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The Influence of the Agricultural Sector to the Poverty in North Sumatera Province (Panel Data Analysis)

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ABSTRACT

The aims of this study were to determine whether there is an influence of Gross Regional Domestic Product (GRDP), GRDP of Agricultural Sector, Total Population and Total Unemployment to the Poverty in North Sumatera. This Research used 33 Regencies in North Sumatera as the cross-section and time series from 2011 until 2021. The method used in this article is quantitative method with panel data regression analysis techniques. The data used are secondary data. The results showed that GRDP and GRDP of Agricultural Sector have negative significant influence to poverty while total population and total unemployment have insignificant influence to poverty.

Keywords: Agricultural Sector, Poverty, Panel Data

INTRODUCTION

Economic development is a change in economic structure. Initially, all countries did not have the technology, so the main occupation of all people before the technology existed was in the agricultural sector in a broad sense, including food crops, fisheries, plantations, animal husbandry, and forestry. Low productivity and technology are also low. Then the economic growth that initially occurred due to the agricultural sector shifted its workforce from the agricultural sector to the manufacturing sector so that labor productivity became higher [1]. The agricultural sector is a sector that triggers economic growth to become a sector based on industry, then in line with technological developments which become the basis of the economy in a country is the service sector. The agricultural sector is a driving force for other economic sectors so it can be said that the agricultural sector is very important in relation to economic development. This is supported by Kuznets's classic analysis in 1964 [2], namely agriculture in developing countries is a very potential economic sector and has four important contributions to the growth and development of the national economy, which include product, market, production factors, and foreign exchange contributions.

The agricultural sector must be developed, both regional and urban agriculture by utilizing existing technology. The development of the agricultural sector at this time should not only be oriented towards increasing production or availability of commodities for food consumption, but the agricultural sector also has a major role in reducing poverty and open unemployment rates and advancing the economy of a region. Based on the Central Bureau of Statistics in 2021 the poverty rate in North Sumatra in 2021 is ranked 18th nationally out of a total of 38 provinces. The

agricultural sector in rural and urban areas must be a trigger for poverty reduction.

Satriawan & Oktavianty stated that poverty in farmers can be caused by many things including the low investment ability of farmers, dependence on farmers, dependence on funds, and the unfulfilled basic needs of farmer households [3]. Farmer management and education to farmers are needed. This research contradicts Sihombing & Bangun which shows a negative direction between the agricultural sector and poverty [4], agricultural growth has an important impact on reducing poverty [5], namely that in addition to economic growth which is important for reducing poverty, income growth in the agricultural sector is also important for reducing poverty. The results of other studies also show that there is no significant difference between the agricultural sector and poverty studied by Niara & Zulfa and Mustika, namely the GDP of the agricultural sector does not have a significant effect on poverty in Indonesia using data for 1993-2014 [6][7]. Salqaura in her research shows that there is a fairly strong correlation between the agricultural sector and poverty in North Sumatra Province, meaning that when the GRDP(Gross Regional Domestic Product) of the agricultural sector increases, poverty also increases[8]. This can happen because most of the poor people in districts within North Sumatra Province are districts with high GRDP values in the agricultural sector, so improvements are needed in the agricultural sector, especially agriculture or smallholder plantations.

North Sumatra Province has an area of 72,981 km2 consisting of 33 Regencies and Cities which have the characteristics of their respective economic sectors that support their economy. In their administration, each district and city together with the province have the authority (decentralization) to calculate and make decisions on the sectors explored in each of these regions. Not only in the plantation sector, namely oil palm, rubber, coffee and tea plantations which are the characteristics of North Sumatra Province which are spread over several districts and cities, but also related to horticultural agriculture which includes vegetable, fruit, ornamental/flower and medicinal plants, as well as food crops, forestry, fisheries and other agricultural sub-sectors. This is in accordance with the Regional Fiscal Study of North Sumatra Province for the third quarter of 2021 which states that the agriculture, forestry and fisheries sectors are the sectors with the largest contribution to the economy of North Sumatra Province so that they become one of the leading sectors. Therefore, this study aims to determine the effect of the agricultural sector on poverty in North Sumatra Province using panel data from 2011 -2021.

