Analysis of Harvest Area, Productivity, and Fertilizer Prices on Farmer Exchange Rate of Rice Food Crop Sub-Sector in Bengkulu Province

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ARTICLE INFO

ABSTRACT

This study examines the relationship between harvest area, productivity, and fertilizer prices on the farmer exchange rate of the rice food crop sub-sector in Bengkulu Province. This research is an explanatory research study with secondary data consists of monthly data from 2018 to 2022, resulting in a total of 60 observations. A multiple linear regression analysis was conducted using the OLS analysis model with Eviews 9. The results of the study indicate that the harvest area has a negative and insignificant effect on the farmer's exchange rate. Furthermore, the productivity of rice yield has a negative and significant effect on the farmer's exchange rate. This suggests that the lower the agricultural productivity, the more significant the farmer exchange rate. With regard to fertilizer prices, the results indicate a positive and significant impact on the farmer exchange rate. This implies that an increase in fertilizer prices leads to a corresponding increase in the farmer exchange rate

INTRODUCTION

In Indonesia, the advancement of the agricultural sector is intended to enhance the well-being of individuals engaged in agricultural pursuits. Given the pivotal role of the agricultural sector in the lives of people in developing countries, such as Indonesia, the continued development and advancement of the agricultural sector is a priority for the Indonesian government. This is because the sector has the potential to generate high-quality and abundant agricultural products, which will greatly benefit farmers by enabling them to obtain high selling prices for their products. As the agricultural sector continues to develop and advance, the lives of those employed in agriculture will also improve (Tsaputra et al., 2012).

In order to enhance the growth of the agricultural sector, the government employs the farmer exchange rate (NTP) indicator as a metric to enhance the income and well-being of farmers in Bengkulu Province. As defined by Nirmala et al., (2016), the farmer exchange rate (NTP) is one of several indicators used to assess the income and welfare of farmers. It is a measure of the ability of products (commodities) produced and sold by farmers to meet the needs of farmers for production and consumption in their households. Consequently, there is evidence to suggest that an increase in the farmer exchange rate is associated with higher incomes and a more prosperous life for farmers.

According to BPS-Statistic Indonesia (2020), one of the strategies for enhancing agricultural development is to improve the welfare of farmers. One of the proxy indicators for measuring the level of farmer welfare is the amount of the Farmer Exchange Rate (NTP), which is a measure of the purchasing power of farmers in rural areas. The NTP is a comparison of the price index of agricultural commodities produced by farmers (It) against the price index of goods and services paid by farmers for household consumption and production costs (Ib). The preceding explanation provides data on the development of the Bengkulu Province farmer exchange rate (NTP) and its comparison with the National NTP data from 2013 to 2022. This data will be used by researchers to ascertain whether there has been an increase or decrease in the farmer exchange rate in Bengkulu Province and to determine whether the farmer exchange rate is above or below the national average farmer exchange rate from 2013 to 2022.

As illustrated in Figure 1., the NTP of Bengkulu Province has consistently been below the national average from 2013 to 2019. However, there has been a notable increase in the province's NTP from 2020 to 2022, reaching a level that is significantly above the national average. A notable change in the NTP is observed, with the NTP of Bengkulu Province exceeding the National NTP in 2022. Specifically, the NTP of Bengkulu Province reached 134.01%, while the National NTP reached 107.33%. Furthermore, an examination of the National NTP over the past decade reveals minimal fluctuations and a consistent annual average above 100%. The graph below illustrates that the highest national NTP was observed in 2022, at 107.33%, while the lowest national NTP was recorded in 2017, at 101.28%.
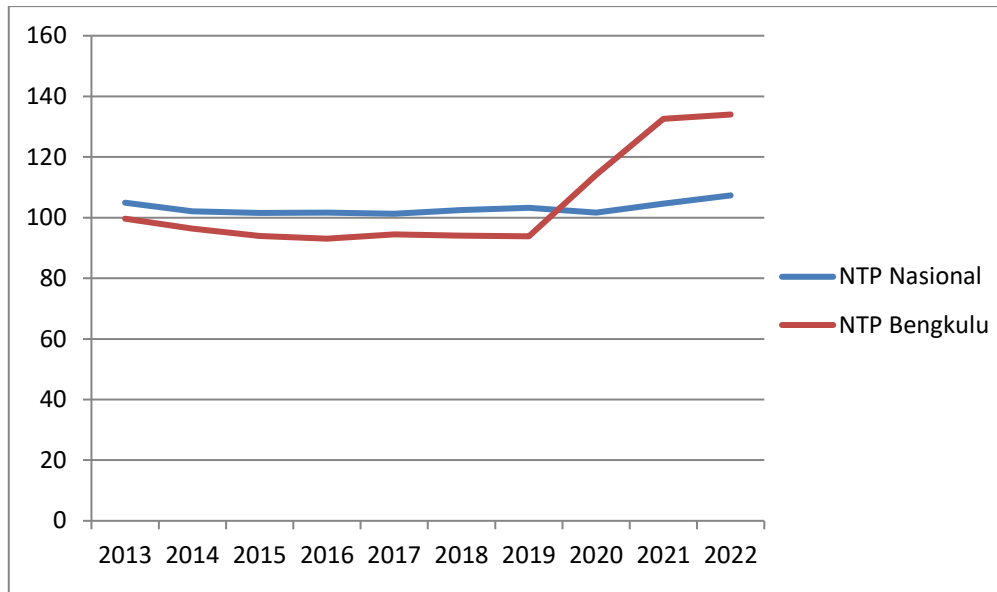
Figure 1. Development of Farmer Exchange Rate (NTP) in Indonesia and
Bengkulu Province in 2013 - 2022
Source: BPS-Statistic Indonesia (2022)

