Advances in Economics, Business and Management Research, volume 199
Proceedings of 1st International Conference on Sustainable Agricultural Socio-economics, Agribusiness, and Rural Development (ICSASARD 2021)

Analysis of Paddy Production to Support Food Security in The West and East Coasts of North Sumatra

Mitra Musika Lubis[1,2*], Bakti Darma[1,3], Ginting Rahmanta[1,4] dan Ayu Sri Fajar[1,5]

[1]*Agricultural Science Study Program, Graduate School, University of North Sumatra, Street Prof. A. Sofyan No. 3, Medan, Indonesia, 20155*
[2]*Agribusiness Study Program, Faculty of Agriculture, University of Medan Area, Street Pool No. 1 Medan Estate, Indonesia, 20231*
[3]*Department of Agrotechnology, Faculty of Agriculture, University of North Sumatra, Street Prof. A. Sofyan No. 3, Medan, Indonesia, 20155*
[4]*Department of Agribusiness, Faculty of Agriculture, University of North Sumatra, Street Prof. A. Sofyan No. 3, Medan, Indonesia, 20155*
[5]*Department of Agribusiness, Faculty of Agriculture, University of North Sumatra, Street Prof. A. Sofyan No. 3, Medan, Indonesia, 20155*
**Corresponding author. Email: mitra@staff.uma.ac.d*

ABSTRACT
This study aims to analyze rice production in the last 10 years (2010 – 2019) to support food security in the west and east coasts of North Sumatra province. The research location was determined using a purposive method by analyzing the West Coast and East Coast regions. The sample area is the West Coast area covering 3 (three) regions, including North Nias Regency, West Nias Regency and Sibolga City as well as the East Coast region covering 3 (three) regions, including North Labuhanbatu Regency, South Labuhanbatu Regency and Tanjungbalai City.The data obtained during the study were processed using qualitative analysis tools in the form of descriptive analysis and quantitative analysis tools in the form of panel data regression analysis, namely the Fixed Effect Model. The results showed that all independent variables such as land, farm labor and the minimum wage had an individual and overall effect on rice production on the West and East Coasts of North Sumatra. The variable of labor in the agricultural sector and the minimum wage has a positive and significant effect, while the variable of land area has a positive but not significant effect on rice production on the West and East Coasts of North Sumatra. Each increase in land area, agricultural sector labor and minimum wages by 1% will cause an increase in the ratio of rice production by 0.039039, 2.654574 and 0.651324, respectively.

Keywords: *Coasts Area, Food Security, Panel Data*

1. INTRODUCTION

North Sumatra is an area that has potential as an agricultural area because it has extensive and fertile agricultural land throughout the region. According to the North Sumatra Agriculture Service, Deli Serdang, SerdangBedagai, Langkat, LabuhanBatu Utara and Mandailing Natal are the largest rice-producing areas in North Sumatra. The success of these four regions can make North Sumatra a rice barn if it can be followed by regions in Sumatra

The inaccuracy of rice production data has been suspected by many parties since 1997. A study conducted by the Central Statistics Agency (BPS) together with the Japan International Cooperation Agency (JICA) in 1998 indicated an overestimation of harvested area of around 17.07 percent [1]. North Sumatra is one of the provinces on the island of Sumatra where almost the entire area cultivates rice plants. Of the 20 level II regions in this province, only Sibolga does not produce rice because in this area the livelihood of the community is mostly fishermen. Meanwhile, Padang Sidempuan which is a level II area which was only formed in 2003 has been able to produce rice. This proves that North Sumatra is one of the rice barns that can support the national rice needs. Rice Planted Area, Production, and Rice Productivity in North Sumatra Province in 2010 - 2019 can be seen in Table 1.

Table 1. Cultivated Area, Production, and Productivity of Rice Fields in North Sumatra Province in 2010 – 2019

Year	Cultivated Area(ha)	Production (tons)	Average Production (quintal/ha)
2010	702 308,0	3 422 264,0	48,73
2011	703 168,0	3 440 262,0	48,93
2012	714 307,0	3 552 373,0	49,73
2013	697 344,0	3 571 141,0	51,21
2014	676 724,0	3 490 516,0	51,58
2015	731 811,0	3 868 880,0	52,87
2016	826 695,8	4 387 035,9	53,07
2017	864 283,3	4 669 777,5	54,03
2018	894 150,1	4 664 865,6	52,17
2019	815 096,0	4 004 167,5	49,13

