Analysis of Factors Affecting Rice Production in Kulon Progo District in 2012-2017 Using Software R and Geoda

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ABSTRACT

Development in the agricultural sector is one of the basic needs for food security in Indonesia. One goal is to improve the quality of agricultural production in order to create food security and increase the welfare of farmers. Based on BPS data in 2016, the number of paddy production in Kulon Progo Regency is at number 4, relatively low compared to other districts in DI Yogyakarta Province. Rice production in Kulon Progo Regency in 2016 was recorded at 116,452.30 tons. and in 2017 there was a decrease in rice production by 0.08% with production of 113,358.80 tons. Increasing rice production needs to be done, because the need for rice will increase every year. Therefore an analysis of the factors that affect rice production will be carried out. The analytical method used is panel data regression. The results of this study, the best panel data regression model using CEM. Variable harvest area, number of farmers, and average production can explain the variable of rice production by 98.521%. The model equation is as follows:
Production = -320.748685 + 6,598419 LAPit - 0.065235 JPit + 8.264648 RRPit

I. Introduction

Indonesia is known as an agrarian country that has vast land with various biodiversity, the majority of which work as farmers. Because development in the agricultural sector is one of the basic needs for food security in Indonesia. One of the objectives is to improve the quality of agricultural production in order to create food security and increase the welfare of farmers, so that the government has an obligation to always strive for availability through various policy measures.

Large land area and diverse biodiversity does not guarantee that it can meet food needs, especially in rice, given that the number of population in each region always increases every year, which then causes the amount of demand to be greater than the amount of rice production. For this matter, the government usually imports rice from other countries to meet the needs of rice, the rice import policy is carried out to increase rice stocks which have decreased. The obstacle faced by the government today is how to increase the amount of rice production every year so that it can always maintain food security.

The Special Province of Yogyakarta has four regencies and 1 municipality, which includes Bantul Regency, Gunung Kidul, Kulon Progo, Sleman and Yogyakarta City. The natural resources owned by DIY are very abundant, while some of the potential wealth of DIY is agriculture, rivers, plantations, livestock, mountains, fisheries, and the sea.

Based on data from the Central Statistics Agency (BPS) of Kulon Progo Regency, the rice field area of Kulon Progo Regency in 2017 was recorded at 10.254 hectares. Compared to 2016 there was a narrowing of rice field area, which is an area of 10.366 hectares. The decrease in wetland area is due to the shifting of the function of agricultural land to non-land, and land conversion is increasing every year, with increasingly narrow land use it also affects the harvest area, because the harvested area will

increase if the land area grows[1]. Based on data from the Central Statistics Agency (BPS) of Kulon Progo Regency, the rice harvest area of Kulon Progo Regency in 2017 was recorded at 18,626.7 hectares. Compared to 2016 there was a narrowing of the harvest area, which was an area of 18,822 hectares.

The amount of rice production is one indicator of national food availability, if the value of rice production is high, then national food availability is also high and is expected to be able to meet national food needs so as to minimize imports, but if the value of rice production is low, national food availability is also low, so government attention in taking policies, so that there is no national food shortage. Analysis of factors that influence rice production is done to facilitate decision making for the government in increasing rice production.

II. Related Research

A. Descriptive Statistics

Descriptive statistics is a science that studies how to collect data and present data so that it is easy to understand, and measures the values of data obtained from a study, so that a general description of the data is obtained [2]. Descriptive statistics include frequency distribution and its parts, which include distribution graphs (histograms, frequency polygons, and ogifs), size of center values (mean, median, mode, quartile, etc.), and dispersion size (range, mean deviation, variance, standard deviation, and some of them).