In addition to examining the comparison or trend of the exchange rate of farmers in Indonesia and Bengkulu Province, this study also examined the average exchange rate of rice farmers between 10 provinces on the island of Sumatra. This is done to ascertain the average of provinces whose rice farmer exchange rate is above 100, which indicates a surplus, and below 100, which indicates a deficit. The term "surplus" is defined as an increase in the price of agricultural production that is greater than the increase in the price of farmer consumption. This implies that the farmer's income rises more than the farmer's expenditure. Conversely, a deficit is defined as an increase in the price of production that is relatively smaller than the increase in the price of farmer consumption goods. This implies that the farmer's income declined less than his expenses.

Table 1. Development of Rice Farmer Exchange Rate of 10 Provinces in
Sumatera Island in 2013-2022

Year	Aceh	North Sumatra	West Sumatra	Riau	Riau Islands	Jambi	Bengkulu	South Sumatra	Bangka Belitung	Lampung
2013	154.25	144.65	137.16	145.57	106.00	117.21	178.93	171.72	107.43	157.46
2014	108.78	112.87	114.18	110.40	102.87	109.71	106.28	107.19	107.55	112.57
2015	115.34	119.91	115.37	118.42	109.33	120.73	114.83	118.30	108.91	123.30
2016	117.59	126.22	117.18	124.28	115.24	127.06	119.05	125.15	107.54	128.60
2017	118.68	125.84	117.09	130.38	119.98	125.85	117.85	126.36	109.46	136.68
2018	124.12	128.19	123.15	132.22	123.94	133.10	129.44	130.36	112.74	148.66
2019	124.32	129.45	130.39	123.42	122.90	138.58	135.52	132.55	113.23	151.85
2020	102.33	99.93	105.34	96.51	100.00	104.71	109.36	103.18	103.84	106.28
2021	100.63	100.54	103.29	95.48	100.00	103.17	105.56	96.52	105.48	105.70
2022	105.73	103.79	110.78	98.22	100.00	108.81	111.60	98.95	102.53	113.13
Mean	117.177	119.139	117.393	117.49	110.026	118.893	122.842	121.028	107.871	128.423

Source: BPS-Statistic Indonesia (2022)

The rice harvest area in Bengkulu Province is significantly below the national average, indicating that the rice harvest area in Bengkulu Province has remained limited over the past five years, from 2018 to 2022. During this period, the rice harvest area in Bengkulu Province has experienced fluctuations that have tended to decrease. The reduction in the harvest area in Bengkulu Province and Indonesia can be attributed to the reduction in the amount or area of land dedicated to rice cultivation due to urbanization and industrialization.

The amount of rice productivity in Bengkulu Province is subject to fluctuations, with an upward trend. Similarly, the value of national productivity exhibits a similar pattern, although with a fluctuating trend. Over the past five years, fertilizer prices in Bengkulu Province have fluctuated but are still above the average value of 100. When compared to the average national fertilizer price, Bengkulu Province is not significantly different.

