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Risk Production Analysis Rice Farming with Just and Pope Approach

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Abstract

Rice plants are included in agricultural commodities that have a high risk. Farming risks can be caused by agroecological environmental factors, input factors and management. This study aims to (1) determine the magnitude of the production risk of rice farming; (2) Identify production factors that affect rice production risks; This research was conducted in Lampulung Village, Pammana District, Wajo Regency. The population in this study amounted to 618 people. From this population, 5% of the population was taken so that a sample of 30 people was taken. Analysis of the coefficient of variation is used to determine the magnitude of the risk and the Just and Pope model is used to identify risk factors. The results showed that (1) the risk of rice production in Lampulung Village, Pammana District, Wajo Regency was relatively large with a coefficient of variation of 0.524, meaning that for every ton of rice productivity that is expected, there is a productivity risk faced by a risk of 52.4 percent of total production which are expected; (2) The production factor that increases the risk of rice production is the seed factor. Variable land area, fertilizer, labor and pesticides are factors that can reduce or reduce the risk of rice production.

Keywords: Rice farming, productivity, pisk production, just and pope

A. Introduction

Rice plays a very strategic role in household food consumption (Nurliani & Rosada, 2016). Rice is still a staple food for Indonesian people so that Indonesia is the largest rice consumer in Asia (Yuliawan & Handoko, 2016). This high demand for consumption shows insignificant results with declining rice production in 2021. BPS Indonesia data shows a decrease in production of 0.41% compared to 2020. Wajo Regency is the second largest contributing district to rice production in South Sulawesi with a production of 13.14% in 2021. This shows that the agricultural sector is still a support for people's lives in Wajo Regency.

Rice plants are included in agricultural commodities that have a high risk, are very vulnerable to breaking and include plants whose growth and harvest depend on the season and climate (Rohmah et al., 2015). In farming, the productivity expected by farmers does not always reach the optimal level of efficiency. Risk is closely related to uncertainty so the risk of farming can be minimized from the efforts made by humans (Shakya & Chauhan, 2019). One of the risk factors in farming is production risk (Astuti et al., 2019). Farming risks can be caused by agroecological environmental factors, input factors and management (Zakirin et al., 2014). Weather/climate is the factor that drives the risk the most, other factors are pests and diseases, seed quality, soil fertility and human resources (Ghozali & Wibowo, 2019). This is in line with the geographical conditions in Wajo Regency, especially in Pammana Subdistrict which is directly adjacent to Lake

Lampulung and the Welannae River which makes this area frequently experience flooding and changing planting schedules.

Farmers' efforts to increase productivity can be seen from optimizing production factors, such as labour, seeds, fertilizers, pesticides and land. Efforts to develop rice farming can be studied in more depth regarding what factors influence the risks faced by farmers and the extent to which these risks have an impact on reducing the productivity of farmer's farming results.

B. Methodology

This research was conducted in Lampulung Village, Pammana District, Wajo Regency, with the consideration that the people in the village generally make their living from agricultural products, one of which is paddy rice farmers and is one of the largest rice producers in Wajo District. In this study, the data used are primary data and secondary data. Primary data was obtained through interviews using a structured list of questions (questionnaire). The population in this study amounted to 618 people. From this population, 5% of the population was taken so a sample of 30 people was taken.

Coefficient variation analysis is an analysis used to determine the magnitude of the risk of rice production in Lampulung Village, Pammana District, and Wajo District. The formulation is as follows:

1. Variance

Variance values indicate deviations or production risks faced by rice farmers. The variance value can be written using the following formula:

$$\sigma^2 = p_1(Y_1 - \hat{Y})^2 + p_2(Y_2 - \hat{Y})^2 + p_3(Y_3 - \hat{Y})^2 \qquad (1)$$

Explanation:

σ^2 = *Variance* of rice productivity

p_i = Probability of an event (farmers obtain the highest productivity, normal and lowest)

Y_i = Rice Productivity (Ton/Ha)

$\hat{Y}_i$ = Rice productivity expectations (Ton/Ha)

