THE IMPACT OF RICE FARM INSURANCE ON THE INCOME OF FARMERS IN INDONESIA

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Abstract: The fluctuation of rice production in Indonesia over the last 5 years shows a downward trend due to a decrease in land area and increase risks. A government's effort to overcome the risks of rice farming is to establish rice farming insurance (AUTP). This research aims to analyze the factors that influence farmers' decisions to join rice farming insurance (AUTP) and how the impact of rice farming insurance on farming income in Indonesia. The data used was secondary data from the survey results from the Central Bureau of Statistics (BPS) in 2018. The number of samples was 470 farmers, consisting of 122 farmers who joined rice farming insurance and 358 farmers who did not take rice farming insurance. Data were analyzed using logistic regression and propensity score matching (PSM) methods. The results show that the variables of education level, participation in socialization, perceptions of decreased production, and production significantly influenced farmers' decisions to join rice farming insurance. The impact of insurance on farm income shows that the average farm income of farmers who follow rice farming insurance is higher than farmers who did not join rice farming insurance. Therefore, the government continued to encourage the implementation of the rice farming insurance program to increase the level of farmer participation and sustainability of the AUTP program.

Keywords: income, participation rate, rice farming insurance, risk

Abstrak: *Fluktuasi produksi padi Indonesia selama 5 tahun terakhir menunjukkan trend cenderung menurun akibat penurunan luas lahan dan peningkatan risiko. Salah satu upaya pemerintah untuk mengatasi risiko usahatani padi adalah dengan membentuk asuransi usahatani padi (AUTP). Penelitian bertujuan menganalisis faktor-faktor yang mempengaruhi keputusan petani mengikuti asuransi usahatani padi (AUTP) dan bagaimana dampak asuransi usahatani padi terhadap pendapatan usahatani di Indonesia. Data yang digunakan adalah data sekunder dari hasil survei Badan Pusat Statistika (BPS) tahun 2018. Jumlah sampel yaitu 470 petani, yang terdiri dari 122 petani yang mengikuti asuransi usahatani padi dan 358 petani yang tidak mengikuti asuransi usahatani padi. Data dianalisis dengan digunakan adalah regresi logistik dan metode propensity score matching (PSM). Hasil penelitian menunjukkan variabel tingkat pendidikan, keikutsertaan sosialisasi, persepsi terhadap penurunan produksi, dan produksi secara signifikan mempengaruhi keputusan petani mengikuti asuransi usahatani padi. Dampak asuransi terhadap pendapatan usahatani, menunjukkan bahwa rata-rata pendapatan usahatani petani yang mengikuti asuransi usahatani padi lebih tinggi dibandingkan dengan petani yang tidak mengikuti asuransi usahatani padi. Oleh karena itu pemerintah tetap mendorong pelaksanaan program asuransi usahatani padi untuk meningkatkan tingkat partisipasi petani dan keberlanjutan program AUTP.*

Kata kunci: *pendapatan, asuransi usahatani padi, tingkat partisipasi, risiko*

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INTRODUCTION

Rice is a strategic commodity for Indonesia because it is the country's primary food supply. Indonesia's population is expected to grow by 12.8 million people in 2018 with a rice consumption rate of 96,33% (BPS, 2019). Food availability impacted by the increasing population. As a result, to meet the increasing demand for rice in Indonesia, it is necessary to increase the land area and/or productivity (Firmana and Nurmalina, 2016; Hilalullaily et al. 2021).

The rice harvest land area in 2017-2020 shows a downward trend. Indonesia's rice output tends to fall as a result of the decline in rice land. The rice harvested area had decreased by 0.019% in 2020 to 10.66 million ha compared to 2019 that reached 10.68 million ha (Fathonah and Mashilal, 2021). The decline in rice production in Indonesia may also cause by risks due to climate change. In 2018, 308.753 ha were affected by plant-disturbing organisms, 150.871 ha by flooding, and 186.328 ha by drought (Ministry of Agriculture, 2018).