From the aforementioned analysis, it can be concluded that in order to enhance food crop agriculture, such as rice, and to increase the exchange rate of rice farmers in Bengkulu Province, it is necessary for the farmers and the government of Bengkulu Province to collaborate in order to advance agriculture in the food crop sector, specifically rice. This is done so that food crop agriculture, such as rice, can become one of the leading sectors in Bengkulu Province and so that rice farming in Bengkulu Province can provide staple foods, such as rice itself, without having to provide and supply goods from outside Bengkulu Province.

In light of the aforementioned description, the development of NTP in Bengkulu Province, situated on the island of Sumatra, is ranked second among the 10 provinces in the region. This indicates that the NTP in Bengkulu Province has exhibited a commendable level of growth and progress over the past decade.

LITERATURE REVIEW
Theory of Farmer Exchange Rate

The farmer exchange rate is a ratio of the price index received by farmers (It) to the price index paid by farmers (Ib) and is expressed in percentage. The price index received by farmers (It) is a price index representing the development of producers of farmers' production. Consequently, the value of the price index received by farmers (It) can demonstrate fluctuations in the production of farmers' goods. Furthermore, the price index can be utilized as data that can support the calculation of income in the agricultural sector.

The price index paid by farmers (Ib) is a price index that reflects the development of prices needed by farmer households. This includes the need for consumption by farmer households and the need for the agricultural production process. The value of the price index paid by farmers (Ib) can therefore be used to show fluctuations in the prices of goods that are often consumed by farmers and fluctuations in goods needed to support the production process of agricultural products.

The rice harvest area is defined as the aggregate of the harvest area of paddy rice and the harvest area of ladang rice. The size of the harvest area is a measure of the level of rice production, as the size of the rice harvest area will automatically

affect the level of rice production. An increase or decrease in the rice harvest area will affect the availability of rice. In conclusion, the rice harvest area is defined as the total area of paddy fields and field rice that can be harvested in a single period or year (Gunawan, 2017). Faridah & Syechalad (2016) found that the harvest area has a significant positive effect on the farmer exchange rate.

H1: It is hypothesized that the harvest size will have a positive and significant effect on the exchange rate of rice farmers in Bengkulu Province.

Theory of Productivity

Productivity is the primary indicator for evaluating the success of agricultural businesses. An increase in rice farming productivity is accompanied by a rise in farmers' exchange rates, while an expansion in the NTP also leads to an enhancement in farmers' well-being. Conversely, a decline in the NTP may discourage farmers from optimizing their long-term productivity in rice production (Kurniawan, 2019).

As Keumala & Zainuddin (2018) notes, the fluctuations in the farmer exchange rate can be observed in the context of crop productivity. When productivity increases, the farmer exchange rate will also rise, and vice versa. However, it is important to note that an increase in NTP is not always beneficial, as the increase in NTP in the food crop sector must be evaluated to ascertain whether the productivity of commodity products has indeed increased significantly. Conversely, a reduction in production may result from adverse weather conditions that disrupt the production process, thereby reducing the overall productivity.

A similar theory is also put forth by Charles & Runtunuwu (2020), which posits that agricultural productivity exerts a positive influence on farmer exchange rates. If productivity increases, the farmer's exchange rate will rise, thereby enhancing the welfare of farmers and vice versa. When agricultural productivity rises, the costs incurred by farmers to procure a number of factors supporting agricultural production become relatively low. Consequently, a decline in the price index paid by farmers results in an increase in farmers' income, thereby enabling them to reach a satisfactory level of welfare. Typically, a decline in agricultural productivity of food crops is attributable to the conversion of productive agricultural land, which impedes farmers' ability to produce agricultural products to their fullest potential.

H2: It is anticipated that productivity will have a positive and significant effect on the exchange rate of rice farmers in Bengkulu Province.

Theory of Price

Swasta and Handoko (2010) posit that price is the amount of money (plus some products) required to obtain a specific number of combinations of goods and services. Price exerts a direct influence on company profits. Furthermore, price plays a significant role in creating customer value and building customer relationships (Abdurrahman, 2015).

The price of fertilizer is the cost incurred by farmers to carry out production. In Indonesia, fertilizers are divided into subsidized and non-subsidized fertilizers. The provision of this subsidy is intended to support the food procurement program and to promote national political stability. For farmers

who lack capital, this subsidy is a valuable resource. At a macro level, the removal of fertilizer subsidies is an effort to improve the efficiency and effectiveness of the use of development funds.

Wicaksana (2023) posits that fertilizer price is one of the indicators of an increasing farmers' exchange rate. This is because an increase in fertilizer price can prompt rice farmers to reduce their fertilizer use. In theory, this should reduce the price index paid by farmers, thereby increasing the farmer exchange rate. However, there is a side effect of reducing the use of fertilizers, which is that farmers' production will not be maximized or sustainably decreased. One potential solution to support the development of the agricultural sector is the implementation of a fertilizer subsidy policy.

