	2014	Rp	15.502.783,00	-3	-Rp	46.508.349,00	9	Rp 14.397.064,06		
4	2015	Rp	15.517.931,80	-2	-Rp	31.035.863,60	4	Rp 16.795.637,98		
5	2016	Rp	16.501.994,40	-1	-Rp	16.501.994,40	1	Rp 19.194.211,90		
6	2017	Rp	20.040.898,40	0	Rp	•	0	Rp 21.592.785,82		
7	2018	Rp	22.576.028,60	1	Rp	22.576.028,60	1	Rp 23.991.359,74		
8	2019	Rp	25.430.864,40	2	Rp	50.861.728,80	4	Rp 26.389.933,65		
9	2020	Rp	26.300.564,40	3	Rp	78.901.693,20	9	Rp 28.788.507,57		
10	2021*	Rp	29.779.871,60	4	Rp	119.119.486,40	16	Rp 31.187.081,49		
11	2022**	Rp	40.229.006,30	5	Rp	201.145.031,50	25	Rp 33.585.655,41		
umlah	11	Rp	237.520.644,00	Rp -	Rp	263.843.131,00	110			
13	2023			6				Rp 35.984.229,33		
14	2024			7				Rp 38.382.803,25		
15	2025			8				Rp 40.781.377,16		

Based on the data above, the values a and b can be determined to fulfill the linear equation that will be used in forecasting using the following equation:

Y'= a bX

The following formula can be used to find the values of a and b:

 $a = \sum Y/n$ 

 $b = \sum XY / \sum X^2$ 

 $a = \sum Y/n$ = Rp237.520.644,00/11= Rp21.592.785,82

 $b = \sum XY / \sum X^2$ = Rp263.843.131,00/110 = Rp2.398.573,92

After getting the values a and b, the GDP trend equation that will be used in making projections is:  $Y'=Rp\ 21.592.785,82 + Rp\ 2.398.573,92(X)$ 

So, for the forecast for Y in 2023, it is known:

X = 6 Y'= Rp 21.592.785,82 + Rp 2.398.573,92 (6) = Rp 35.984.229,33

The forecast for Y in 2024, it is known:

X = 7 Y'= Rp 21.592.785,82 + Rp 2.398.573,92 (7) = Rp 38.382.803,25

Meanwhile, the forecasting for Y in 2025 is: X = 8 Y'= Rp 21.592.785,82 + Rp 2.398.573,92 (8) = Rp 40.781.377,16

After carrying out calculations using the equation above, it can be concluded that the results of the projection using the least squares method for GDP data based on current prices in 2023 were obtained at IDR 35,984,229.33, for 2024, it was IDR 38,382,803.25, and for 2025 we obtained amounting to IDR 40,781,377.16.

n	Tahun	PDRB ADHK (Dalam		kode waktu		xv	X2	v
ш	Tanun		juta rupiah)	(X)	AI		A2	1
1	2012	Rp	10.373.324,60	-5	-Rp	51.866.623,00	25	Rp 10.627.449,09
2	2013	Rp	11.183.817,90	-4	-Rp	44.735.271,60	16	Rp 11.293.334,19
3	2014	Rp	12.299.816,30	-3	-Rp	36.899.448,90	9	Rp 11.959.219,28
4	2015	Rp	12.630.456,60	-2	-Rp	25.260.913,20	4	Rp 12.625.104,38
5	2016	Rp	13.088.620,80	-1	-Rp	13.088.620,80	1	Rp 13.290.989,48
6	2017	Rp	13.976.750,90	0	Rp	•	0	Rp 13.956.874,58
7	2018	Rp	14.854.588,00	1	Rp	14.854.588,00	1	Rp 14.622.759,68
8	2019	Rp	15.861.820,20	2	Rp	31.723.640,40	4	Rp 15.288.644,78
9	2020	Rp	15.708.370,70	3	Rp	47.125.112,10	9	Rp 15.954.529,88
10	2021*	Rp	16.345.374,10	4	Rp	65.381.496,40	16	Rp 16.620.414,98
11	2022**	Rp	17.202.680,30	5	Rp	86.013.401,50	25	Rp 17.286.300,08
Jumlah	11	Rp	153.525.620,40	0	Rp	73.247.360,90	110	
13	2023			6				Rp 17.952.185,18
14	2024			7				Rp 18.618.070,28
15	2025			8				Rp 19.283.955,37

## Table 4. The GRDP result using the Least Square Method

 $a = \sum Y/n$ 

 $b = \sum XY / \sum X^2$ 

 $a = \sum Y/n$ = Rp 153.525.620,40/11

= Rp 13.956.874,58

 $b = \sum XY / \sum X^2$ 

 $= \overline{R}p 73.247.360,90/110$ 

= Rp 665.885,10

The GRDP trend equation that will be used in making projections is:

Y' = Rp 13.956.874,58 + Rp 665.885,10 (X)

So we can see that the forecast for Y in 2023 is: X = 6

Y'= Rp 13.956.874,58 + Rp 665.885,10 (6) = Rp 17.952.185,18

The forecast for Y in 2024 is known as:

X = 7Y'= Rp 13.956.874,58 + Rp 665.885,10 (7) = Rp 18.618.070,28

Meanwhile, the forecast for Y in 2025 is as follow:

X = 8Y'= Rp 13.956.874,58 + Rp 665.885,10 (8) = Rp 19.283.955,37

After carrying out calculations using the equation above, we can conclude that the results of the projection using the least squares method for GRDP data at constant prices for 2023 are IDR 17,952,185.18, for 2024 it is IDR 18,618,070.28 and for 2025 obtained amounting to IDR 19,283,955.37.