Disasters due to climate change in rice farming will result in a decrease in rice productivity and eventually crop failure (Perdinan et al. 2008). Crop failure reduce farmers' revenue or perhaps prevent them from receiving farm income at all. Farmers will suffer loss so they will not have any capital for the next business activities. Therefore, the government encourages farmers to join AUTP to protect the risk of rice production (Apriana et al. 2017; Mulyaqin, 2020; Hendrawan et al. 2021). Agricultural insurance is essential for farmers to help them from heavy losses and ensure that they have working capital for the next farm (Pasaribu, 2010; Sayugyaningsih et al. 2020; Hendrawan et al. 2021).

Rice farming insurance was developed in 2015 compliance with Minister of Agriculture Regulation No. 40 of 2015 on agricultural insurance facilitation. The purpose of implementing rice farming insurance (AUTP) is to safeguard farmers in the crop failure due to the risk of flooding, drought, and pest attacks. Agricultural insurance will assist in resuming production activities following crop failure or poor harvest years (Pasaribu, 2010).

The amount of the claim fee for damage to rice farming is 75%, which is IDR 6,000,000/ha/season. The premium paid is IDR 180,000/ha/season. The amount of premium support from the government is IDR 144,000/ha/season and the rest are self-subsistent farmers of IDR 36,000/ha/season. The insurance company is PT Asuransi Jasindo (Ministry of Agriculture, 2018). Government subsidies and farmers' awareness of the insurance benefits are beneficial and increase prospects in the agriculture sector and assist farmers in maintaining their livelihoods (Jin et al. 2016; Nain et al. 2017; Islam et al. 2021).

Not all rice farmers in Indonesia have participated in the membership of the AUTP program (Sayugyaningsih et al. 2020). The level of innovation adoption from farmers is affected by the farmer characteristics both business and personal. The success or failure of the insurance program carried out by the government must be seen from the process of implementation the insurance program based on the participation of farmers in the AUTP program (Prasetyo 2019; Rehman et al. 2015).

Realization of the AUTP in 2015-2018 did not reach the government's target of 1.000.000 ha. In 2015 as the initial establishment of rice farming insurance, few farmers participated in the insurance program of 233.499 hectares. From 2016 to 2017, there was a trend towards the realization of farmers' land area. In 2017, there was an increase of 997.961 hectares. Meanwhile, in 2018 the number of farmers who participated in the AUTP program decreased that reflect by the area of land decreased to 901.421 hectares (Ministry of Agriculture, 2017).

The main factor causing a decrease in farmer participation in AUTP is due to several obstacles. These obstacles are the farmer's lack of socialization about the benefits of the AUTP program and the low awareness of farmers in insurance. Meanwhile, on the insurance company side, the obstacles include some delays in issuing policies and claiming payments, lack of scheduling clarity from PT Jasindo in carrying out the field observation, and limited human resources to socialize the AUTP program (Ambarawati et al. 2018). Saputra et al. (2020) stated that the role of farmer groups and extension workers is very important as the main source of information that accessed by farmers. In addition, on of improving farmers' awareness and understanding of crop insurance through advertisement and training (Afroz, 2017). Farmers who understand rice farming insurance have the opportunity to participate, and those who take insurance training are more interested in participating than other farmers

(Prasetyo, 2019; Rehman et al. 2015; Kipkemoi and Ceyhan, 2021). The participation of farmers in insurance programs shows that farmers understand the function of insurance as one of the risk mitigation measures in farming under conditions of risk and uncertainty (Jin et al. 2016; Patil and Veettil, 2018).

The AUTP program had a positive impact on rice farming income. Farmers' participation in the AUTP program protect rice farming from risks. Farmers that participate in the AUTP program will receive financial compensation in the event of crop failure due to natural disasters so that their incomes are largely guaranteed (Ashimwe, 2016; Chikaire et al. 2016; Sujarwo and Rukmi, 2018). Research on rice farming insurance (AUTP) needs to be conducted in the center of rice production because it is a priority in the implementation of AUTP and locations that are prone to experiencing the risk of crop failure such as coastal areas that are prone to flooding (Diani, 2020).