Source: Central Bureau of Statistics of North Sumatra Province 2020

Based on the Table 1. above, it can be seen that the increase in rice production in North Sumatra occurred in several years, namely in 2012-2017 by 3,552,373 - 4,669,777 tons (0.31%), although in 2014 it decreased slightly by only 0, 02%. The increase in production may be due to an increase in the area of rice harvested from 714,307 ha to 864,283 ha and an increase in the average productivity of rice in North Sumatra. However, in 2019 rice production in North Sumatra decreased by 4,004,167 tons, this was due to the reduced harvested area to 815,096ha so that productivity was also reduced. So that requires North Sumatra Province to still import rice to meet its rice needs. The dependence of imported rice to meet demand shows that North Sumatra's rice production has not been efficient. The failure of North Sumatra's rice farming to meet rice needs is also caused by unbalanced rice prices. This imbalance causes the income of rice farmers to not be maximized so that farmers' production is also not optimal, indirectly reducing the amount of rice available. Whereas rice production can still be increased through a number of programs such as seed assistance, fertilizer, assistance, agricultural machinery, reservoirs, and price guarantees for farmers [8].

Based on the rice production problems mentioned above, it is necessary to study the factors that affect rice production especially the west coast and east coast in North Sumatra Province.

2. RESEARCH METHOD

2.1. Research Time and Location

Research on the factors that affect paddy production in North Sumatra was conducted by collecting data from several institutions related to the research. These institutions include the Department of Agriculture and Food Crops of North Sumatra Province, The Central Bureau Statistics Agency (BPS),and other institutions that support research, as well as previous studies. This research was conducted for three months, from October to December 2020.

Based on its location and natural conditions, North Sumatra is divided into 3 (three) groups of regions/regions, namely the West Coast, the Highlands, and the East Coast. Purposively, this study only analyzes the West Coast and East Coast areas because these 2 (two) areas include a large area in North Sumatra so that they are in accordance with the research objectives. The West Coast region includes North Nias Regency, West Nias Regency, Sibolga City. The East Coast region includes North Labuhanbatu Regency, South Labuhanbatu Regency, Tanjungbalai City.

2.2. Data Types and Sources

The data used in research on the factors that affect rice production based on the type is using quantitative data. Quantitative data in this study is data obtained from facts and information that can be measured in the form of numbers. The quantitative data used in this research consists of data on total paddy production, land area, agricultural sector labor, anddistrict minimum wages inNorthSumatraProvince in 2010-2019.

2.3. Method of collecting data

Data collection method is a method that can be used in research to collect data. This research on the analysis of factors that influence paddy production in North Sumatra uses secondary data with panel data (time series and cross section) from 2010 to 2019(10 years).

With the sample area covering the West Coast covering 3 (three) regions, including North Nias Regency, West Nias Regency and Sibolga City and the East Coast region covering 3 (three) regions, including North Labuhanbatu Regency, South Labuhanbatu Regency and Tanjungbalai City.

2.4. Data Processing and Analysis Method

The data obtained during the study were processed using qualitative analysis tools in the form of descriptive analysis and quantitative analysis tools in the form of panel data regression analysis. Descriptive analysis is an analysis carried out by providing an overview. The purpose of descriptive analysis is to provide a systematic and accurate description of the relationship between the phenomena studied. The data obtained from the company will be analyzed using the panel data regression method, namely the Fixed Effect Model. First, analyze the independent variable to determine the effect of the independent variable (X) including land area, labor and minimum wage on the dependent variable (Y) as the total production individually or as a whole by using statistical tests including namely t test, coefficient of determination (R2) and F test. Then the classical assumption test is carried out, namely multicollinearity, autocorrelation and heteroscedasticity tests to analyze the level of precision of the regression model obtained. After getting the right regression model, the next step is to draw conclusions.

