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Analysis of Farmers' Risk Preference Factors on the Determination of Rice Micro Insurance Premiums Using the Utility Theory

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Abstract

Business activities in the agricultural sector, especially rice farming, will always be faced with a high risk of uncertainty. The risks experienced by farmers come from the natural environment, natural disasters, climate, and plant-disturbing organisms. To avoid this situation, the government is currently providing the best solution in the form of a Rice Farming Insurance program (AUTP), which is expected to provide protection against the risk of crop failure that farmers may experience. The purpose of this research is to analyze rice farmers' risk preferences in determining rice farming insurance premiums. The research method for rice farmers' risk preferences was analyzed using constant relative risk averse (CRRA) utility theory. Based on the research results, rice farmers in Majalaya District, Bandung Regency has a very risk averse risk preference. The risk preferences of farmers participating in AUTP and non-AUTP are very risk averse. The policy implications that can be explained based on the results of this study are increasing farmers' understanding regarding the description and benefits of agricultural insurance through counseling and assistance by the Agriculture Service and PT. Jasindo, so that rice farmers in Majalaya District, Bandung Regency have awareness of the benefits of insurance. Encouraging the participation of rice farmers in Majalaya District in the AUTP program can also be carried out by prioritizing rice farmers with very risk averse risk preferences. The policy implications that can be explained based on the results of this study are increasing farmers' understanding regarding the description and benefits of agricultural insurance through counseling and assistance by the Agriculture Service and PT. Jasindo, so that rice farmers in Majalaya District, Bandung Regency have awareness of the benefits of insurance. Encouraging the participation of rice farmers in Majalaya District in the AUTP program can also be carried out by prioritizing rice farmers with very risk averse risk preferences. The policy implications that can be explained based on the results of this study are increasing farmers' understanding regarding the description and benefits of agricultural insurance through counseling and assistance by the Agriculture Service and PT. Jasindo, so that rice farmers in Majalaya District, Bandung Regency have awareness of the benefits of insurance. Encouraging the participation of rice farmers in Majalaya District in the AUTP program can also be carried out by prioritizing rice farmers with very risk averse risk preferences.

Keywords: Rice farming insurance, risk preference, utility theory, constant relative risk averse

1. Introduction

Indonesia is an area with a very high frequency of natural disasters and is often called a "disaster-prone" area. Business activities in the agricultural sector will always be faced with quite high risks. The risks experienced by farmers come from the natural environment, natural disasters, climate, and plant-disturbing organisms (Reardon & Vosti, 1995; Bengston, et al., 2004).

Many researchers have analyzed risk preference factors, including (Rokhani, et al., 2021) analyze the production risk preferences of lowland rice farmers using the Just and Pope Risk Functions.Besides that (Suryanto, et al., 2020; Anggraeni, et al., 2014), analyze rice farmers' risk preferences using the absolute risk aversion (AR) model, which is associated with the utility function.

Utility in the economic sense refers to the total satisfaction obtained from consuming goods or services. Valuation of utility for goods, services or money can be different, depending on the risk preferences of each individual (Von Neumann & Morgenstern, 2007). Risk preference shows the tendency of individual behavior in the face of profit or

loss probability variants to maximize their utility. Utility is used as an approach in making decisions in conditions of uncertainty (Eckel & Grossman, 2008; Aimone & Houser, 2012). Through utility theory, Arrow and Pratt provide a functional form of the utility equation to show individual risk preferences, by measuring relative risk aversion is constant. Pratt (1964) shows the measurement of risk preference with constant relative risk averse (CRRA).

In general, farmers have risk averse risk preferences. Risk preference is thought to influence farmers' decisions in participating in the AUTP program. Farmers with risk averse risk preferences who participate in AUTP make AUTP a non-production way of mitigating risks to overcome the impact of crop failure.

Preference is a person's process of choosing information or something that consumers prefer. Preference is also defined as a person's choice of likes or dislikes for a product or service used (Sari, 2019; Kamboj & Matharu, 2021). Farmers' risk preferences are grouped into three characteristics, namely risk takers, risk neutral decision makers, and risk averse decision makers. According to Alemayehu, et al., (2018) Preferences can be expressed as individual tendencies to choose something that is preferred over something else. The existence of risks is of course followed by the preferences or choices of farmers in dealing with risks. This preference will further influence farmers' decisions in dealing with risks. The impact of a farmer's risk preference on the strategy that will be chosen by a farmer depends on the nature of the risks faced.

