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Chapter 5
The Effect of Risk Preference and Farmer Perception on Climate Change to Farmer Participation on Farm Insurances

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Abstract: Agricultural farming is one of the most vulnerable sectors in Indonesia since weather, pests, diseases, and other factors may directly affect crop yield. Since 2015, the national policy for climate change adaptation has provided agricultural insurance for rice farmers. This study aims to explore how farmers perceive the impacts of climate change on rice farming and investigate factors influencing farmer's participation in the national insurance scheme. Logistic regression and propensity score matching (PSM) were used to analyze the factors influencing participation in farm insurance and the impact of farm insurance on farmer income. The results revealed that risk preference, age, and education have positive effects on farmers' willingness to participate in farm insurance, while land ownership has a negative effect on it. Furthermore, farmers' incomes were significantly different between national insurance participants and non-participants. Finally, it is concluded that the national insurance program is important for rice farmers in medium and high-risk areas.

1. Introduction

Agricultural farming is a risky business since weather, pests,

diseases, and other factors may directly affect crop yields (Cline 2007; Nordhaus 1991). Rice is one of the staple foods in Indonesia which relies on the climate conditions. Changes in rainfall intensity and frequency can cause extreme weather such as floods and droughts which also affect irrigation water availability and adequacy. Accordingly, adverse weather causes production loss (Surmaini et al. 2011).

The impact of adverse climate change (CC) on farming is determined by the vulnerability of farmers which has three interrelated functions: exposure to hazard, sensitivity to damage, and ability to cope (IPCC 2014). One of the ways to reduce the impact of CC is by promoting adaptive strategies (Jamshidi et al. 2019). Some studies justify that farm adaptation to CC in farm practices can reduce farm losses (Khanal et al. 2018). Adaptation can be classified as autonomous adaptation, and planned adaptation (Stage 2010). While in autonomous adaptation farmers practice adaptation strategies based on their knowledge independently, in planned adaptation, the government plays an important role in planning and implementing an adaptation policy.

One of the adaptation policies run by the government is farm insurance. Since 2015, the Indonesian government has actively supported the implementation of national agricultural insurance, locally called Asuransi Usaha Tani Padi (AUTP), especially for paddy farming. The insurance provides subsidies for rice farmers with 80% premium payment while the rest is paid independently by the farmers themselves. However, from 2015 to 2018 the number of farmers participating in farming insurance is still low, only 3–4% (Table 5.1). Although the percentage seems to be increasing, it is still low compared to other sectors and other countries. This research aimed to find out the reason why farmers' participation is low and to find an alternative solution.

Table 5.1 Paddy rice area in Indonesia based on participating in agricultural insurance.

Year	Paddy Area (Ha)	Registered Area (Ha)	Percentage (%)
2015	14,116,638	233,500	1.65
2016	15,156,166	307,217	2.02
2017	15,712,015	997,961	6.58
2018	15,994,512	806,199.64	5.04
Total	**60,979,331**	**2,344,877.64**	**3.82**

Source: Ministry of Agriculture, Indonesia, 2018.

2. Rice Farming, National Policy, and Farmer's Perception

In Indonesia, rice productivity varies from area to area and year to year. On average, rice productivity in Indonesia was around 5 tons per ha in 2015, decreasing in 2016–2017, and slightly increasing in 2018. Therefore, there are some hypotheses that rice productivity may depend on areas, environmental factors such as climate change, and input uses as macro conditions. Rice productivity in Java is higher than outside of Java. Especially, rice productivity in Java and Sulawesi is higher than in other areas due to better agricultural infrastructures for irrigation. Meanwhile, Sumatra and Kalimantan have low rice productivity due to many areas being used for plantation crops (i.e., palm oil trees, and forestry).

In addition, most farmers in Indonesia manage their own land (70%), while others are renting (18%), and sharecropping (10%) (Table 5.2). Sharecropping is high in some areas such as Sumatra and Java while it is low in some other areas such as Maluku and Papua. The question "How do they manage their farming?" was raised. The answer is that it mainly depends on ownership. It means that farmers who have their own land can access and manage their farms easily, but for farmers who

are leasing or sharecropping, it still depends on their location.

Table 5.2 Land management and sharecropping.