METHODS

Location and Time of Research

This study used secondary data with panel data consisting of a combination of time series which are years and cross-sections which are regencies and cities in North Sumatra Province. This panel data used time series from 2011 until 2021 and cross-sections which are 33 districts and cities in North Sumatera Province. Panel data is a combination of time series data with cross sections data [9]. This research was conducted in North Sumatra Province which is one of the provinces with an agricultural sector with various types of agricultural sub-sectors, namely plantations, horticulture, food crops, forestry, fisheries, and animal husbandry. Regency and city data used in North Sumatra Province are Nias, Mandailing Natal, South Tapanuli, Central Tapanuli, North Tapanuli, Toba Samosir, Labuhanbatu, Asahan Simalungun, Dairi, Karo, Deli Serdang, Langkat, South Nias, Humbang Hasundutan, Pakpak Bharat, Samosir, Serdang Berdagai, Batu Bara, North Padang Lawas, Padang Lawas, South Labuhanbatu, North Labuhanbatu, North Nias, West Nias, as well as the City of Sibolga, Tanjungbalai, Pematangsiantar,

Tebing Tinggi, Medan, Binjai, Padangsidimpuan, and Gunungsitoli.

Sampling Technique

The determination of the timeseries based on the data that the Centre Bureau of Statistics published for five variables which were used in this research. The variables used were Total of Poor People, GRDP of each Regencies (Gross Regional Domestic Product), GRDP of Agricultural Sector each of Regencies, Total People in District or City, and Total of Unemployment.

Types of Research Data

Research analysis using Eviews10 software. The variables used are the number of poor people, GRDP, agricultural sector GRDP, total population, and total unemployment. The data sources used come from various publications of the Central Bureau of Statistics for North Sumatra Province in Figures with variations in various years.

The equations analyzed are as follows:

$Log(MSKN)_{it} = a_0 + a_1*Log(PDRBSPN)_{it} + a_2*Log(PDRB)_{it} + a_3*Log(PDDK)_{it} + a_4*Log(PNGGRN)_{it} + u_{it}$.....(1)

MSKN = Total Poor People

PDRB = Gross Regional Domestic Product

PDRBSPN = Gross Regional Domestic Product of Agricultural Sector

PDDK = Total People in District or Regency or City

PNGGRN = Total Unemployment

Data Analysis Techniques

In this analysis used panel data. There are three-panel data regression models (common effect, fixed effect, and random effect) so to determine the three models several tests are needed to choose which model is most appropriate to use. Three tests were used to select the model, namely the Chow test, the Hausman test, and the Breusch Pagan test. These equations will be tested sequentially to determine the best model.

Chow test

The Chow test is a test to determine the best model between the fixed effect or common effect by using the F test where the F test equation is as follows [10]:

$$F = \frac{(R^2_{ur} - R^2_r)/(m)}{(1 - R^2_{ur})/(n-k)} \quad \text{..... (2)}$$

Information:

R^2r = R^2 model Common Effect Model (CEM)

R^2ur = R^2 model Fixed Effect Model (FEM)

m = number of restrictions or restrictions in the model without dummy variables (restricted variables)

n = number of samples

k = number of explanatory variables

The hypothesis used in this F test is:

$H_0 : \alpha_1 = \alpha_2 \ldots\ldots = \alpha_1 = 0$ (same intercept, no significant effect from unit cross-section)

$H_1 : \alpha_I \neq 0$; i = 1,2, . . .,n (there is at least one intercept that has a difference, there is a significant effect of the unit cross-section.

R^2 is the value obtained from the regression results, both R for Restricted refers to the common effect model or UR for Unrestricted or a fixed effect model.

If Fcount> $F_{\alpha;db1;db2}$ or Probability value < α (10%, 5% or 1%) then H_0 is rejected, it means that the fixed effect model is better than the common effect model. If the F value is not statistically significant, it can be concluded that there is no difference in intercept between the cross-section variables, so the common effect model is better, and vice versa [10] .