Furthermore, in this research will be infactor analysis of farmer's risk preferences in determining rice microinsurance premiums using utility theory. This study aims to use the theoretical framework of utility theory to determine farmers' risk preferences in determining the AUTP premium in Majalaya District, Bandung Regency.

2. Research methods

This section discusses the search for the coefficient of r to determine farmers' risk preferences using utility theory.

*Gross profit*is the result of farmers using part of their wealth in risky activities. The risky activities referred to in this study are rice farming activities carried out by farmers.

Farmers will maximize the input costs used in rice farming to obtain optimal production results by assuming that the total value of variable costs has the same value as the indemnity (compensation value) of the rice micro insurance program per hectare, so it can be written:

$$GP = p.y - r.x \quad (1)$$

$$GP = TR - TVC \quad (2)$$

The isoelastic utility function is one of the functions in elasticity where the change in the dependent variable to the cause of the change in the independent variable has a fixed percentage level. The function is written as follows:

$$U(x) = \frac{x^{1-r}}{1-r}; r \geq 0, r \neq 1 \quad (3)$$

$$U(x) = \ln(x); r = 1 \quad (4)$$

Pratt (1964) shows the measurement of risk preference with constant relative risk averse (CRRA). The utility equation of the exponential form of the equation:

$$U(x) = x^{1-r}, x > 0 \quad (5)$$

So the constant relative risk averse (CRRA) equation is as follows:

$$U(x) = \frac{x^{1-r}}{1-r}, x > 0 \quad (6)$$

Thus in case , then$r = 1 U(x) = \ln x$

CRRA is a form of relative risk aversion (RRA), where the greater the value of wealth owned by an individual, the percentage of total wealth used in risky activities by that individual will remain the same.

$$Rr(GP) = -\frac{U''(GP)}{U'(GP)} . GP \quad (7)$$

With$GP > 0; U' > 0 \; dan \; U'' < 0$

Measurement of risk preference using constant relative risk averse (CRRA) for gross profit (GP) with the utility function as follows:

$$U(GP) = \frac{GP^{1-r}}{1-r} \quad (8)$$

With ; in case , then$GP > 0 r = 1 U(GP) = \ln GP$

3. Results and Discussion

3.1 Characteristics of respondent rice farmers

The characteristics of the respondent rice farmers consist of the age of the farmer, the length of time he has cultivated rice, the area of rice farming land, formal education, the value of risk preference, the level of understanding of AUTP, and the amount of premium that can be paid. The number of respondents in this study was 100 respondent farmers with 50 farmers participating in AUTP and 50 non-AUTP participants respectively.

3.1.1. Age of rice farmers

Age can be associated with the ability of farmers to manage their farming. A farmer who is at a productive age between 15 and 50 years is generally able to provide better yields when compared to a farmer at a non-productive age (more than 50 years) or nearing a productive age (less than 15 years). In addition, age is also thought to influence the response to new innovations. Characteristics of respondent farmers based on age can be seen in Table 1.

Table 1: Characteristics of respondent farmers based on age

No	Farmer Age (Years)	AUTP participant		Non-AUTP	
		Amount	%	Amount	%
1	≤30	0	0	2	4
2	31-40	7	14	12	24
3	41-50	22	44	20	40
4	51-60	19	38	13	26
5	>60	2	4	3	6
	Total	50	100	50	100
	Average	49.38		46.44	
	Minimum	32		27	
	Maximum	69		68	
	Standard deviation	8.504236639		10.02478561	

3.1.2. Long time farming rice

The length of rice farming is the number of years that have accumulated in order to do rice farming, the more years accumulated by the respondent rice farmers, it can be said that the more experience they have. Experience is one of the factors that determine success in rice farming. The duration of rice farming affects the knowledge and skills of farmers in managing their farming and the attitudes of farmers in dealing with the risks of rice farming. The characteristics of the respondent's length of rice farming can be seen in Table 2.

Table 2: Characteristics of respondent farmers based on length of rice farming

No	Old (Year)	AUTP participant		Non-AUTP	
		Amount	%	Amount	%
1	≤10	6	12	5	10
2	11-20	25	50	23	46
3	21-30	10	20	14	28
4	>30	9	18	8	16
	Total	50	100	50	100
	Average	20.2		19.98	
	Minimum	4		2	
	Maximum	42		44	
	Standard Deviation	9.324096498		10.07824491	

3.1.3. Paddy farming area

Land is one of the main production factors in rice farming. The area of land used in farming can describe economic conditions and also the amount of capital used by farmers, the wider the area of land used, the amount of capital used in farming and the income that will be obtained is also greater when compared to farmers with a narrow land area. The area of land used for rice farming by the respondent farmers can be seen in Table 3.