H3: It is anticipated that a rise in fertilizer prices will have a positive and significant impact on the exchange rate of rice farmers in Bengkulu Province.
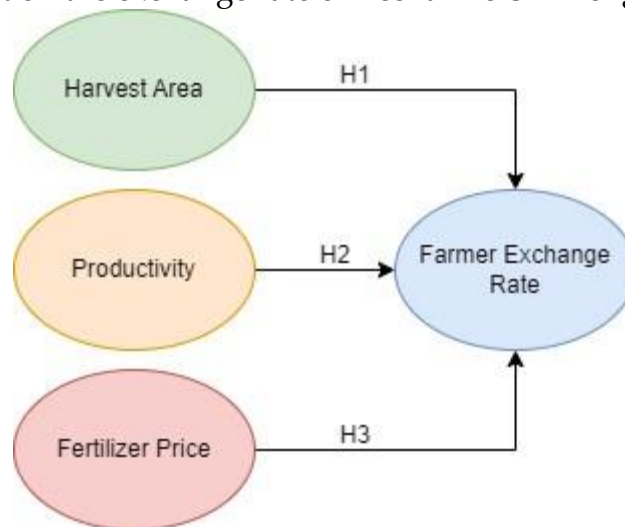

Figure 2. Conceptual Framework

METHODOLOGY

This research is an explanatory research study. In this study, the relationship between the independent variable (Farmer Exchange Rate, NTP) and the dependent variable (harvest area, rice productivity, and fertilizer prices) is explained. The data utilized in this study is secondary data, ensuring the availability of data necessary for the study. It consists of monthly data from 2018 to 2022, resulting in a total of 60 observations. The entire data set was obtained from the Central Statistics Agency (BPS) of Bengkulu Province and other pertinent literature related to the analysis of the exchange rate of farmers in the rice food crop sub-sector in Bengkulu Province. A multiple linear regression analysis was conducted using the ordinary least squares (OLS) analysis model, resulting in the following equation:

$$\text{Ln } Y = \text{\ss}0 + \text{\ss}1\ln X1 + \text{\ss}2\ln X2 + \text{\ss}3\ln X3 + \mu$$

Description:
Y : farmer exchange rate
X1: harvest area

X2: productivity
X3: fertilizer price
ß1, ß2, ß3: regression direction coefficient
ß : constant
ln: natural logarithm
μ : standard error

The farmer exchange rate (NTP) (Y) is defined as the ratio between the price received by farmers (HT) and the price paid by farmers (HB). The measurement of NTP is expressed in the form of an index as follows:

NTP = IT/IB

Description:
NTP = Farmer Exchange Rate Index
IT = Price index received by farmers
IB = Price index paid by farmers

The term "harvest area" (X1) refers to the land area of rice plants that are ready for harvesting. In Bengkulu Province, this is defined as rice plants that are old enough and ready to harvest. The unit of measurement is "thousand Ha."

The term "productivity" (X2) refers to the rice production calculated per unit area of land. Rice productivity is calculated based on the amount of rice production in the form of milled dry grain (GKG) per unit land area in Bengkulu Province in units of (quintal ha).

Fertilizer price (X3) is the cost incurred by farmers to carry out production. The role of fertilizer in increasing agricultural productivity and production, as well as ensuring food security for rice farmers in Bengkulu Province, is of paramount importance.

DISCUSSION RESULT
Development of Rice Farmer Exchange Rate in Bengkulu Province

The development of the rice farmer exchange rate in Bengkulu Province can be described as follows: if the farmer exchange rate is greater than 100 (NTP> 100) and shows that the price index received by farmers (It) is greater than the price index paid by farmers (Ib), then it can be said that farmers receive a profit or surplus. This can be observed in Figure 3., which depicts the monthly data of rice NTP in Bengkulu Province from 2018 to 2022.