Breusch-Pagan Lagrange Multiplier Test

To find out whether there is a random effect. With other reviews it can be said that the Breusch-pagan Lagrange Multiplier test aims to compare the common effect or random effect model which is the best model. If the value is equal to zero, it means that there is no random effect. This is because it only uses one hypothesis, it uses a chi-square distribution with 1df, because only one hypothesis is tested, namely $\sigma_u^2 = 0$ [10]. The LM test was developed by

Breusch Pagan. The LM formula is as follows [11]:

$$LM=\frac{nT}{2(T-1)}\left(\frac{\sum_{i=1}^{n}\left(\sum_{t=1}^{T}\hat{e}_{it}\right)^{2}}{\sum_{i=1}^{n}\sum_{t=1}^{T}\hat{e}_{it}^{2}}-1\right)^{2} = \frac{nT}{2(T-1)}\left(\frac{\sum_{i=1}^{n}(T\,\bar{e}_{it})^{2}}{\sum_{i=1}^{n}\sum_{t=1}^{T}\hat{e}_{it}^{2}}-1\right)^{2} \quad \text{..... (3)}$$

Information:
n = Number of individuals
T = Number of time periods t
E = Residual OLS approximation
Hypothesis:
H_O: $\sigma_u^2 = 0$
H_1: $\sigma_u^2 \neq 0$
If the LM statistic value > the critical value of the chi-square's statistic then H_0 is rejected. This means that the better estimate is the regression of the random effect model from OLS. On the other hand, if the LM statistic value < the critical chi-squares value then H_O fails to be rejected or accepted, which means that random effect estimation cannot be used, then estimates from the OLS or common effect model are used.

Hausmann's test
The Hausman test is a test conducted to find out which random effect or fixed effect model is the best model. The combined error components of time series and cross-section are compared, whether they are correlated with one or all of the explanatory variables or not. If it is correlated then the fixed effect model is better but if it is not correlated then the random effect model is chosen. The Hausman test is used if the fixed effect and cross-section models are known to be significant then it will be decided which one is better by comparing the two models.
The Hausman test used follows Wald's criteria by using statistical values that follow the chi-square distribution, as follows [12] :

$$W=x^2[K]=[\hat{\beta},\hat{\beta}_{GLC}]\hat{\Sigma}^{-1}[\hat{\beta}-\hat{\beta}_{GLS}] \quad \text{..... (4)}$$

With a hypothesis
H_O: Correlation ($X_{it,it}$) = 0; there is no cross-sectional effect associated with other independent variables so that the random effect model is better to use than the fixed effect model
H_1: Correlation ($X_{it,it}$) ≠ 0, then the cross-sectional effect is related to other independent variables so that the fixed effect model is better chosen than the random effect model
The three tests do not have to be used in full. Because it is possible that one of the tests will be skipped because the tendency of the results of the first test is not included in the next test model.

Hypothesis test
Hypothesis testing using analysis Regression of Panel Data (Fixed effect, common effect or random effect) which are suspected that the independent variables (GRDP, GRDP Agricultural Sector, Total Population, and Total unemployment) have a significant influence to the number of poor people (poverty). It is suspected GRDP and GRDP Agricultural Sector have significant negative influence to the poor people (poverty) while Total Population and Total Unemployment have significant positive influence to the poor people (poverty).

RESULT

Before we discuss about the results of analysis, several tests were carried out to determine the best model for the panel data regression results. The following is the result of the chow test, it is known that in table 1 Fcount> $F_{\alpha;db1;db2}$ or the Probability value < α (10%, 5% or 1%) then H_0 is rejected, it means that the fixed effect model is better than the common effect model so there is intercept differences between cross-sectional variables [10]. Because in this test the model is not included in the common effect, therefore the Breusch Pagan Lagrange Multiplier test is not carried out but is continued with the Hausman test to see whether the fixed effect or random effect is the best model.

Table 1. Chow Test

Redundant Fixed Effects Tests			
Equation: Untitled			
Test cross-section fixed effects			
Effects Test	**Statistic**	**d.f.**	**Prob.**
Cross-section F	211.483367	(32,326)	0.0000***
Cross-section Chi-square	1118.051697	32	0.0000***
Source: Secondary Data Analyzed, 2023			

Table 2 shows the results of the Hausman test, it is known that the random cross-section probability value is known to be 0.00 or less than < α (10%, 5% or 1%) so that H_0 is rejected and H_1 is accepted, it means that there is a cross-sectional effect related to the variable other independent so that the fixed effect model is better chosen than the random effect model.