The following is a panel data analysis model for the influence of land area, agricultural sector labor and minimum wages on total rice production in North Sumatra Province, the equation is as follows:

$$(TPPNS)= f(Ln(LANS), (ASWNS), (WMNS)) \quad (1)$$

So that the panel data regression equation is obtained as follows:

$$(Y) = \beta 0 + \beta_1 * Ln\ (LANS) + \beta_2 * Ln\ (ASWNS) + \beta_3 * Ln\ (WMNS) + et \quad (2)$$

$$(Y) = -28.57299 + 0.039039*Ln(LANS)+2.654573*(ASWNS)+ 0.651324*(WMNS) + et \quad (3)$$

Where:

TPPNS = Total paddy production (tons)
LANS = Land area
ASWNS = agricultural sector workforce
WMNS = wages minimim
0 = Constant
β1 - β3 = Parameter coefficient
E t = Disturbance error

3. RESULTS

This study analyzes the effect of total paddy production, land area, agricultural sector labor, and district minimum wages in North Sumatra Province in 2010 – 2019. The analytical tool used is panel data with Random Effect Model analysis model and is completed through computer statistics, namely Eviews 9,0. Furthermore, the results of data processing presented in this chapter are considered to be the best estimation results because they can meet statistical and econometric criteria.

3.1. Data Quality Test

3.1.1. Heteroscedasticity Test

Heteroscedasticity means that in a model there is a difference from the residual variance on the observation. In a good model there is no heteroscedasticity. Based on the heteroscedasticity test, the probability value of all independent variables is greater than the significant level at the 5% level. This situation indicates that there is the same variant or the occurrence of homoscedasticity. The following are the results of the heteroscedasticity test:

Table 2. Heteroscedasticity Test Results

Variable	Coef .	Std. Error	t-Statistic	Prob.
C	-3.27967	4.251218	-0.77147	0.4441
Land area	0.186248	0.119476	1.558877	0.1253
Workforce	0.048496	0.162905	0.297697	0.7672
wages minimim	0.215129	0.26351	0.816397	0.4181

3.1.2. Multicollinearity Test

Multicollinearity is the existence of a linear relationship between the independent variables in the regression model. To test the presence or absence of multicollinearity in the model, the researcher used apartial method between independent variables. The rule of thumb of this method is if the correlation coefficient is high enough above 0.85 then it is suspected that there is multicollinearity in the model. On the other hand, if the correlation coefficient is relatively low, it is assumed that the model does not contain elements of multicollinearity [3].

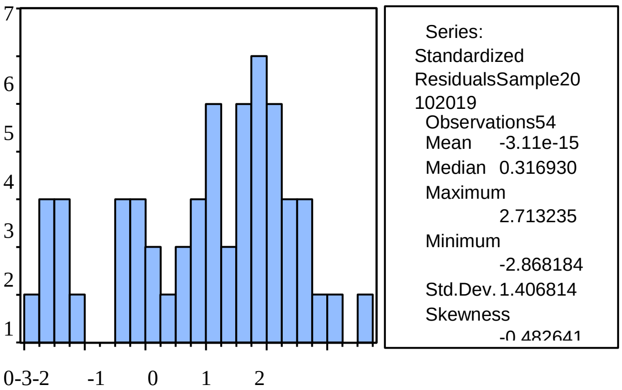
Classic assumption test deviation to approach multicoliniearitas do with the approachon value R^2 and the significance of the variables that are used. The discussion is to analyze the data used by each variable and the results of existing data processing, the data usedincludetimeseriesdataandcrosssectiondata.However, multicollinearity occurs usually in time series data on the variables used. Rule of Thumbalso define if obtained R^2 are high while there are mostly large or all of the variables are partially not significant then allegedly occurred multicoliniearitas on the model of the [3]. The multicollinearity test was used to determine whether or not there was a relationship between the independent variables in the study.

Table 3. Multicollinearity Test Results

	Land area	workforce	wages minimum
Land area	1.000000	0.784492	0.007272
workforce	0.784492	1.000000	-0.1412
wages minimum	0.007272	-0.1412	1.000000

Based on Table 3. It can be concluded that the correlation coefficient between the independent variables <0.9 which means that there is no multicollinearity in the regression model.

3.1.3. Data Normality Test



From results above shows the value of 0.215629 probability means is greater than the value of alpha 0:05 then the residual is said to be distributed normally.

3.2. Model Selection Analysis

Estimation method of the model regression using the data panel can be done via three approaches [4], among others models Pooled Least Square (PLS), Fixed Effect Model (FEM), or Random Effects Model (REM). Of the three regression models that can be used to estimate panel data, the regression model with the best results will be used in the analysis. So in this study to find out the best model to be used in analyzing whether the Pooled Least Square (PLS) model, Fixed Effect Model (FEM), or Random Effect Model (REM), then tested first using the Chowtestand Hausman test.