Thus, this research examined AUTP in the rice production centers in Indonesia with the AUTP program and coastal areas prone to flooding. Based on this explanation, the purposes of this study are to (1) analyze and determine the factors that affect farmers' decisions to participate in the AUTP and (2) determine the impact of AUTP participation on farm income.

METHODS

The main data in this study is secondary data derived from the results of the 2018 Indonesia Statistics (BPS) survey. The data is the latest from BPS. Furthermore, BPS is the official government data provider. Other secondary data as supporting data were obtained from the BPS, and the Ministry of Agriculture.

The data used consisted of a national scale with a choice of ten central provinces: Aceh, Lampung, West Sumatra, Central Java, Yogyakarta, East Java, Banten, East Nusa Tenggara, West Kalimantan and East Kalimantan. These ten provinces were chosen purposively following the location of the implementation of the AUTP and they were central provinces that produce the largest rice producers in Indonesia.

The data used was cross-sectional data in 2018. This study's sample size was made up of 470 households, where 122 farmers used insurance and 358 farmers did not. The number of farmers who participated in rice farming insurance before data cleaning was 133 and those who did not use rice farming insurance were 5.282. Due to the limited data from the BPS survey, a sample of 122 farmers who took insurance and 358 farmers who took insurance of rice farming was used. Data cleaning was done by removing empty data, outliers, and those outside one growing season.

The analysis used to determine the farmer's decision to take rice farming insurance was binary logistic regression analysis. Logistic regression analysis was utilized to see the relationship between the independent variable and the dependent variables. Farmers who participated in rice farming insurance were given a score of (1) and those who did not participate in rice farming insurance were given a score of (0). Systematically, the logit function model to see farmers' decisions to use AUTP can be written in general as follows (Scott et al. 1991; Rehman et al. 2015; Huang et al. 2020; Rachman et al. 2021 Kipkemoi and Ceyhan, 2021).

$$\text{Ln}(pi/1\text{-}pi) = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{5i} + \beta_6 X_{6i} + \beta_7 X_{7i} + \varepsilon_i$$

Where: P_i= farmers' decisions to use AUTP (probability) (1= use AUTP, 0 = did not use AUTP). X_{1i} = Farmers' age (Year); X_{2i}= Education level (Year); X_{3i}= Farmers' perception of production decline due to climate change (dummy, 1 = 51-100%; 0 = 0-50%); X_{4i}= The area of land cultivated by farmers (Ha); X_{5i}= Land ownership, (dummy,1= owned by the farmers, 0 = rent); X_{6i} = Participation in socialization (dummy) (1 = participated in socialization; 0 = did not participate in socialization); X_{7i}= Production (Kg), $\beta_1 \ldots \beta_7$= Variables of regression coefficient; β_0= Intercept (Constant); e_i= Intruder errors. All variables were partially tested for parameters and the role of the regression coefficient between each independent variable on the dependent variable were examined.

Factors that affect farmer participation in rice farming insurance are described in the following hypothesis:

H_0: There is no significant effect between each independent variable (X) on the dependent variable (Y)

H_1: There is a significant effect between each independent variable (X) on the dependent variable (Y)

The criteria for making the logit test decision are as follows; If t-count > t-table and significant value > 0.05 then H_0 is accepted; if t-count < t-table and significant value <0.05 then accept H_1.

The impact of rice farming insurance (AUTP) on rice income can be analyzed using the trend score method or known as propensity score matching (PSM). PSM analysis is carried out based on the propensity value between two sample groups selected based on the similarity of their characteristics (Abdallah et al. 2019; Khandker et al. 2010). The design in this study is that the treatment group consists of farmers who use AUTP while the control group consists of farmers who do not use AUTP. Meanwhile, the outcome refers to the income.