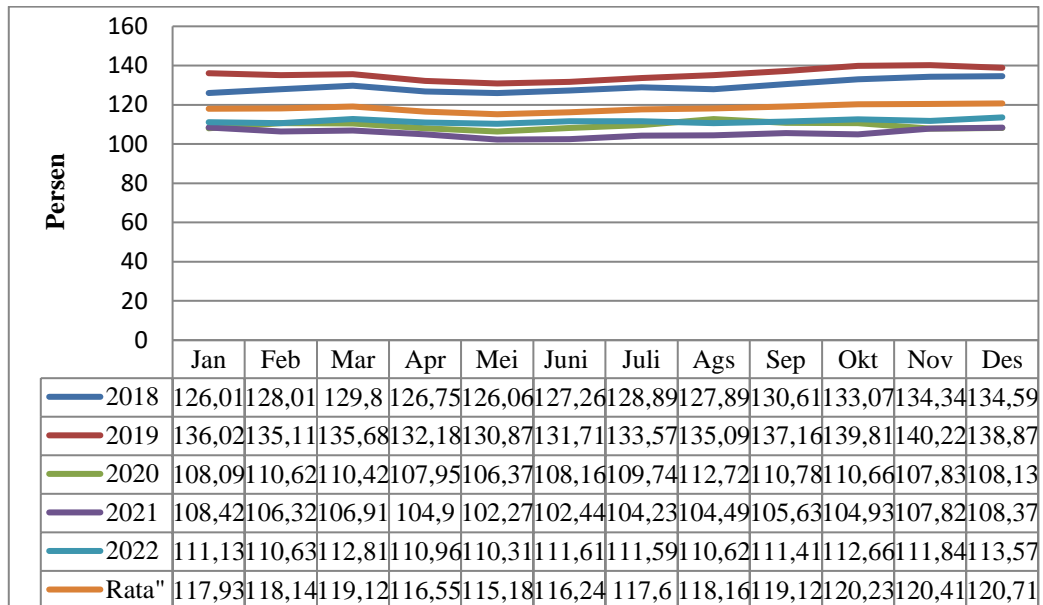|	Jan	Feb	Mar	Apr	Mei	Juni	Juli	Ags	Sep	Okt	Nov	Des
2018	126,01	128,01	129,8	126,75	126,06	127,26	128,89	127,89	130,61	133,07	134,34	134,59
2019	136,02	135,11	135,68	132,18	130,87	131,71	133,57	135,09	137,16	139,81	140,22	138,87
2020	108,09	110,62	110,42	107,95	106,37	108,16	109,74	112,72	110,78	110,66	107,83	108,13
2021	108,42	106,32	106,91	104,9	102,27	102,44	104,23	104,49	105,63	104,93	107,82	108,37
2022	111,13	110,63	112,81	110,96	110,31	111,61	111,59	110,62	111,41	112,66	111,84	113,57
Rata"	117,93	118,14	119,12	116,55	115,18	116,24	117,6	118,16	119,12	120,23	120,41	120,71

Figure 3. Development of Rice Farmer Exchange Rate in Bengkulu Province per Month (Percent)
Source: BPS-Statistic Indonesia (2022)

Figure 3. indicates that the development of rice NTP in Bengkulu Province per month for the last five years has been relatively stable, with values consistently above 100. When viewed on average in the table above, the rice NTP in May is the smallest value during the five years, with a value of 115.18%. December is the month with the largest value among the others during the last five years, with a value of 120.71%.

Development of Rice Harvest Area in Bengkulu Province

The development of rice harvest area per month in Bengkulu Province from 2018-2022 has a fluctuating average value that tends to decrease, which is due to the reduction of rice harvest area due to attacks from plant destroying organisms, or it can also be the impact of natural disasters and the development of non-agricultural sector.
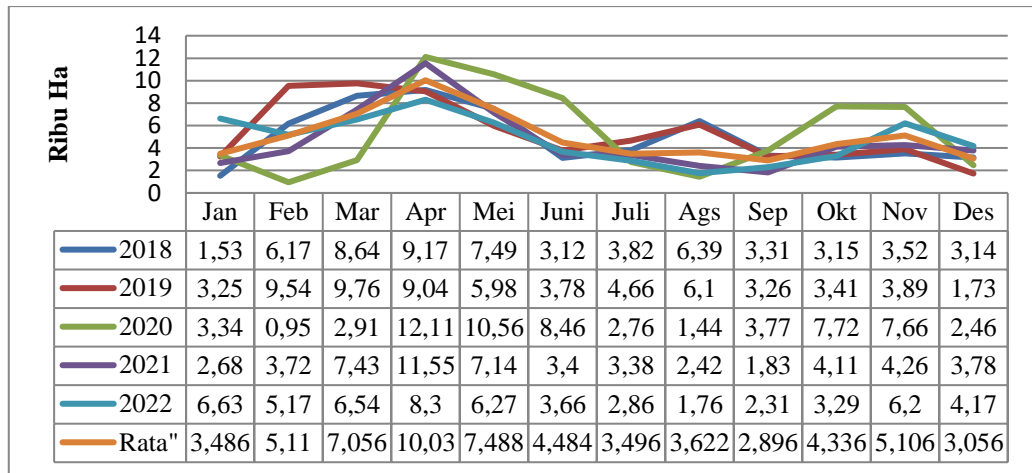
Figure 4. Development of rice harvest area in Bengkulu province per month, 2018-2022 (thousand ha).