B. Simple Linear Regression Analysis

Simple linear regression analysis is a statistical method that is used to analyze the relationship of influence between two variables[3]. Simple linear regression analysis is used to determine the effect of the independent variable on the dependent variable or in other words to find out how far the changes in the independent variable affect the dependent variable. the equation for a simple linear regression model is as follows:

$$Y_i = \beta_0 + \beta_1 X_i + \varepsilon_i$$

Information :

Y = Variables dependent
X = Variables independent
β_0 = *Intercept*
β_1 = *Slope*
ε = *Error*
i = Observation to-i, i = 1,2,…, n

C. Double Linear Regression Analysis

Simple linear regression analysis is used to measure the mathematical relationship between more than two independent variables (X) with the dependent variable (Y)[4]. In general, multiple linear regression models can be written as follows:

$$Y_i = \beta_o + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + ... + \beta_J X_{Ji} + \varepsilon_i$$

Information :

Y = Variables dependent
β_0 = *Intercept*
β_J = Coefficient variables independent to-J
J = 1,2,…., J
X_J = Variables independent to-J
ε = *Error*
i = Observation to-i, i = 1,2,…, n

D. Panel Data Regression Analysis

Panel data is the result data from observations on several individuals (cross sectional units) which are each observed in several consecutive time periods[5]. Panel data regression is a regression by combining both cross section data and time series in an equation.

III. Research Methodology

A. Data Type

In this study the type of data used is secondary data in the form of panel data, the data consists of two data, namely cross section data and time series data. The cross section data used as many as 12 sub-districts in Kulon Progo Regency and time series data used are data for 2012-2017. Twelve sub-districts selected for the study were Temon, Wates, Panjatan, Galur, Lendah, Sentolo, Pengasih, Kokap, Girimulyo, Nanggulan, Kalibawang, Samigaluh sub-districts. The variables used were rice production (production), wetland area (LLS), harvested area (LAP), average production (RRP), area of pest attack (LSH), number of farmers (JP), and number of groups farmer (JKT).

B. Data Source

The type of data used in this study is secondary data. Secondary data was obtained from the Central Bureau of Statistics of the Special Region of Yogyakarta and the Central Bureau of Statistics of Kulon Progo Regency. Secondary data collection from this study comes from the book Kulon Progo Regency in Figures from 2012 to 2017. In this study data on rice production, harvest area, paddy field area, number of farmers, average production, extent of pest attacks, number of farmer groups were obtained. for the past 5 years.

C. Data Analysis Methods

1. Descriptive analysis is used to give a general description or description of the amount of Paddy Production in Kulon Progo Regency in 2012-2017 along with the factors that influence it using the Geoda software.
2. Analysis of the data in this study using panel data regression analysis using software R. The output of the panel data regression analysis will be analyzed so that it is known about what factors influence the amount of rice production in Kulon Progo Regency.

IV. Results and Discussion

A. Descriptive Analysis

Before conducting panel data regression analysis, first see how the general picture of the data. Descriptive analysis in this study was used to visually describe the average amount of rice production in Kulon Progo Regency in 2012-2017 and the factors that influenced it.

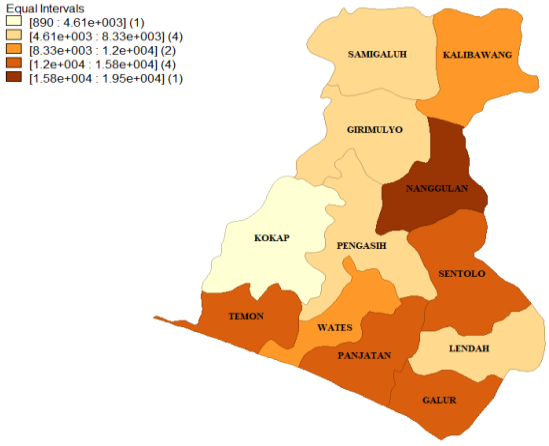

Figure 4.1 Region average number of sub-district rice production in 2012-2017 in Kulon Progo Regency.

Based on Figure 4.1 the results of the mapping above, according to the researcher, it can be seen that there is a spatial element in the average level of rice production in the sub-districts of Kulon

Progo Regency. It can be seen that the darkest color is a sub-district that has the highest average rice production, which is found in Nanggulan tons District. Nanggulan Subdistrict is a rice producing center in Kulon Progo, the highest rice production, which is in the Nanggulan sub-district of 1.95e+004 tons. Nanggulan Subdistrict is the rice producing center in Kulon Progo, the rice production in the sub-district is the highest and continues to increase compared to other sub-districts in Kulon Progo Regency. Whereas for the youngest color is the sub-district which has the lowest average rice production, which is found in Kokap Subdistrict of 890 tons.