The model used to see the average value of the impact of insurance on farmers' income can be carried out using the Average Treatment of Treated (ATT) method. The PSM estimation model using the ATT approach can estimate the average value of farmers who use AUTP or do not. In the PSM method, observation values that are too high or too low will be excluded from the equation. The ATT model can be written as follows (Khandker et al. 2010).

$$ATT = E [Y_{1i}|Di = 1] – E [Y_{0i}|D_i = 0]$$

ATT is the impact calculated from the variable of outcome (rice farming income) which was estimated from the results of farmers who use farming insurance, which was $E [Y_{1i}|D_i = 1]$ minus farmers who do not use farming insurance, $E [Y_{0i}|D_i = 0]$. This PSM approach can reduce bias in decision-making due to the possibility of heterogeneity and cofounding. To overcome the bias, Nearest Neighbour Matching will be used in the technical estimation of ATT.

Nearest neighbour matching is the easiest matching algorithm by selecting a treatment group paired with a control group to get the closest tendency score or the most similar characteristics (Heinrich et al. 2010). Statistically, the ATT estimation test with a significance level of was rejecting H_0 if the p-value <α (Aisyah, 2017).

RESULTS

Characteristics of Farmers as the Respondents

Characteristics of farmers serve as indicators in seeing their ability in conducting farming activities (Table 1). In general, the average age of farmers is 50 years. The results of the statistical analysis revealed that there is no significant difference in age between farmers who used AUTP and those who did not, with a p-value of 0.406. Meanwhile, the variable of education between the treatment and control groups shows that the average level of education of farmers is an elementary school and junior high school. However, more farmers who do not use insurance graduated from elementary. The level of education in the two groups indicates a significant difference with a p-value of 0.004.

Characteristics of respondents based on gender in both groups reveal that there are more male farmers. Gender does not show a significant difference with the 5% confidence level. Meanwhile, the results of statistical analysis of farmer participation in socialization indicate a p-value of 0.000. Therefore, the characteristics of the participation in the socialization of the two groups indicate a significant difference.

Land ownership is also an essential issue in farming. In terms of land ownership between the two groups, more land is owned by private ownership. Statistical findings also demonstrate that there is no significant difference in land ownership between farmers who use AUTP and those who do not. Meanwhile, the perception of a decrease in production indicates that farmers who are not AUTP participants have a low perception of a decrease in production that can occur under certain conditions. From the results of statistical analysis, there are significant differences in perceptions of the decline in production between the treatment and control groups.

Land area is one of the factors that affect the amount of rice production and farmers in managing their farming risks. The average land area of farmers who use AUTP is larger than those who do not. The statistical results indicate a significant difference with a p-value of 0.000. Meanwhile, the production between those who use AUTP and those who do not statistically indicate no significant difference. However, the production of rice farming is higher for farmers who use AUTP

than those who do not. Furthermore, the agricultural income between the two groups also shows a difference statistically. Farmers who use AUTP have a higher income than those who do not. AUTP encourage farmers to use production inputs as recommended, so as to increase rice farmer production and agricultural income. In addition, farmers who follow AUTP who experience crop failure will get compensation as capital for the next farming business.

Factors Affecting Farmers' Decisions to Participate in the Rice Farming Insurance Program

In this section, we will discuss the analysis of the factors that affected farmers in participating in rice farming insurance. The findings of the analysis use the logit method, in which logit analysis is used to see the magnitude of the opportunity for the independent variable to the farmers' decision to use the AUTP. The estimation results can be seen in Table 2.

The results of the analysis showed that the value of R square was 0.2301. It means that the variables in the model were able to explain about 23% possibility of farmers taking rice farming insurance. The remaining 77% was explained by other variables outside the model. Meanwhile, the chi-square value in the analysis results showed a value of 77.89 with a significance of 0.000. furthermore, the significance value was less than the real level of = 10 percent. Therefore, the independent variables together had a significant effect on farmers' decisions to participate in the AUTP.