Source: BPS-Statistic Indonesia (2022)

Looking at the above figure, the highest average rice harvest area in the last five years was in April, which was 10,030 thousand (ha), and the lowest rice harvest area was in September, which was 2,896 thousand (ha).

Development of Rice Productivity in Bengkulu Province

The development of rice productivity per month in Bengkulu Province from 2018 to 2022 exhibits an average value that fluctuates, with a tendency towards an increase. This may be attributed to one of two factors: the exchange rate of rice farmers in Bengkulu Province increases or tends to stabilize from year to year.
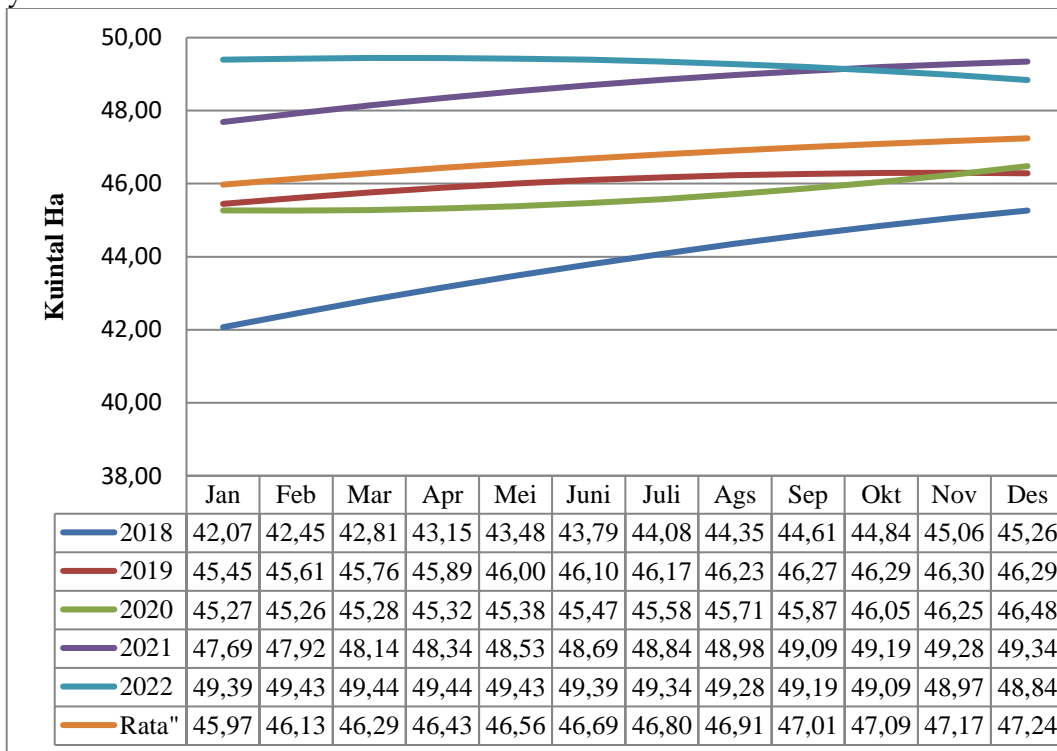

Figure 5. Presents The Development of Rice Productivity in Bengkulu Province per Month from 2018 to 2022 (in quintal ha)

Source: BPS-Statistic Indonesia (2022)

As illustrated in the figure above, the highest average value of rice productivity was observed in December over the past five years, with an average of 47.24 quintals (ha). In contrast, the lowest rice productivity was recorded in January, with an average value of 45.97 quintals (ha).

Development of Rice Fertilizer Prices in Bengkulu Province

The development of rice fertilizer prices in Bengkulu Province over the past five years, namely from 2018 to 2022, is illustrated in Figure 6., which depicts the average value per month. The figure reveals that the average value tends to fluctuate.