Table 2. 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	97.867571	4	0.0000***

Source: Secondary Data Analyzed, 2023

Table 3. The Results of Panel Data Regression

Dependent Variable: LOG(MSKN)				
Method: Panel Least Squares				
Sample: 2011 2021				
Periods included: 11				
Cross-sections included: 33				
Total panel (balanced) observations: 363				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	13.96222	1.104815	12.63760	0.0000***
LOG(PDDK)	-0.074019	0.130432	-0.567491	0.5708^{ns}
LOG(PDRB)	-0.075008	0.029626	-2.531819	0.0118**
LOG(PDRBSPN)	-0.103342	0.056537	-1.827885	0.0685*
LOG(PNGGRN)	0.003021	0.009057	0.333593	0.7389^{ns}
	Effects Specification			
Cross-section fixed (dummy variables)				
R-squared	0.991151	Mean dependent var		10.38227
Adjusted R-squared	0.990174	S.D. dependent var		0.706359
S.E. of regression	0.070019	Akaike info criterion		-2.383758
Sum squared resid	1.598253	Schwarz criterion		-1.986808
Log likelihood	469.6520	Hannan-Quinn criter.		-2.225972
F-statistic	1014.307	Durbin-Watson stat		0.704693
Prob(F-statistic)	0.000000			
Source: Secondary Data Analyzed, 2023				

Table 4. Cross-section Fiexed Effect Value

No.	**Regency**	**Effect**
1	Nias	-0.498531
2	Mandailing	0.424627
3	South Tapanuli	-0.058543
4	Middle Tapanuli	0.486106
5	North Tapanuli	-0.016463
6	Toba Samosir	-0.717939
7	Labuhanbatu	0.476022

8	Asahan	1.169854
9	Simalungun	1.323671
10	Dairi	-0.273092
11	Karo	0.336595
12	Deli Serdang	1.485356
13	Langkat	1.554304
14	South Nias	0.500729
15	Humbang Hasundutan	-0.694975
16	Pakpak Bharat	-2.340073
17	Samosir	-0.794007
18	Serdang Bedagai	0.782381
19	Batu Bara	0.607336
20	North Padang Lawas	-0.172097
21	Padang Lawas	-0.281809
22	South Labuhanbatu	0.254253
23	North Labuhanbatu	0.344663
24	North Nias	-0.006592
25	West Nias	-0.654747
26	Sibolga	-1.332459
27	Tanjungbalai	-0.437813
28	Pematangsiantar	-0.544783
29	Tebing Tinggi	-1.079963
30	Medan	2.142619
31	Binjai	-0.858737
32	Padangsidimpuan	-0.823381
33	Gunung sitoli	-0.302511

Source: Secondary Data Analyzed, 2023

DISCUSSION

Based on the F test, it is known that the F-probabilistic value is smaller than α (0.01, 0.05 & 0.1) so that it means that the independent variables, namely population, unemployment, GRDP and agricultural sector GRDP, together have a significant effect on the dependent variable, namely the number of poor people. When the number of samples used is large, we can more loosely relate to the assumption of normality. Now there are a lot of cross section and time series data that have a very large number of observations. Therefore, the assumption of normality may not be crucial in large data. This is also supported by Ghasemi et. al. which states that when the sample is in the hundred we can ignore the distribution of the data [13]. Therefore, in this study using panel data, classical assumptions were not tested. Adj value. R2 shows that 99.02% of the independent variables, namely population, number of unemployed, GRDP, and GRDP of the agricultural sector are able to explain the variable number of poor people, while the remaining 0.98% is explained by other variables outside the model.

Based on the best model test for panel data regression, it is known that the best model is the fixed effect model, which means that this model assumes that there are differences in individuals that can be accommodated from differences in intercepts. This model is also called LSDV, namely Least Square Dummy Variable, even though the slope between individuals remains the same [12]. In other words, there are differences for each cross-section which are regencies and cities in North Sumatra Province.