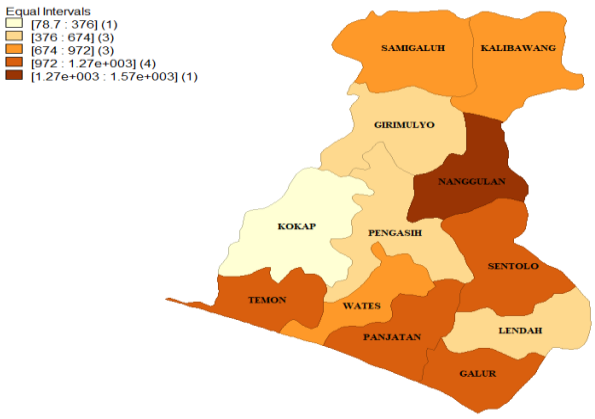

Figure 4.2 Average area of sub-district rice fields in 2012-2017 in Kulon Progo Regency.

Based on Figure 4.2 above is the display or output of the average area of sub-district rice fields, which have the darkest color is the sub-district with the widest average area of paddy fields, which is found in Nanggulan District of 1.57e+003 Hectares. Whereas the youngest color is the sub-district that has the lowest average area of paddy fields, which is found in Kokap Subdistrict of 78.7 hectares.

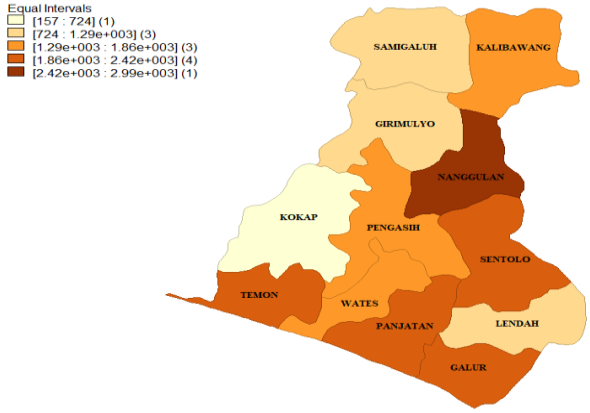

Figure 4.3 Region average harvest area for districts in 2012-2017 in Kulon Progo Regency.

Based on Figure 4.3 above is the display or output of the average area of sub-district rice fields, which have the darkest color is the district with the highest average harvest area, which is found in Nanggulan District of 2.99e+003 Hectares. Whereas the youngest color is a sub-district that has the least area of rice fields, which is found in Kokap Subdistrict of 157 hectares.

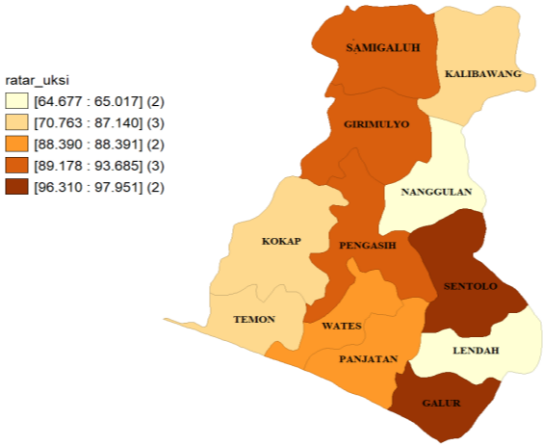

Figure 4.4 Region variable average of sub-district rice production in 2012-2017 in Kulon Progo Regency.

Based on Figure 4.4 above is a display or output of the average area of sub-district rice fields, which have the darkest color is the district with the highest average rice production, which is found in Sentolo District of 96.310 Kw / Ha and Galur District is 97.951 Kw / Ha. Whereas the youngest color is the sub-district which has the lowest average rice production, which is found in Lendah District, which is 64,677 Kw / Ha and Nanggulan District is 64,677 Kw / Ha.