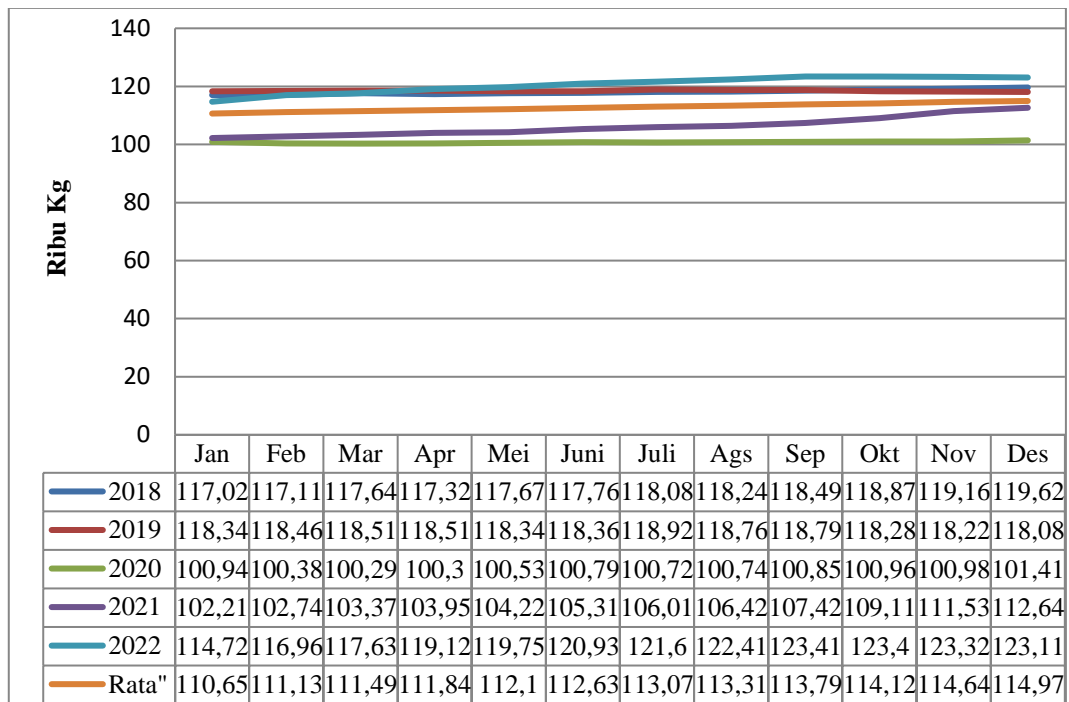|	Jan	Feb	Mar	Apr	Mei	Juni	Juli	Ags	Sep	Okt	Nov	Des
2018	117,02	117,11	117,64	117,32	117,67	117,76	118,08	118,24	118,49	118,87	119,16	119,62
2019	118,34	118,46	118,51	118,51	118,34	118,36	118,92	118,76	118,79	118,28	118,22	118,08
2020	100,94	100,38	100,29	100,3	100,53	100,79	100,72	100,74	100,85	100,96	100,98	101,41
2021	102,21	102,74	103,37	103,95	104,22	105,31	106,01	106,42	107,42	109,11	111,53	112,64
2022	114,72	116,96	117,63	119,12	119,75	120,93	121,6	122,41	123,41	123,4	123,32	123,11
Rata"	110,65	111,13	111,49	111,84	112,1	112,63	113,07	113,31	113,79	114,12	114,64	114,97

Figure 6. Development of Rice Fertilizer Prices in Bengkulu Province per Month 2018-2022 (Thousand/Kg).
Source: BPS-Statistic Indonesia (2022)

Figure 6. illustrates that the growth of rice fertilizer prices in Bengkulu Province has a trend that tends to be stable. The highest growth in fertilizer prices over the past five years occurred in December with an average value of 115 thousand/kg, while the lowest productivity was in January with an average value of 110.6 thousand/kg.

Data Interpretation

The results of data processing, conducted using multiple linear regression analysis on Eviews-9, yielded the regression equation, which answered the hypothesis regarding the effect of LP (Harvest Area), PDV (Productivity), and HP (Fertilizer Price) variables on NTP (Farmer Exchange Rate).