3.2.1. Chow test

Chow test is conducted to compare or choose which one is the best between the Common Effect Model or the Fixed Effect Model. Decision making by looking at the probability value (p) for Cross-Section F. If the p value > 0.05 then the model chosen is the Common EffectModel.Butif p <0.05thenthemodelsthathavebeen selectedarethe Fixed Effects Model.

Table 4. Chow Test Results

Effects Test	Statistics	Df	Prob.
Cross-section F	29.22599	(5.45)	0.000
Cross-section Chi-square	78.09972	5	0.000

Based on Table 4.the Chow test above, the two probability values of Cross Section F and Chi square are smaller than Alpha 0.05, thus rejecting the null hypothesis. So showing the fixed effect, the best model used is the model using thefixedeffectmethod.Based on the results of the Chow test which rejected the null hypothesis, then the data testing continued to the Hausman test.

3.2.2. Hausman test

Hausman test is conducted to compare or choose which model is the best between the Fixed Effect Model and the Random Effect Model. Decision making by looking at the probability value (p) for Cross-Section Random. If the value of p>0.05 then the model that was chosen is the Random Effect Model, but if p<0.05 then the models were chosen are Random Effect Model.

Table 5. Hausman Test Results

Test Summary	Chi-Sq. Statistics	Chi-Sq. df	Prob.
Cross-section random	0.797585	3	0.85

The value of Chi Square Statistics in Random Cross-section = 0.7997585 with p value = 0.8500 > 0.05, thus rejecting hypothesis one. So based on Hausman test, the model that best use is a model by using the method of Random Effect Model.

3.2.3. LM (Lagrange Multiplier) Test

The LM test is used to determine the Random Effect model is better than the Common Effect (OLS) method and is also used to ensure that the Fixed Effect and Random Effect model results are in consistent in the previous test. In the case of using the LM test, because at the moment do test Housman models that fit is a model Random Effect but on tests Chow ideal is a model Fixed Effect. So to decide which model to use, this LM test is carried out.

LM.Test Hypothesis
H0: Fixed Effect
H1: Random Effect
Alpha 5% = (0.05)

Table 6. LM. Test Results

	Hypothesis Test		
	Cross-section	**Time**	**Both**
Breusch-Pagan	113.8282	0.313280	114.1415
	(0.0000)	-0.5757	(0.0000)

Source: Results of processed Eviews 9.0

From the Table 6, the results output in the above can be seen that the value of Prob. Breusch-Pagan (BP)of 0.0000 is smaller than Alpha 0.05, thus rejecting the null hypothesis. So based on the LM test, the best model to use is a model using the Random Effect Model.

3.3. Best Model Analysis

The results of the model selection using the best analysis test are presented in the following table:

Table 7. Estimated Result of *Common Effect, Fixed Effect and Random Effect*

Dependent variable: Paddy Production	Model		
	Common	**Fixed**	**Random**
Constant (C)	-22.6445	-35,81615	-28.57299
Standard error	8.311166	12.04367	8.868423
T-Statistic	-2.72459	-2.973857	-3.221879
Probability	0.0088	0.0047	0.0022
Land Area	-0.0064	0.031099	0.039039
Standard error	0.233576	0.162697	0.161419
T-Statistic	-0.0274	0.191146	0.241851
Probability	0.9783	0.8493	0.8099
Agriculture sector workforce	2.207316	3.252988	2.654573
Standard error	0.318481	0.939829	0.651550
T-Statistic	6.930765	3.461257	4.074244
Probability	0.0000	0.0012	0.0002
Wages	0.574988	0.0012	0.651324
Standard error	0.515163	0.303291	0.290497
T-Statistic	1.116127	2.398573	2.242103
Probability	0.2697	0.0207	0.0294
R^2	0.720841	0.934274	0.303283
F-statistics	43.03654	79.95803	0.303283
Prob (F-stat)	0.000000	0.000000	0.000392
Durbin-Watson Stat	0.261589	1.164339	1.069792

Basedon the model specification test that has been carried out from both analyzes using the like lihood test, the Hausman test both recommends using the fixed Effect Model and the Random Effect Model, so an LM test is held to determine which model should be used, and from the comparison of the best selection test, the regression model that is used is used is the Random Effect Model.