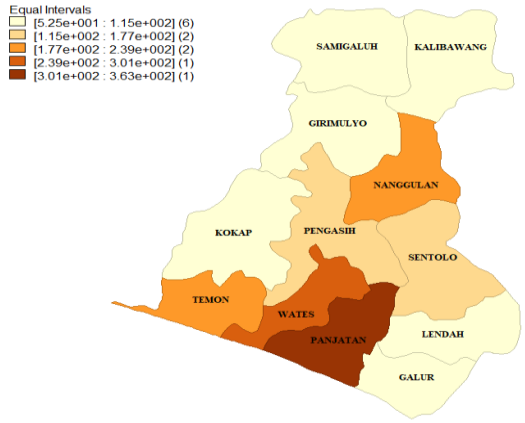

Figure 4.5 The average area of pest attacks in 2012-2017 in each sub-district in Kulon Progo Regency.

Based on Figure 4.5 above is a display of the results of the average area of pest attacks in each sub-district. The extent of pest attacks in each sub-district in Kulon Progo Regency tends to decrease every year. It can be seen that having the darkest color is a sub-district with the widest average area of pest attacks, which is found in Panjatan Subdistrict, which is 3.63e+002 hectares. Whereas the youngest color is a sub-district with an average area of low pest attacks which are found in Kalibawang, Girimulyo, Galur, Lendah, Samigaluh and Kokap Districts. The lowest area of pest attack is found in Kokap Subdistrict of 5.25e+001 hectares.

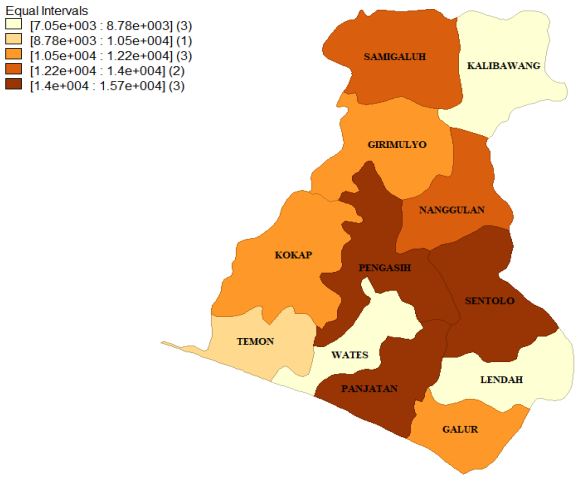

Figure 4.6 Region average number of farmers in 2012-2017 in each sub-district in Kulon Progo Regency.

Based on Figure 4.6 it can be seen that the number of farmers in each sub-district in Kulon Progo Regency tends to be stable every year. It can be noted in the image that has the darkest color is the sub-district with an average number of farmers classified as high compared to other sub-districts, which is found in Sentolo District, Pengasih and Panjatan. Panjatan Subdistrict with a total of 14,098 inhabitants, Pengasih District with a total of 14,767 inhabitants, and sub-districts with the highest average number of farmers in Sentolo Subdistrict, which is 15,704 people. Whereas for those who have the youngest colors are sub-districts with an average number of farmers classified as low, which are found in Wates, Lendah, and Kalibawang Districts. The average number of farmers is the least in Kalibawang Subdistrict, which is 7,051 people.

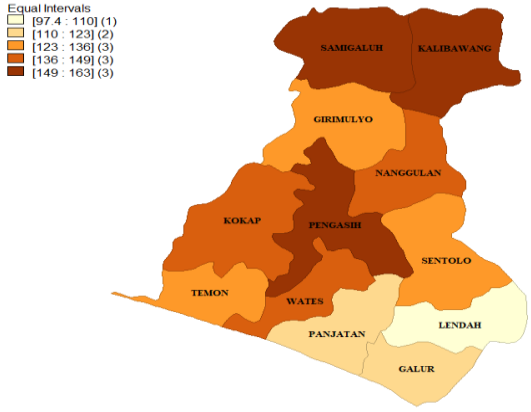

Figure 4.7 Region average number of Farmer Groups in 2012-2017 in each sub-district in Kulon Progo Regency.

Based on figure 4.7, the number of farmer groups in each sub-district in Kulon Progo Regency in 2012 to 2017 tends to increase every year. sub-districts in Kulon Progo Regency which have the darkest colors are sub-districts with an average number of farmer groups that are high when compared to other sub-districts, which are found in Pengasih District, Samigaluh, and Kalibawang. Districts with the highest number of farmers in Kalibawang sub-district are 162 groups. Whereas for the youngest color is the sub-district with the lowest average farmer group, which is found in Lendah District, which is 97 groups.