Table 3: Characteristics of respondent farmers based on the area of rice farming land

No	Land area (Hectares)	AUTP participant		Non-AUTP	
		Amount	%	Amount	%
1	≤0.50	15	30	34	68
2	0.51-1.00	30	60	13	26
3	1.01-1.50	4	8	3	6
4	>1.50	1	2	0	0
	Total	50	100	50	100
	Average	0.7094		0.5702	
	Minimum	0.1		0.2	
	Maximum	1.94		1.5	
	Standard Deviation	0.354282316		0.323813312	

3.1.4. Formal education

The level of education is one of the factors that determine the mindset of farmers, the higher the level of education of farmers also increases the ability of farmers to accept and understand either new knowledge or technology in order to improve the performance of their farming business. Farmers with a high level of education are usually more careful in making farming decisions and tend to adopt new technologies more easily. Characteristics of respondent farmers based on formal education level can be seen in Table 4.

Table 4: Characteristics of respondent farmers based on education level

No	Education Level (Year)	AUTP participant		Non-AUTP	
		Amount	%	Amount	%
1	0-5 (did not pass elementary school)	0	0	2	4
2	6-8 (graduated elementary school)	7	14	17	34
3	9-11 (graduated middle school)	22	44	23	46
4	12 (graduated high school)	11	22	3	6
5	>12 (Higher Education)	10	20	5	10
	Total	50	100	50	100
	Average	11,16		9,12	
	Minimum	6		2	
	Maximum	16		16	
	Standard Deviation	2.951028876		3.061545561	

3.1.5. Risk preference value

In general, farmers have risk averse risk preferences (Jin et al., 2016). Risk preference is thought to influence farmers' decisions in participating in the AUTP program. Farmers with risk averse risk preferences who participate in AUTP make AUTP a non-production way of mitigating risks to overcome the impact of crop failure.

The risk preference value is obtained from the conversion results of the selected partner choices. The lower the risk preference value, it is suspected that the respondent rice farmer has a risk taker preference, and vice versa. The risk preference value of the respondent rice farmers can be seen in Table 5.

Table 5: Characteristics of respondent farmers based on risk preferences

No	Risk Preference Value	Classification	AUTP participant		Non-AUTP	
			Amount	%	Amount	%
1	$r < -0{,}60$	*Very Risk Taker*	0	0	0	0
2	$-0{,}60 - -0{,}01$	*Risk Takers*	0	0	12	24
3	$0{,}00 - 0{,}19$	*Neutral Risk*	1	2	13	26

4	$0{,}20 - 0{,}49$	*Risk Averse*	6	12	19	38
5	$0{,}50 - 0{,}99$	*Very Risk Averse*	43	86	6	12
6	$r \geq 1$	*Do Nothing*	0	0	0	0
	Total		50	100	50	100

Average	0.6022	0.113
Minimum	0.05	-0.55
Maximum	0.85	0.85
Standard deviation	0.224783706	0.301704342

3.1.6. AUTP understanding level

Knowledge and understanding related to rice farming insurance (AUTP) is an important factor in the successful implementation of the AUTP program. The low interest in agricultural insurance in developing countries, especially in Indonesia, is due to the lack of knowledge and understanding of farmers regarding agricultural insurance. Another impact of the low knowledge and understanding of agricultural insurance can also have an impact on determining self-help premiums and subsidized premiums that will be provided by the government.

Table 6: The average score of respondent farmers' understanding of AUTP

No	Question	AUTP participant	Non-AUTP
1	Land types that can be registered for the AUTP program	4.88	3.94
2	The maximum area of paddy fields that can be registered in the AUTP program	4.48	3.60
3	Self-registration process to become an AUTP participant	3,24	1.68
4	The maximum deadline for registering for the AUTP program for each growing season	2.86	0.69
5	The amount of AUTP premium paid by farmers	4.56	4.45
6	The type of risk covered in AUTP	4.38	3.70
7	Time limit for notification of damage to PPL/POPT	3,32	0.54
8	The amount of land damage intensity for compensation claims in the AUTP program	4.50	3.54
9	The amount of compensation obtained in the event of a crop failure	4.96	4.36
10	Age of plants that get compensation in case of damage	3.50	0.50
11	Compensation payment system in the AUTP program	2.92	0.96

Characteristics of respondent rice farmers based on the level of knowledge and understanding of AUTP can be seen in Table 7.