# C. Data Analysis

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1) Hypothesis Examining

#### Table 5. t-test using GRDP data based on current prices

Group Statistics								
					Std	. Error		
	Data Type	Ν	Mean	Std. Deviation	N	Iean		
Actual	1	3	32103147.433	7249040.0322	4185	235.2140		
Value & Projection	2	3	38382804.000	2398574.0000	1384	817.3446		

Based on the results of the SPSS output in the table above, the mean or average value of the actual and predicted values, namely the predicted value, is 38382804.000, higher than the actual value, 32103147.433

Table 6. t-test using GRDP data based on current prices

#	Independent Samples Test										
Levene's Test for Equality of Variances			t-test for Equality of Means								
		Γ	Sin	+	Аf	Sin () tailad)	Mean Difference	Std. Error Difference	95% Confi I	dence Differ	e Interval of the ence Unner
Actual Value & Projection	Equal variances assumed	4.187	.110	-1.424	4	.227	-6279656.5667	4408391.1889	2010		5959999.5715
	Equal variances not assumed			-1.424	2.433	.269	-6279656.5667	4408391.1889	-22354249	4046	9794936.2713

Based on the results of the SPSS T-Test independent sample test output above, a sig (2-tailed) value of 0.227 > 0.05 was obtained. The HO independent sample t-test was accepted as the basis for decision-making, and Ha was rejected. It means there is no significant difference between the actual and predicted values.

Table 7.	t test ı	ising (	GRDP	data	at	constant	t pric	es

Group Statistics									
	Data trina	N	Maan	Std Doviation	Std. Error				
	Data type	IN	Ivicali	Sid. Deviation	Mean				
Actual Value & Projection	1	3	16418808.367	749856.4788	432929.8399				
rojection	2	3	18618070.000	665885.0000	384448.8840				

Based on the results of the SPSS output in the table above, the mean or average value of the actual and predicted values, namely the predicted value, is 18618070.000, which is higher than the actual value, 16418808.367.



#### Table 8. t test using GRDP data at constant prices

Based on the results of the SPSS T Test independent sample test output above, a sig (2-tailed) value of 0.019 > 0.05 can be obtained. The basis for decision-making accepts the HO independent sample t-test, and Ha is rejected. It means there is no significant difference between the actual and predicted values.

#### 2) Discussion

The research data was analyzed using the least squares method. The author found that the projected GRDP value of Nunukan Regency (GRDP data at Current Prices) for 2023 was IDR 35,984,229.33, in 2024 it was IDR 38,382,803.25 and for 2025 it was IDR 40,781,377.16. Meanwhile, the projected GRDP value for Nunukan Regency (GRDP data at Constant Prices) for 2023 is IDR 17,952,185.18; in 2024, it is IDR 18,618,070.28 and for 2025 it is IDR 19,283,955.37.

Based on the results of the researcher's hypothesis test, it can be seen that the independent sample t-test shows that the HO results are accepted, and Ha is rejected. It means there is no significant difference between the actual and predicted values. It is proven by the results obtained through the independent sample t-test showing the sig. (2-tailed) value of 0.227 > 0.05 (GRDP data at Current Prices) and the sig. (2-tailed) value of 0.019 > 0.05 (GRDP data at constant prices).

It is because that year, there was an outbreak, namely COVID-19, which made the government implement a social distancing policy to prevent the spread of the outbreak. It resulted in a decline in the economic level that year. So, various economic sectors experienced quite an enormous impact. The policies implemented by the government have a severe impact on private companies/BUMN.

It happened due to replacing the work system using a part-time work system, area restrictions, closure of entertainment venues, school activities being carried out online, and many layoffs (PHK). It is what caused the economic situation in those years to experience instability.

However, looking at the GRDP projection results by researchers using the least squares method, it can be concluded that the GRDP of Nunukan Regency has increased over time based on the existing time series data.

## V. CONCLUSION

Based on the results of the analysis and discussion by researchers using the methods and analysis tools mentioned in the previous chapter, it can be concluded that:

1. The projected GRDP value of Nunukan Regency based on current prices in 2023 is IDR 35,984,229.33; for 2024, it is IDR 38,382,803.25 and in 2025 it is IDR 40,781,377.16. The projected value of GDP for Nunukan Regency at Constant Prices in 2023 is IDR 17,952,185.18; for 2024, it is IDR 18,618,070.28, and for 2025, it is IDR 19,283,955.37.

2. There is no significant difference between the GRDP values for 2020, 2021, and 2022 and the predictions for 2023, 2024 and 2025. It is proven by the t-test results, which was carried out using the SPSS Statistics 25 application, which resulted in HO being accepted and Ha being rejected. It means there is no significant difference between the actual and predicted values.

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