Table 8. Estimated Results of Random Effect Model Dependent Variable: LNTPPNS
Method: Panel EGLS (Cross-section random effects)
Date: 08/18/21 Time: 23:05
Sample: 2010 2018
Periods included: 9
Cross-sections included: 6
Total panel (balanced) observations: 54
Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNLANS	0.039039	0.161419	0.241851	0.8099
LNASWNS	2.654573	0.651550	4.074244	0.0002
LNWMNS	0.651324	0.290497	2.242103	0.0294
C	-28.57299	8.868423	-3.221879	0.0022
Effects Specification				
			SD	**Rho**
Cross-section random			2.080744	0.8875
Idiosyncratic random			0.740816	0.1125
Weighted Statistics				
R-squared	0.303283	Mean dependent var		0.987867
Adjusted R-squared	0.261480	SD dependent var		0.842843
SE of regression	0.724316	Sum squared resid		26.23168
F-statistics	7.255043	Durbin-Watson stat		1.069792
Prob(F-statistic)	0.000392			
Unweighted Statistics				
R-squared	0.683836	Mean dependent var		8.382344
Sum squared resid	118.7983	Durbin-Watson stat		0.236219

3.4. Panel Data Model Estimation Results

Based on the specifications of the model testing that has been carried out and from the comparison of the values of the regression model, the best panel data used is Random Effect. In the previous test, this model was successfully used through the classical assumption test, so that the results obtained after the estimation were consistent and unbiased. Table 8. above shows the results of the estimated data on the number of observations as many as 6 districts/cities during the period 2010 – 2019.

1. β_0 = -28.57299 means that if all the variables independent (land area, agricultural sector workforce , Wages minimum) assumed to be constant, or do not undergo changes in the total production of paddy would be as big as -28.57299 .
2. β_1= 0.039039 Land area can be interpreted that when (land area) increases by 1% , the total paddy production increases by 0.039039.
3. β_2 = 2.654573 means that when agricultural sector workforce by 1%, then the total production of paddy experienced a rise of 2.654573.
4. β_3 = 0.651324 can be interpreted that when the minimum wage increases by 1%, the total paddy production increases by 0.651324.

In the model estimation at the top, seen that the influence of *across-section* that is located in each district/city to the total production of paddy in the province of North Sumatera. Based on the classical assumption test, it was found that all independent variables, namely land, farm labor, minimum wages, individually and as a whole affect rice production on the west and east coasts of North Sumatra. This is in accordance with the research conducted by Putra and Nasir [6] which showed the results that the variables of land area and labor had a positive effect on rice production and contrary to the opinion of Pancawati [7] which stated that thenumber of farm workers had no effect on rice production.

4. CONCLUSION

Based on the analysis that has been done, it can be concluded as follows:

1. All independent variables namely land, agricultural laborers, the minimum wage affects individually and as a whole on rice production in the west and east coasts in North Sumatera.
2. The agricultural sector labor variable and the minimum wage have a positive and significant effect, while the land area variable has a positive but not significant effect on lowland rice production for the west and east coasts of North Sumatra. Each increase in land area, agricultural sector labor and minimum wages by 1% will cause an increase in the rice production ratio of 0.039039, 2.654574 and 0.651324, respectively.

ACKNOWLEDGMENTS

The team of authors would like to thank the experts and implementers of food security and nutrition policies in government institutions in North Sumatra who have provided invaluable information and data for this paper. In particular, we would like to express our deepest appreciation and gratitude to the Faculty of Agriculture, University of North Sumatra for the assistance and support provided during this study.

REFERENCES

[1] Rice Crop Area Survey Using Household Approach in Java Year, 1996/97

[2] Ministry of Agriculture, 2018

[3] Gujarati, N. Damodar, Basic Econometrics Fourth Edition. Jakarta: Erlangga, 2003.

[4] D. Nachrowi. Econometrics For Economic and Financial Analysis. Jakarta: UI, 2006.

[5] I. Ghozali, Multivariate Application with SPSS Program. Semarang: Diponegoro University Publishing Agency, 2005.

[6] H. Putra, and M. Nasir, Analysis of Factors Affecting Production in the Agricultural Sector in Aceh Province. Agripep Volume 16, No. 1, 2015, 53-60.

[7] K. Pancawati, Analysis of Rice Production in Java for the Period 2008 - 2013. Yogyakarta: Undergraduate Thesis. Faculty of Economics, Islamic University of Indonesia, 2014.

[8] S. Ika, H. Setiawan, and Sad, Political Evaluation of Indonesian Food and Fiscal Political Support. Economics and Finance Studies, 19(1), 2015, doi: 10.31685/kek.v19i1.15.