Table 1. Descriptive Statistics

Variabel	Treatment		Control		p-value
	Mean/ Modus	Sd	Mean/ Modus	Sd	
-1	-2	-3	-4	-5	-6
Age (year)	50.33	11.76	49.25	11.99	0.406
Education (year)	285	1.41	2.34	1.29	0.004**
Gender (L= 1)	0.00	0.5	0.00	0.3	0.391
Socialization Participation (Participate =1)	0.00	0.49	0.00	0.48	0.000**
Land ownership status (1 = owned by the farmers)	0.00	0.45	0.00	0.45	0.798
Farmers' perception of production decline (1 = 51-100%)	0.00	0.5	1.00	0.31	0.000**
Land area (ha)	0.44	2.0	0.27	0.5	0.000**
Production (kg/ha)	5.721	897	5.576	1.113	0.196
Farm Income (Rp 000)	17.403	3.101	15.879	4.587	0.001**
Observation (n)	112	358			

Notes: Mode for nominal-scale variable; ** significant at the 5% level of significance

Table 2. Factors affecting farmer participation in rice farming Insurance

Variables	Odds Ratio	Z	p > Z
Age (year)	1.004	0.39	0.649
Education (year)	1.271	2.73	0.006**
Farmers' perception of production decline (1 = 51-100%)	6.731	6.97	0.000**
Land ownership status (1 = owned by the farmers)	0.779	-0.39	0.696
Land area (Ha)	1.379	0.81	0.419
Socialization Participation (Participate =1)	2.378	3.4	0.001**
Production (kg)	1.001	2.5	0.012**
Wald chi^2 (8) = 77.89			
Prob > chi^2 = 0.0000			
Pseudo R^2 = 0,2301			

Notes: ** significant at the 5% level of significance

The variables that significantly affect farmers' decisions to use AUTP including farmers' education level, farmers' perceptions of production declines, farmers' participation in socialization, and production. The variable of farmers' age has no statistically significant effect on farmers' decision to use rice farming insurance. The odds ratio value of the farmer age variable was 1.004. It showed that an increase in farmer age by one unit would reduce the chances of farmers participating in the AUTP program by 1.004 times. This is in line with research by Siswadi dan Syakir 2016 and Rachman et al. 2021 which stated that age had no significant effect on farmers' decisions to participate in AUTP. This is due to the average age of farmers in the research was older. Meanwhile, Saputra (2020) argued that the older the farmer, the higher the chance of participating in the AUTP program, where the attitude of farmers who tended to only join the program because it sounded good and there were factors from fellow friends who participate in the AUTP program as well.

The higher the level of education of the farmers, the more likely they are to participate in rice farming insurance and be wiser in decision making. The results of the analysis indicate that education has a statistically significant effect on farmers' decisions to use rice farming insurance with a p-value of 0.006. The education level odds ratio value was 1.271. It means that the higher a person's education, the chance to take part in rice farming insurance would increase by 1.27 times. The estimation results were supported by the level of farmer participation in rice farming insurance. In this research, the majority were high school graduates. Farmers with higher education relatively had a better understanding of the implementation of the rice farming insurance scheme (Jin et al. 2016; Prasetyo, 2019).

The greater the decline in production, the greater the opportunity for farmers to participate in AUTP (Jin et al. 2016). Farmers' perceptions of the decrease in rice production have a statistically significant effect with a 5% confidence level. The farmer perception odd value was 6.731 and the z coefficient is positive. It means that the more often farmers experience crop failure or a decrease in production in rice farming, the opportunity to participate in the AUTP would increase by 6,73 times. A previous study (Diani, 2020) reveals that the perception hypothesis has a significant effect, but the results of the perception research have no statistically significant effect. This discrepancy can be affected by the conditions of other factors in each research location area.