Table 2. Multiple Regression Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	241.4291	88.37251	2.731948	0.0084
LP	-0.482519	1.490387	-0.323754	0.7473
PDV	-160.6014	18.53860	-8.663081	0.0000
HP	104.7350	11.38760	9.197283	0.0000

R-squared	0.736025	Mean dependent var	118.2718
Adjusted R-squared	0.721884	S.D. dependent var	12.23055
S.E. of regression	6.449991	Akaike info criterion	6.630375
Sum squared resid	2329.733	Schwarz criterion	6.769998
Log likelihood	-194.9112	Hannan-Quinn criter.	6.684989
F-statistic	52.04718	Durbin-Watson stat	0.219004
Prob(F-statistic)	0.000000		

Source: Data Processed, Eviews 9 (2023)

Table 2. presents the results of the calculations performed using Eviews 9. The equation is as follows:

The regression equation yields the following results:

NTP = 241.4291 - 0.482519LP - 160.6014PDV + 104.7350HP

These results indicate that:

a. The constant value of The value of 241.429 indicates that, in the absence of variables pertaining to harvest area, productivity, and fertilizer price, the farmer exchange rate would be 241.4291%.

b. The coefficient value of LP (harvest area) is -0.482519 and is found to have no significant effect on NTP. This indicates that an increase in harvest area by 1 thousand hectares (ha) will result in a decrease in NTP by 0.482519%.

c. The coefficient value of productivity of -160.6014 is significant, yet it has no effect on NTP. This indicates that if there is an increase in productivity by 1 quintal (ha), the NTP will decrease by 160.6014%.

d. The coefficient value of HP (fertilizer price) is 104.7350 and has a significant effect on NTP. This indicates that a 1,000-kilogram increase in the price of fertilizer will result in a 104.7350% increase in NTP.

DISCUSSION

The Effect of Harvested Area on the Exchange Rate of Rice Farmers

The results of a multiple linear regression using Least Squares indicate that the coefficient of the harvest area variable is -0.482519 with a probability of 0.7473. This suggests that the harvest area variable has no significant effect on the NTP (Farmer Exchange Rate) of rice in Bengkulu Province. This result differs from the initial hypothesis, which assumed a positive effect of the harvest area on the NTP of rice. This discrepancy can be attributed to fluctuations in the harvest area per month, which may be influenced by climate change. Consequently, each month may produce a different harvest area. Therefore, if the harvest area increases, it will not have a significant impact on the farmer exchange rate. This implies that, regardless of the extent of the harvest area, it will not lead to rice farmers becoming prosperous.

The Effect of Productivity on Rice Farmer Exchange Rate

The coefficient of the productivity variable is -160.6014 with a probability of 0.0000. This indicates that the productivity variable has a negative and significant effect on the NTP of rice in Bengkulu Province. Consequently, the higher the productivity of rice, the lower the exchange rate of farmers. However, NTP is not solely influenced by productivity; it can also be influenced by other input factors. This result is consistent with the initial hypothesis, which postulates that the productivity variable will have a significant effect on the NTP of rice in Bengkulu Province.

The results of this study align with the findings of Rahayu (2011), which indicate a negative correlation between productivity and NTP. This is due to the fact that during the harvest season, rice productivity increases significantly, yet the price received by farmers is below the basic price of grain, particularly during the harvest season. Consequently, the real price received by farmers is consistently low, and at the same time, farmers must pay higher prices to meet their needs. Consequently, this condition results in a decline in the welfare level of farmers, despite an increase in productivity.

The Effect of Fertilizer Price on Rice Farmer Exchange Rate

The results of a multiple linear regression using Least Squares indicate that the coefficient of the fertilizer price variable is 104.7350, with a probability of 0.0000. This demonstrates that the fertilizer price variable has a positive and significant effect on the exchange rate of rice farmers in Bengkulu Province. This implies that an increase in the price of fertilizer will also result in an increase in the exchange rate of farmers, which suggests that farmers are becoming increasingly prosperous. This is because farmers will indirectly raise the selling price of their paddy to offset the rise in fertilizer prices.

CONCLUSIONS AND RECOMMENDATIONS

The results of the study indicate that the harvest area has a negative and insignificant effect on the farmer's exchange rate. This implies that the wider the rice harvest, the less significant it is to increase the farmer's exchange rate. Furthermore, the productivity of rice yield has a negative and significant effect on the farmer's exchange rate. This suggests that the lower the agricultural productivity, the more significant the farmer exchange rate. With regard to fertilizer prices, the results indicate a positive and significant impact on the farmer exchange rate. This implies that an increase in fertilizer prices leads to a corresponding increase in the farmer exchange rate.

ADVANCED RESEARCH

It is hoped that future researchers will examine the factors that affect the farmer exchange rate, apart from the variables that have been studied previously. These include variables such as harvest area, productivity and fertilizer prices as a whole in Indonesia.

ACKNOWLEDGMENT

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