Region	Own	Lease	Sharecropping	Ratio
Sumatra	14,452 (23.39%)	5,826 (36.90%)	3,101 (33.16%)	2
Java	24,708 (39.99%)	4,976 (31.52%)	3,319 (35.49%)	3
Kalimantan	6,646 (10.76%)	1,243 (7.87%)	829 (8.87%)	4
Sulawesi	7,535 (12.20%)	1,414 (8.96%)	676 (7.23%)	4
Bali & Nusa Tenggara	7,064 (11.43%)	2,222 (14.07%)	1,270 (13.58%)	3
Maluku	747 (1.21%)	72 (0.46%)	57 (0.61%)	6
Papua	632 (1.02%)	35 (0.22%)	99 (10.6%)	5
Indonesia	61,784 (70.75%)	45,788 (18.08%)	9,351 (10.71%)	3

Source: Statistics Indonesia (BPS), 2014.

In Indonesia, the non-irrigated area is around 55%, higher than the irrigated area of 45%. The percentage of irrigated land in Java is higher than outside of Java (Table 5.3).

Table 5.3 Share of cultivated land in Indonesia.

Region	Non-irrigated land	Irrigated land	Ratio
Sumatra	13,674 (28.61%)	9,791 (24.77%)	13
Java	16,466 (34.45%)	16,720 (42.30%)	9
Kalimantan	3,212 (6.72%)	8,776 (14.08%)	5
Sulawesi	8,757 (18.32%)	905 (2.29%)	96
Bali & Nusa Tenggara	4,988 (10.44%)	5,608 (14.19%)	8
Maluku	226 (0.47%)	651 (1.65%)	3
Papua	477 (1%)	291 (0.74%)	16
Indonesia	**47,800 (54.73%)**	**39,530 (45.27%)**	**12**

Source: Statistics Indonesia (BPS), 2018.

(1) The Strategic Goals and Targets of RAN-API

Indonesia is one of the agricultural countries most vulnerable to

climate change and its impacts. To mitigate the negative impacts of climate change, the Government of Indonesia has formulated a national action strategy plan, namely the Nation Action Plan for Climate Change Adaptation (RAN-API). The existence of seven main programs supports these strategies, including: 1) Adapting the food production system to climate change, 2) Expanding the area of food production, 3) Improving and developing climate-proof agricultural infrastructure, 4) Food diversification, 5) Developing innovative and adaptive technologies, 6) Developing information and communication systems (for climate and technology), 7) Establishing supporting programs. Some areas received government subsidies.

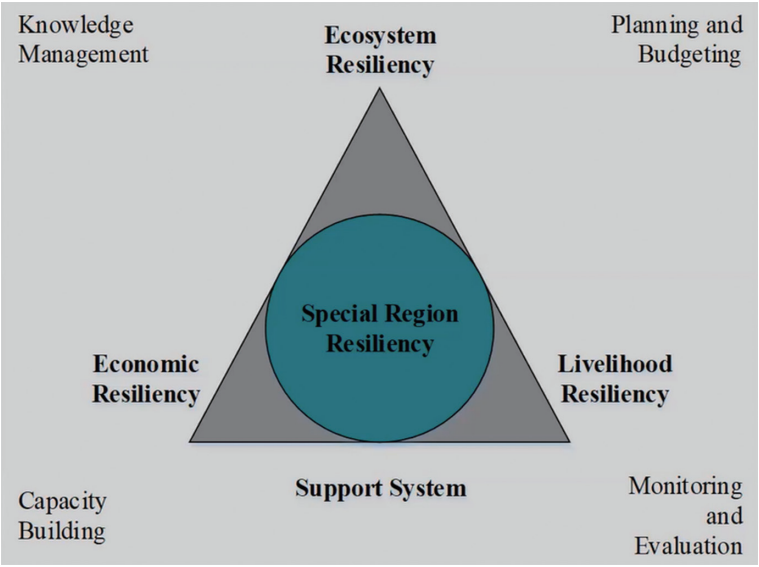

Figure 5.1 The strategic goals and targets of RAN-API. Source: (BAPPENAS)

More specifically, since 2015, the Indonesian government has implemented a national agricultural insurance scheme locally called

Asuransi Usaha Tani Padi (AUTP), especially for paddy farming. The insurance scheme as a financial instrument provides subsidies that will help farmers who experience crop failure owing to climate change to enhance their capacity and continue their farming activities. The farmers only need to pay 20% of the insurance premium of Rp 200,000 or US$13 per ha. It is quite a small amount of money when compared to rice productivity and profit. The rest, 80% of the insurance premium, will be subsidized by the government. When crop failures caused by climate change occur, the insurance payment is about one-third of total productivity and nearly US$700. It is much higher than the insurance cost.