Table 7: Characteristics of respondent rice farmers based on the level of understanding of Rice Farming Insurance

No	Assess level of understanding	AUTP participant		Non-AUTP	
		Amount	%	Amount	%
1	0-11 (very low)	0	0	0	0
2	12-22 (low)	1	2	16	32
3	23-33 (moderate)	8	16	29	58
4	34-44 (height)	13	26	5	10
5	45-55 (very high)	28	56	0	0
	Total	50	100	50	100

Average	43.6	27.96
Minimum	20	18
Maximum	55	44
Standard deviation	8.919137874	6.69742564

3.1.7. The amount of premium that can be paid

Characteristics of respondent farmers based on the amount of premium they are able to pay can be seen in Table 8.

Table 8: Characteristics of respondent farmers based on the amount of premium

No	Premium amount	AUTP participant		Non-AUTP	
		Amount	%	Amount	%
1	IDR 0.00	4	8	43	86
2	IDR 18,000.00	29	58	7	14
3	IDR 36,000.00	14	28	0	0
4	IDR 54,000.00	3	6	0	0
	Total	50	100	50	100
	Average	IDR 20.445.00		IDR 1.855.00	
	Minimum	IDR 0.00		IDR 0.00	
	Maximum	IDR 54.000.00		IDR 18,000.00	
	Standard deviation	12563.64308		4947.708705	

3.2 Reasons for Farmers' Participation in the AUTP Program

Rice Farming Insurance was created to provide protection against the risk of crop failure, but farmers still participate in AUTP, judging from the area of registered paddy fields. The lack of participation of rice farmers in Majalaya District, Bandung Regency can be due to several reasons. The following will explain several reasons regarding the reasons for farmers who joined the AUTP program and those who did not participate in the AUTP program. Reasons for farmer participation in the AUTP program can be seen in Table 9.

Table 9: Reasons for participation of rice farmers in the AUTP program

No	Reasons to join the AUTP program	Number of respondents	Percentage
1	Flood risk and pests	25	50
2	Claim amount	11	22
3	Premium amount	7	14
4	Following other farmers	4	8
5	AUTP as a government program	3	6
	Total	50	100

3.3 Farmers' Risk Preferences in Majalaya District, Bandung Regency

Risk preference is assessed using the coefficient value$\boldsymbol{r}$from the results of choosing a partner that has a certain output probability. Rice farmers' risk preferences are assessed from each individual respondent. The distribution of rice farmers' risk preferences in Majalaya District is shown in Table 10.

Table 10: Distribution of risk preferences of rice farmers in Majalaya District

Risk Preference	AUTP participant		Non-AUTP		Total Respondents	
	r^1	Distribution2	r^1	Distribution2	r^1	Distribution2
Very Risk Taker	-	0	-	0	-	0
Risk Takers	-	0	-0.30333	12	-0.30333	12
Neutral Risk	0.05	1	0.05	13	0.05	14
Risk Averse	0.26	6	0.26	19	0.26	25
Very Risk Averse	0.662791	43	0.616667	6	0.639729	49
Do Nothing	-	0	-	0	-	0
Total	0.972791	50	0.623333	50	0.646395	100

Based on the results of the risk preference assessment of each individual rice farmer respondent, an average assessment was carried out based on farmer groups in AUTP and non-AUTP participants, and overall in Majalaya

District, Bandung Regency. The risk preferences of rice farmer respondents in Majalaya District, Bandung Regency are shown in Table 11.

Table 11: Respondent rice farmer risk preferences

Respondents	Risk Preference	
	The average value of the coefficient r	Description
AUTP	0.97279	*Very Risk Averse*
Non-AUTP	0.62333	*Very Risk Averse*
AUTP and Non-AUTP	0.6464	*Very Risk Averse*

Respondent rice farmers in Majalaya District, Bandung Regency have a risk preference *very risk averse*, with an average value of the coefficient r of 0.65. Rice farmer respondents participating in AUTP also have a very risk averse risk preference with an average value of the coefficient r of 0.97. Non-AUTP respondent rice farmers also have a very risk averse risk preference with an average value of the coefficient r of 0.62.

4 Conclusion

The rice farmer risk preference value for respondents participating in AUTP has an average of 0.6022 (very risk averse). Meanwhile, the rice farmer risk preference value for non-AUTP respondents has an average of 0.113 (risk neutral). Rice farmers in Majalaya District, Bandung Regency, mostly have a very risk averse preference, with 49 rice farmer respondents (the average value of the coefficient r is 0.64). Most of the rice farmers in Majalaya District, Bandung Regency with a very risk averse preference are rice farmers participating in AUTP with an average value of r coefficient of 0.97. Non-AUTP respondent rice farmers also have a very risk averse risk preference with an average value of the coefficient r of 0.62.

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