2. Standard Deviation

To find out the magnitude of the risks faced by rice farming actors using the Standard deviation. Mathematically it can be written as follows:

$$\sigma_i = \sqrt{\sigma^2} \qquad (2)$$

Explanation:

σ^2 = Variance of rice productivity

σ_i = Standard deviation of rice productivity

3. Coefficient Variation

To compare the risks faced by rice production using the coefficient of variation. Mathematically the coefficient variation can be written as follows:

$$CV = \sigma i / Y_i \qquad (3)$$

Explanation:

CV = Coefficient Variation

σ_i = Standard deviation

Y_i = Rice Productivity expectations

The analysis of the production risk function and rice production risk function in Lampulung Village, Pammana District, Wajo Regency uses the model developed by Just and Pope. The model has accommodated the existence of risk in the production equation by including the variance of production. Sari et al., (2020) (Sari et al., 2020)argue that the production function in the Just and Pope model which uses a two-step procedure is the Cobb-Douglas production function in natural

logarithmic form. The Just and Pope production function model by including the risk element is as follows:
Production Function:

$$f(x) = LnY_i = \beta_0 + \beta_1 LnX_1 + \beta_2 LnX_2 + \beta_3 LnX_3 + \beta_4 LnX_4 + \beta_5 LnX_5 + \varepsilon \text{.......(4)}$$

Risk Production:

$$\sigma^2 Y_i = (Y_i - \hat{Y}_i)^2 \text{ ....(5)}$$

Where production risk in this study is the residual from the regression model (variance productivity) which is obtained from the difference between actual production and output production regression. Production Risk Function:

$$g(x) = Ln\sigma^2 Y_i = \alpha_0 + \alpha_1 LnX_1 + \alpha_2 LnX_2 + \alpha_3 LnX_3 + \alpha_4 LnX_4 + \alpha_5 LnX_5 + \varepsilon$$

Explanation:
Y = Rice production (ton)
Ŷ = Estimated rice production (ton)
β = Parameters estimated in the production function
α = Parameters estimated in the production risk function
X1 = Land Area (Ha)
X2 = Seed (kg)
X3 = Labor (HOK)
X4 = Fertilizer (kg)
X5 = Pesticide (liter)

C. Findings and Discussion

The risk that is often faced by farmers, especially rice farmers in Lampulung Village, Pammana District, Wajo Regency is production risk where every season, it fluctuates and tends to decrease productivity produced by farmers. Fluctuating productivity is indicated by the highest, normal and lowest productivity values. The results of productivity calculations that have been received by farmers can be seen in the following table:

Table 1. The average productivity of rice produced by rice farmers in Lampulung Village, Pammana District, Wajo Regency

Variable	Average	Standard deviation
Lowest Productivity (Ton/Ha)	3,410 Ton/Ha	-
Normal Productivity (Ton/Ha)	4,822 Ton/Ha	-
Highest Productivity (Ton/Ha)	7,379 Ton/Ha	-
Lowest Odds	0,333	0,330
Normal Odds	0,400	0,305
Highest Odds	0,267	0,365
Expected Productivity	5,274	1,515

Table 1 shows that the highest productivity achieved by rice farmers in Lampulung Village, Pammana District, Wajo Regency was 7,379 tons/ha, the lowest productivity was 3,410 tons/ha, and the productivity most often produced by rice farmers in the area was 4,822 Tons/Ha. This shows that there is a large difference between rice farmers producing the highest and lowest productivity, which has implications for the erratic production results. Conditions in the field indicate that rice productivity is determined more by the variety used and the use of farming inputs by farmers. Every rice farmer will experience high, low and normal productivity conditions. This is related to several factors that can cause rice productivity to reach the highest level, namely good weather conditions, properly selected varieties, high soil fertility, and good irrigation. The measurement of the amount of risk in this research is seen from the value of the variance, standard deviation and the resulting coefficient of variation. The higher the value of the variance and the coefficient of variation, the higher the risks faced by farmers. As for the magnitude. The risk of rice productivity in Lampulung Village, Pammana District, Wajo Regency can be identified as follows:

Table 2. The Magnitude of Rice Productivity Risk in Lampulung Village, Pammana District, Wajo Regency

Measure	Value
Variance (Ton/Ha)^2	10,691
Std. Deviation (Ton/Ha)	2,718
Coefficient vatiation	0,524

Based on Table 2, shows that the magnitude of the productivity risk faced by rice farmers in Lampulung Village, Pammana District, Wajo Regency is 0.524. This value indicates that for every ton of expected rice productivity, there is a productivity risk of 0.524 tons/ha (there is a risk of 52.4 per cent of the total expected production). The magnitude of the risk is relatively large. This is thought to be caused by several factors such as the selection of varieties used, the availability of fertilizers, the availability of water on the land, the unpredictable weather and climate, and the time of harvest.

Production Risk Function of Rice Farming

The determination of the production risk function used in this study is based on the variance value obtained from the estimation of the production function using the Just and Pope model. Where the Just and Pope model can accommodate risks in production. The behaviour of rice farmers in facing risk is traced based on the use of production factors. The variables used in estimating the production function and production risk for rice farmers are the variables of land area, seeds, labour, fertilizers and pesticides and the number of workers.

Test Assumption Classic

To provide certainty that the regression equation used has accuracy in estimation and is not biased and consistent, a Classical Assumption Test is carried out which includes tests for normality, multicollinearity and heteroscedasticity as follows.

1. *Normality test.*

The normality test is needed to find out whether the data we use is normally distributed or not. This normality test uses the Eviews 12.0 application through the Histogram-Normaity Test. If the data has a probability value of Jarque-Bera > Alpha 0.05, then the data is declared to be normally distributed.

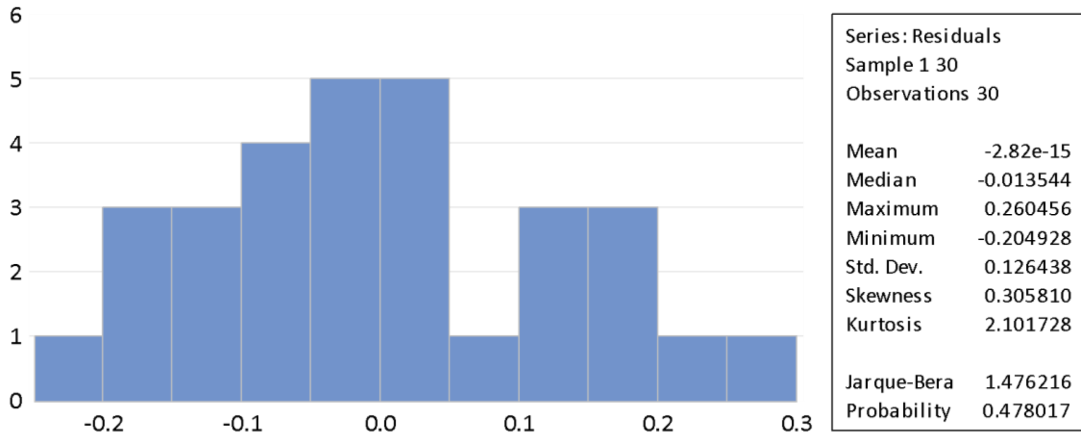

Figure 1. Normality Test Results

Figure 1 shows that the Jarque-Bera value is 1.476 with a probability of 0.478 > 0.05 (95% confidence level), which means that the residuals are normally distributed. The results of the regression analysis show that the regression model used is good because one of the BLUE (Best Linear Unbiased Estimator) conditions is met.

2. *Multicollinearity.*

A multicollinearity test was conducted to find out whether the independent variables in the regression equation are not correlated with each other. To detect multicollinearity one must look at the tolerance value and the Variance Inflation Factor (VIF) value. VIF is used as a criterion for detecting multicollinearity in linear regression involving more than two independent variables (Sriningsih et al., 2015). If the VIF value is greater than 10, it can be said to have a multicollinearity problem.