B. Determination of Panel Data Regression Models

To find out the effect of independent variables in the model on the dependent variable simultaneously and partially, then the F test and the T test are carried out.

1) Chow Test

Chow Test is a test that aims to choose the Fixed Effect Model or Common Effect Model that is most appropriate to use.

a) Hypothesis

Ho: β01 = β02 = ... = β0K (i and t effects do not mean / Common Effect Model)
H1: At least there is one i with β0i ≠ 0 (effect i and t means / Fixed Effect Model)

b) Significance level (α = 0.05)

c) Test statistics

F hitung	*p-value*
1.8342	0.06321

d) Critical area

Reject Ho if p-value <α

e) Decision

p-value = 0.06321, failed to reject Ho

f) Conclusion

By using a significance level of α = 0.05, it can be concluded that it failed to reject Ho, because the value of p-value is greater than 0.05, so the Chow Test model that is better used is the Common Effect Model.

2) F Test

The F test is conducted to determine whether the selected model is feasible to use or not and to determine the effect of simultaneous independent variables on the dependent variable.

a) Hypothesis

H_0: β_1 = β_2 = ⋯ = β_J = 0 (the model is not feasible to use)
H_1: there is at least β_J ≠ 0 (the model is feasible to use

b) Significance level (α = 5%)

c) Critical area

Reject H_ (0) if F count> Ftable or p-value <α (0.05)

d) Test statistics

Variabel	Koefisien	t hitung	*p-value*	Keputusan
LLS	0.134333	0.3030	0.762442	Gagal Tolak H_0
LAP	6.517747	29.9850	$2.2x10^{-16}$	Tolak H_0
RRP	8.735648	2.2583	0.025846	Tolak H_0
LSH	0.392161	1.0978	0.274606	Gagal Tolak H_0
JP	-0.066866	-2.8640	0.004989	Tolak H_0
JKT	0.631002	0.2687	0.788666	Gagal Tolak H_0

e) Critical Point

Reject Ho if p-value = 2.22x10-16 <α = 0.05

f) Decision

p-value = 2.22x10-16, reject Ho

g) Conclusion

By using a significance level of 95%, it can be concluded that rejecting Ho is because the value of p-value is smaller than α (0.05), which means that the model is feasible to use and the independent variable has an effect on the dependent variable.

Based on the above results, it can be seen in the output of the t test on the statistical test points, there are results of decisions which of the six variables there are 3 significant variables and the other 3 are not significant. To do a panel test, then test the significant variables while for the non-significant variables, not included in the next test.

C. Interpretation of Panel Data Regression Models

Based on the Chow test results it can be concluded that the Common Effect Model model is more appropriate when compared to Fixed Effect Model, to determine the factors that influence rice

production in Kulon Progo District in 2012-2017. Based on the F test, it is known that the model is feasible to use and the independent variables in the model simultaneously influence the dependent variable. In the next stage, the T test is carried out, the variables that affect the rice production variables significantly are LAP, RRP, and JP variables.

Based on the value of R2 obtained, which is equal to 0.98521 which means that the variables LAP, RRP, and JP, and is able to explain the variable Rice Production in Kulon Progo Regency is 98,521%, while 1,479% is explained by other factors not included in the model.

Variabel	*Coefficient*	*p-value*
LAP	6.598419	$2.2x10^{-16}$
JP	-0.065235	0.005626
RRP	8.264648	0.030757

Based on the table above, the model equation is obtained as follows:
Production = -320.748685 + 6.598419 LAP - 0.065235 JP + 8.264648 RRP

V. Conclusion

Factors that influence the amount of rice production in Kulon Progo Regency are Harvest Area (LAP), Number of Farmers (JP), and Average Production (RRP). The magnitude of the effect given by the Harvest Area Area on rice production is 6,598419, which means that every increase in rice harvest area is 1 hectare, then rice production will increase by 6,598419. The amount of influence given by the Number of Farmers variable on rice production is -0.065235, which means that every increase in the number of farmers is 1 unit, the rice production will decrease by -0.065235, while the influence of the Average Production (RRP) on rice production 8.264648, which means that every increase in the number of farmers is 1 unit, then rice production will decrease by 8.264648.

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