The variable of land ownership indicates the results of the analysis that it does not have a statistically significant effect on farmers' decisions to participate in the rice farming insurance program with a p-value of 0.696. The z value for land ownership was negative, with an income ratio of 0.779. It means that the status of land ownership, both privately owned and leased land, does not affect farmers' participation in the AUTP program. This study is directly proportional to the previous study (Suindah et al. 2020) that land ownership in the implementation of the program has no significant effect on farmers' decisions in participating in the AUTP.

Similar to land area, the results of the estimation of the variable of land area have no statistically significant effect on farmers' decisions to participate in the AUTP. The value of the coefficient of the land area was positive. It means that the larger the area of land cultivated by the respondent farmers, the greater the opportunity for farmers to participate in the AUTP program. The odds ratio value of the land area variable was 1.379. It means that an increase in one unit of farmer's land area would reduce the chances of farmers participating in the AUTP program by 1.37 times. The decrease in farmers' opportunities to participate in the AUTP program on large lands was due to the limitation of the area of land that can be insured. Marphy and Priminingtyas (2019) and Diani (2020) stated that the larger the farmers' land, the smaller the possibility of farmer's decision to use agricultural insurance.

The decision to use insurance is extremely dependent on farmers' understanding of insurance products. Farmers who understand rice farming insurance are more likely to participate, and those who receive insurance training are more likely to participate than other farmers (Prasetyo et al. 2019; Rehman et al. 2015). According to the findings of the study, farmers' participation in socialization has a significant effect with a p-value of 0.001. The value of the z coefficient was positive with an odds ratio of 2.378. It means that with the increased participation of farmers in the socialization of rice farming insurance, the chances of farmers participating in AUTP increased by 2.37 times compared to farmers who did not participate in AUTP socialization. According to previous research (Saputra et al. 2020), socialization participation has a favourable effect on enhancing farmers' knowledge, which affects farmers' decisions to participate in the AUTP program.

The Impact of Rice Farming Insurance on Farming Income

The impact of the rice farming insurance program in this study was analyzed using the Propensity Score Matching (PSM) method. For the PSM test, the findings of the statistically significant logit analysis were used. PSM analysis technique is to perform a covariate balance by comparing groups that use insurance and those that do not.

Figure 1 demonstrates that there is a significant difference in the balance plots of the treatment and control groups (graph on the left). This criterion indicates that the two groups are not equally matched. Feryanto and Rosiana (2021) stated that comparing the two directly would give inaccurate conclusions because of bias. Heinrich et al. 2010, the distribution of propensity scores for the treated and untreated groups were to visually check for overlapping conditions and to see if matching could make the distributions more similar. After matching the two matched groups, it was confirmed that the difference in income between the two groups was caused by rice farming insurance.

During the matching process for the propensity score, some observations were discarded during the matching process. It is because there are mismatched or dissimilar covariates. The total number of covariates utilized before matching is 470. After matching, the covariates wasted 6, so the total used was 464. Then, a balancing test is performed in the common support area to determine the bias of each variable utilized in the matching process between groups that use rice farming insurance and groups that do not. Following the Balancing test, a new output was obtained, as can be seen in Table 3.