Table 3. Multicollinearity Test Results

No.	Variable	Value VIF
1.	Land Area (X1)	7,566
2.	Seed (X2)	3,038
3.	Fertilizer (X3)	1,035
4.	Labor (X4)	3,351
5.	Pesticide(X5)	7,796

Table 3 shows that all variables have a VIF value of less than 10, so it can be concluded that the regression model used is good because there are no correlation problems between independent variables or multicollinearity does not occur.

3. *Heteroscedasticity.*

To find out whether there is the same distribution of variance in the residuals, a Heteroscedasticity Test was carried out. To find out whether there is a heteroscedasticity problem using the White Heteroscedasticity test in the Eviews12.0 program. if valueProb. Chi-squared on Obs*R-Squared is greater than alpha 0.05, so the regression model is free from heteroscedasticity problems.

Table 4. Heteroscedasticity Test Results

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	2,007385	Prob. F	0,0465
Obs*R-Squared	26,09531	Prob. Chi-Square	0,1627

Table 4 shows that the Prob. Chi-squared on Obs*RSquared of 0.1627 is greater than alpha 0.05 meaning that the regression model is homoscedasticity or in other words, there is no problem with the assumption of non-heteroscedasticity so it can be concluded that the data on each independent variable in the model has a homogeneous variance.

Statistical Test

Testing the hypothesis of soybean production factors using multiple linear regression analysis by analyzing the coefficient of determination (R2), T-test and F-test. The confidence levels used in this study were 95% and 90% (α = 5%, α = 10%).

Table 5. Function of Production Risk in Lampulung Village, Pammana District, Wajo Regency

Production Function				
Variable	**coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	-8,281312	1.173446	-7,057255	0,0000
Ln Land Area (X_1)	-0,982120***	0,111617	-8,799007	0,0000
Ln Seed (X_2)	0,499524***	0,075372	6,627478	0,0000
Ln Fertilizer (X_3)	-0,001497^{ns}	0,037037	-0,040379	0,9681

Ln Labor (X_4)	1,779632***	0,284789	6,248960	0,0000
Ln Pesticide (X_5)	0,174027*	0,100901	1,724720	0,0974
R-squared			0,841261	
Adjusted R-squared			0,808190	
F-Statistik			25,43831	
Prob (F-Statistik)			0,000000	
Production Risk				
Variable	**coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	12,09012	8,814479	1,371621	0,1829
Ln Land Area (X_1)	-0,423633	0,838425	-0,505272	0,6181
Ln Seed (X_2)	1,774274***	0,566163	3,133859	0,0045
Ln Fertilizer (X_3)	-0,148518	0,278483	-0,533310	0,5987
Ln Labor (X_4)	-4,873154**	2,139222	-2,278003	0,0319
Ln Pesticide (X_5)	-0,167615	0,757932	-0,221148	0,8268
R-squared			0,416950	
Adjusted R-squared			0,295481	
F-Statistik			3,432564	
Prob (F-Statistik)			0,017617	

Description: *** = 99% Confidence Level
** = 95% Confidence Level
* = 90% Confidence Level
ns = Non-significant

1. *F-test.*

The F test is used to determine the effect of the independent variables simultaneously on the dependent variable in a significant way or not. Table 5 shows that the calculated F-values for the production function and production risk function are respectively 25.438 and 3.433 with a probability value of <α = 1%, namely 0.000. Thus it can be concluded that the independent variables of land area, seeds, fertilizers, labour and pesticides jointly affect rice productivity.