Regarding climate change perceptions, farmer's perception was identified to be influenced by demographic, institutional, environmental, and psychological/social factors. Environmental factors seem to be macro-conditions, while demographic and psychological factors can be maintained and depend on environmental and institutional factors. Therefore, the perceived impact of climate change can increase autonomous adaptation and affect adaptation outcomes (Rondhi et al. 2019). When the way to adapt to climate change is correct, the benefits for rice production will come. However, incorrect ways of adapting to climate change (or maladaptation) can lead to a decline in rice production.

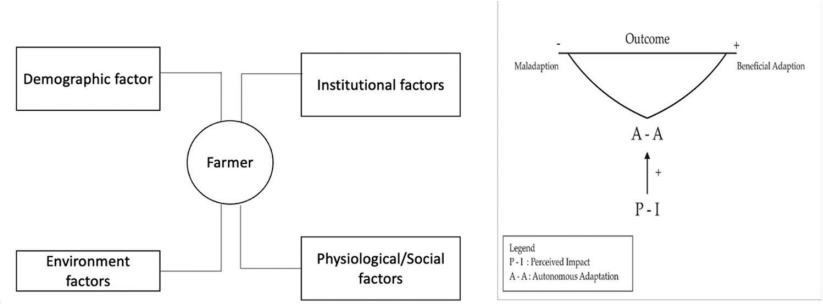

Figure 5.2 Climate risk perception. Source: Author

(2) Research Site and Method

The study was conducted in Jember District, East Java, Indonesia, through interviews with 87 rice farmers. The study uses the logistic model to identify farmers' perceptions and influencing factors. The regression model is expressed as follows:

$$\ln\left(\frac{P_1}{1-P_1}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 D_1 + \beta_7 D_2$$

Where Y_i presents AUTP participation (1 = participation, 0 otherwise), X_1 – risk preference, X_2 – age of rice farmers (years), X_3 – total area (ha), X_4 – education (years), X_5 – family members (persons), D_1 – farmer perception (Dummy variable with 1 = 51-100%, 0 = 0-50%), and D_2 – land ownership (Dummy variable with 0 = own, 1 = not own). Furthermore, propensity score matching (PSM) was applied to explain the impact of farmer's participation in farm insurance on farm income.

3. Results and Discussion

(1) Perceived Impact of Climate Change on Rice Farming in Indonesia

Climate change and its impacts in the study are related to drought, flood, and pest attacks. Figure 5.3 shows that farmers in some areas (i.e., West Kalimantan) perceived a high impact of climate change where drought is dominant compared to others. Meanwhile, farmers in some other areas (i.e., Java) perceived the low impact of climate change, where flooding is more predominant than droughts and pest attacks. Farmers in west Borneo Island (West Kalimantan) and Riau Island

perceive a higher impact of drought than others. East Kalimantan and South Sumatra provinces face a higher flood risk than others. On the other hand, rainfall and pest attacks occurred in all provinces at low levels.

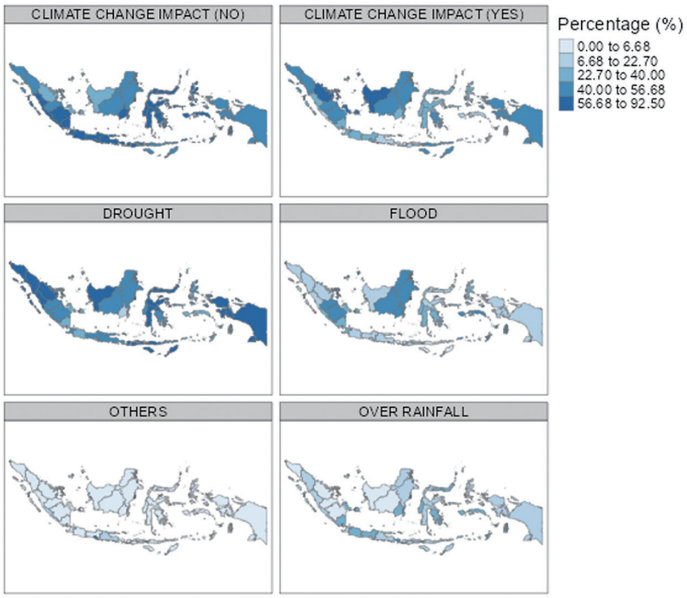

Figure 5.3 The percentage of farmers perceived the impacts of climate change in Indonesia. Source: Author

As mentioned above, for risk preference, this study divides risk preference into risk-averse farmers (who avoid risks and have a low-risk tolerance) and risk-takers (farmers who are more willing to take risks). The average age of surveyed rice farmers is 50 years old. Most of the rice farmers surveyed have attended mainly elementary school (37%) and senior high school (29%). The average number of family members

is around four people. Regarding the perception of CC, more than 70% of farmers perceived the impacts of CC. The majority of farmers (73%) cultivate rice in their own land (Table 5.4).