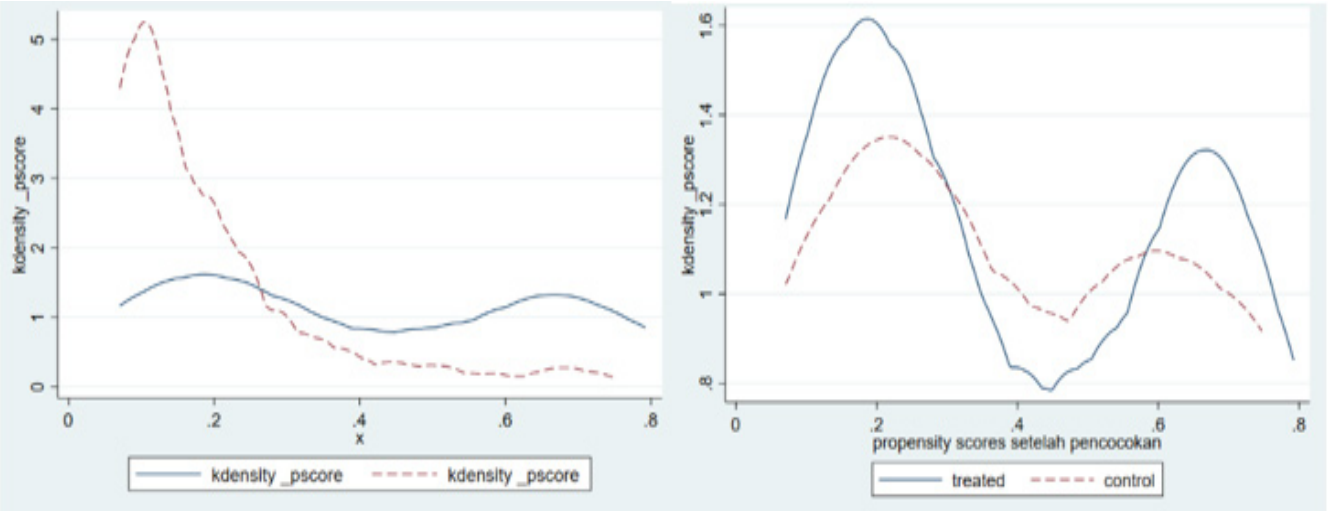

Figure 1. Balance plot before and after matching

Table 3. Impact of rice farming insurance (AUTP) with the nearest neighbour method following the balancing test

Outcome	Methods		Treated	Control	ATT	S.E.	T-stat
Income (Rp.000)	Nearest Neighbour	Matching	112	352	1.49	5.48	2,73

After calculating the impact of the estimated impact of the rice farming insurance program using the Nearest Neighbor Matching method on the income with the amount of ATT, the total income is IDR 1.49 million. These findings indicate that the AUTP program can increase farmers' income by IDR 1.49 million compared to farmers who do not participate in AUTP. The results of the analysis indicate that rice farming income has a significant effect with a positive t-statistic with a t-stat value of 2,73. Farmers who get claims to help farmers do sustainable farming and maintain the stability of agricultural income. In addition, AUTP participant farmers conduct agricultural management in accordance with the recommendations according to information when distributing socialization. This study is in line with previous research (Ashimwe, 2016; Abdallah et al. 2019; Diani, 2020) that ATT has a positive value and the average income of farmers who participate in AUTP is higher than those who do not participate in AUTP and the AUTP program has a positive impact on farmers' income.

Managerial Implications

Rice farming insurance is a government program to protect farmers from the risk. Based on the results of this research, the participation of farmers who take part in AUTP in Indonesia is still low and has never reached the target. The results of the logit analysis showed that the level of farmer participation in AUTP was affected by the level of education, farmers' perceptions of the decline in production, participation in socialization, and production. Based on the results of the PSM method that rice farming insurance had a positive impact on income. The cost of claims obtained by farmers when rice farming experiences risk or crop failure could help farmers for the next farming capital and can maintain stable farm income. Therefore, the government should continue to encourage the implementation of the AUTP to increase the level of farmer participation and sustainability of AUTP program.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The factors affecting the farmers' decision to participate in the rice farming insurance program include farmers' age, formal education, farmers' perceptions of decreasing production, land area, land ownership status, participation in socialization, and production. Significant variables that affect farmers' decisions to use rice farming insurance include education, perception, participation in socialization, and sustainable production. The impact of the AUTP on rice farming income following matching with the nearest neighbour method after the balancing test has a statistical effect with a positive t-stat value of 2.73. Farmers who use AUTP have a higher income than those who do not.

Recommendations

Increasing farmer involvement in rice farming insurance requires increased socialization and promotion activities from various insurance program stakeholders in order to farmers to gain insight or knowledge about insurance benefits. Furthermore, more research on the impact of insurance on rice farming performance is required because there are still very few that examine the impact of the program on income. It is also highly recommended to conduct research with primary data to obtain the most up-to-date information about rice farming insurance.

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