2. *T-test.*

The t-test is used to determine the effect of each independent variable on the dependent variable. Statistical Test Results for the Production Function and Production Risk Function are detailed as follows.

a. Land Area (X_1)

The results of the estimation of the rice production equation show that the variable land area is found to have a significant effect on rice productivity at the 99% confidence level at α=1 per cent. If farmers want to increase rice production in the region, land variables must be the main concern. Therefore, to increase rice production, land expansion is urgently needed. This is in line with what was stated (Ayu et al., 2021) that land area has a positive and significant effect on farmers' income. The narrower the land, the more inefficient farming is done. In general, it is said, that the larger the area of land (cultivated/planted), the greater the amount of production produced by that land. In a risky land function, the area hurts the risk of rice production. This means that any additional land area will reduce the production risks faced by farmers. However, land area does not affect production risk.

b. Seed (X_2)

The statistical t-test results in Table 5 show that seeds have a significant effect on rice productivity at the 99% confidence level with a p-value of 0.000 which is smaller than α, which is 0.01. The regression coefficient value is 0.499, which is positive, meaning that every 1 per cent increase in the number of seeds will increase rice productivity by 0.499 per cent with other assumptions being constant. This is by Zarliani (2020) which states that seeds have a significant effect on rice productivity, the use of superior seeds and certificates and the appropriate amount will affect rice productivity.

In the risk function, the seed production factor is a factor that can pose a risk to rice production. This is indicated by the value of the seed coefficient which is positive and has a significant effect on rice productivity, and has a positive sign. The positive effect of using seeds indicates that the quality of the seeds used by farmers is relatively good. If the quality of the seed is not good, then the addition of seed will not be followed by an increase in production, or it can even have a negative effect.

c. Fertilizer (X_3)

The statistical t-test results in Table 5 show that fertilizer has no significant effect on rice productivity. This is because, in the research area, floods often occur, so when the water recedes nutrients are stored in agricultural lands that have been submerged. The limited use of fertilizers in the study area was also a factor in the non-effect of fertilizers on rice productivity.

The effect of fertilizer on risk is negative which indicates that increasing the amount of fertilizer will reduce production risk. This means that when the use of fertilizer is increased it will also increase production yields and production risk will decrease. This is not by the results of research by Chrisdiyanti & Yuliawati (2019) which shows that the use of manure and organic manure will even increase the risk of farming. This is because the addition of fertilizer will increase the availability of nutrients in the soil, but the use of fertilizer that is above the production threshold will reduce the level of soil fertility for a certain period resulting in a decrease in production in the following years.

d. Labor (X_4)

The statistical test results in Table 5 show that labour has a significant influence on rice productivity at an error rate of 99% because the p-value of 0.000 is less than $\alpha = 0.01$. This means that rice production can be increased through the addition of labour used.

The risk factors for labour production have a negative influence on the risk of rice production. This means that an increase in the number of workers used will lead to a decrease in production risk. This is because floods often occur in this area, so farmers need workers to plant quickly and on time to avoid climate and weather changes. This is not in line with the research results of Nadapdap & Saefudin (2020) which show that additional labour will increase the risk of farming. This is because the workforce used is a workforce that is less skilled and does not understand a good plant maintenance system.

e. Pesticides (X_5)

The statistical test results in Table 5 show that pesticides have a significant effect on rice productivity at an error rate of 90% because the p-value of pesticides is 0.097 which is less than α 0.1. Pesticides can reduce and prevent attacks by pests and diseases that damage crops and agricultural products, especially rice. This is consistent with research by Suharyanto et al., (2015) which states that the use of pesticides has a significant effect on reducing production risk. Where farmers make decisions to use pesticides as a preventive measure to reduce pest and disease attacks on plants.

The effect of pesticides on risk is negative which indicates that increasing the amount of pesticides will reduce production risk. This is not by the results of research (Apriana et al., 2017) which shows the use of pesticides can reduce the risk of rice production. Pesticide spraying is carried out when the pest population is too large, two to three times spraying according to the intensity of the attack pest.

D. Conclusion

The risk of rice production in Lampulung Village, Pammana District, Wajo Regency was relatively large with a coefficient of variation of 0.524, meaning that for every ton of rice productivity that is expected, there is a productivity risk faced by a risk of 52.4 percent of total production which are expected. The production factor that increases the risk of rice production is the seed factor. Variable land area, fertilizer, labor and pesticides are factors that can reduce or reduce the risk of rice production.

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