Table 5.4 Descriptive statistic.

Variable	Average (frequency)
Risk preference (X_1)	
Risk averse	71
Risk taker	16
Age (year)	50
Area (ha)	0.1–0.5
Education (X_4)	
Not primary	6
Elementary	37
Junior high school	11
Senior high school	29
University/academy	4
Family member (X_5)	4
Perceptions (D_1)	
Yield decreasing 1–50%	16
Yield decreasing 51–100%	71
Land ownership (D_2)	
Own	73
Rent/share	14

Source: Field Survey, 2020.

(2) Factors Affecting Farmer's Participation in AUTP Insurance

The results from Table 5.5 show that risk preference has a positive significance on participation in a farming insurance scheme. This means that risk-taking farmers have low participation, while risk-averse farmers tend to participate in insurance. In some areas with high impacts of climate change, farmers also tend to participate in insurance. In addition, there is a positive relationship between farmers' ages and

their participation in AUTP insurance. This means that an increase in the age of rice farmers can increase the probability of participating in the national insurance of the Indonesian government. It shows the same trend as for the education variable. It means that education can also facilitate participation in national insurance schemes. Importantly, the variable of land ownership has a negative impact on insurance participation. This means farmers renting land or sharecropping are less likely to participate in farming insurance, while farmers owning land are more likely to participate in a farming insurance scheme.

Table 5.5 Result of logistic model.

Variable	B	S,E,	Wald	Df	Sig,	Exp(B)
Risk preference (X_1)	0.640	0.208	9.468	1	0.002**	1.897
Age (X_2)	0.079	0.027	8.679	1	0.003**	1.082
Area (X_3)	-0.233	0.645	0.131	1	0.717	0.792
Education (X_4)	0.181	0.079	5.260	1	0.022**	1.198
Family member (X_5)	0.120	0.224	0.286	1	0.592	1.127
Perceptions (D_1)	-1.205	0.928	1.684	1	0.194	0.300
Land ownership (D_2)	-2.010	0.779	6.664	1	0.010**	0.134
Constant	-4.955	1.801	7.566	1	0.006	0.007

Source: Field Survey, 2020.

(3) Discussion

Risk-averse farmers tend to participate in farm insurance, especially farmers whose plots are in areas affected by climate change risks such as pest attacks and flooding. The government has a specific program for each area in Indonesia due to the specific characteristics of the environment in each respective area. Generally speaking, this finding supports previous research (Vassalos and Li 2016; Rondhi et al. 2019). Farmers who have experienced farm failure tend to be risk averse and tend to participate in farm insurance.

Land-owning farmers tend to participate in farm insurance, as they have full access to the management of their land, while land-sharing farmers or land-renting farmers do not have much access to land. Hence, they are less likely to participate in farm insurance. Land-sharing or land-renting farmers perceive that an insurance claim will be paid after they harvest the crop, and at that time, the farmer does not have the right to manage the plot. Therefore, those farmers prefer not to participate in farm insurance.

There is a difference in income between AUTP and non-AUTP farmers by Rp 895,052. The result shows that AUTP farmers receive more income (Rp 6,956,096) than non-AUTP farmers (Rp 6,061,044). Those farmers manage their farms as recommended by good practices (GAP). Moreover, AUTP farmers receive insurance claims for farm failures. The ease of making claims due to farm failure raises farmers' eagerness to participate in farm insurance.

4. Conclusion

This study attempted to find out the factors influencing rice farmers' decisions on insurance participation in Jember District, East Java of Indonesia. The national insurance program can partially enhance farmers' adaptation capacity to climate change to ensure their livelihood. However, actual participation in insurance schemes is still low among rice farmers.

The findings indicate that farmer determinants to participating in AUTP insurance are risk preference, age, education, and land ownership, while farmers' perceptions and the number of family members do not affect their participation. Risk-averse farmers and land-owning farmers tend to participate in farm insurance. Importantly, the AUTP program should be addressed to rice farmers in medium and high-risk areas.

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Chapter 5. The Effect of Risk Preference and Farmer Perception on Climate Change to Farmer Participation on Farm Insurances

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