The results of the analysis in table 3 show that there are variables that are not significant to the number of poor people in North Sumatra Province, namely the number of residents (or total population) and unemployment because the probability values exceed the level of confidence in each α (0.1, 0.5, & 0.01) used. While there are variables that have a significant effect on poverty (total poor people), namely GRDP with a level of confidence in α (0.05)

and GRDP in the agricultural sector (α = 0.1). Both of these variables have a significant negative effect on the number of poor people. This means that when there is an increase in GRDP in North Sumatra Province by 1%, the number of poor people will decrease by 0.075008%, as well as the GRDP in the Agricultural Sector, when there is 1% an increase in GRDP in the Agricultural Sector in North Sumatra Province, the number of poor people will decrease by 0.103342%. This shows that the Agricultural Sector GRDP and GRDP help reduce the number of poor people in districts and cities in North Sumatra Province. This is in accordance with the theory that the agricultural sector is a sector that encourages both rural and urban areas to develop so as to reduce the number of poor people and another research [4][8].

The number of residents is not significant to the number of poor people, which is not in accordance with previous research [14]. Nugroho found that population has a significantly negative effect on poverty in Malang City [14]. The number of unemployed does not have a significant effect on the number of poor people, this is not in accordance with the research [15] and another researcher found that unemployment and open unemployment had a significant effect on poverty in East Luwu and Central Sulawesi Provinces using panel data with a random effect model [16]. In this case there are differences in the variables between those studied and those in previous research, namely in this study poverty was shown from the number of poor people in each district and city in North Sumatra Province while what was carried out in previous research was poverty data according to BPS criteria.

GRDP is the total value of goods and services produced in a certain area and at a certain time, generally within a period of one year. The high or low levels of economic growth can be indicated by the high and low GRDP values which indicate that the area is experiencing progress in the economy [14]. The results of this study are different from Nugroho and Nabawi which show that there is no significant relationship between GRDP and poverty in both Central Sulawesi Province and Malang City [14] [17]. However, the results of this study are in accordance with the research of Dama et al. which states that there is a significant negative effect of GRDP on the poverty rate in Manado City [18]. GRDP growth is an indicator in determining the success of the development of a region and is a necessary condition for poverty reduction [18]. GRDP growth must spread to all groups, including the poor, so that GRDP growth in each business sector is very important in reducing and overcoming the number of poor people and the level of poor people because each region has advantages in each business sector.

The panel data regression results show that the constants are significant. This means that when the independent variables, namely population, unemployment, GRDP, and agricultural sector GRDP are zero or constant, the number of poor people is 13.96222%. The heterogeneity value of districts and cities in North Sumatra Province means that each district and city has a different intercept due to the conditions of the economic system, culture and other variables [19]. The district that has the smallest individual effect value is North Nias followed by North Tapanuli. Meanwhile, the individual effects with the greatest positive value are the cities of Medan, Langkat, Deli Serdang, Simalungun and Asahan it means that if GRDP, GRDP of Agricultural Sector, Total Population and Total Unemployment constant or zero then those districts have positive percentage of poor people we can assume that those cities and district have large area and densely populated. With the largest negative value or the smallest value is Phak Phak West (-2.340073) meaning that when the population, unemployment, GRDP, and GRDP of the agricultural sector are constant or zero, Pakpak West has the smallest intercept meaning that the number of poor

people is the smallest when the independent variable is constant.

CONCLUSION

Gross Regional Domestic Product has significant negative effect towards the total of poor people. Gross Regional Domestic Product of Agricultural Sector has significant negative influence towards total of poor people. While total of population and unemployment were insignificant to total poor people in North Sumatra. Based on the result, some regency especially in the cities have to give more attention to the total of poor people.

Mapping the prospect of each region must be calculated based on the natural wealth it has. In other words, we can say that local wisdom can be considered (in this study agricultural sector) as the backbone of an area (bottom-up decisions). While decisions from the top down can be considered or adjusted to circumstances. Another research is needed to make sure and evaluate each of regency can mapping, manage and prospect their own resources.

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