THE WILLINGNESS OF FARMERS TO PAY INSURANCE PREMIUMS FOR SUSTAINABLE RICE FARMING IN BALI

I Wayan Budiasa[1,4*], I Gede Rai Maya Temaja[1,5], I Nyoman Gede Ustriyana[1,4], I Wayan Nuarsa[2,4], and I Gusti Bagus Adi Wijaya[3]

[1]Faculty of Agriculture, Udayana University, Bali, Indonesia
[2]Faculty of Marine and Fishery, Udayana University, Bali, Indonesia
[3]Financial Service Authority Regional Office 8 of Bali and Nusa Tenggara, Denpasar
[4]Bali Center for Sustainable Finance, Udayana University, Bali, Indonesia
[5]Research and Community Services Institute, Udayana University, Bali, Indonesia
[*]Corresponding author: wba.agr@unud.ac.id

(Received: April 29, 2019 Accepted: April 19, 2020)

ABSTRACT

One of the systemic and institutional effort for mitigating risk of crop harvest failure is rice farm insurance (RFI) which has been implemented in Bali since 2015. The RFI premiums and the coverage value for one hectare insured paddy field in one planting season were IDR180,000 and IDR6,000,000, respectively. The study sought to estimate the farmer willingness to pay (WTP) for the RFI premiums and analyze the interaction between socio-economic characteristics of farmers and their decision to join in the RFI program. The socio-economic characteristics and farmer WTP data were collected by Contingent Valuation Method (CVM) survey to 270 representative participants of the RFI program in nine regencies or city in Bali Province during 11 to 18 September 2018 by involving nine enumerators. This survey used closed-ended dichotomous choice format questionnaire. The WTP was estimated by using software of STATA 11.0 version while decision analysis was by using Chi-squared Automatic Interaction Detector (CHAID) method. Based on the estimation results, the farmer WTP is IDR61,281.57 (34.05%) of RFI premiums per hectare in one planting season. The farmers' socio-economic characteristics especially cropping pattern, land tenure status, gender, and rice productivity affected their participation in the RFI program. As much as IDR60,000 per hectare of the RFI premiums could be charged to the insurance while government's subsidy could be reduced to IDR120,000 per hectare in one planting season.

Key words: agricultural insurance, CVM, rice farm, subsidy, WTP

INTRODUCTION

The agricultural sector is seen as a business with a high risk of natural dynamics and is susceptible to unexpected attacks by pests, diseases and natural disasters. The conditions can lead to a decrease in agricultural production yields and even crop failures and risk of price fluctuations so that farmers' income declines. These problems need to get protection from the chance of failure. The increasing incidence and intensity of floods or droughts causes an escalation of crop damage. In general, risks and uncertainties in rice farming have increased and so far the farmers have to responsible to the risk themselves. The implication is that the future of national food security will face fragile conditions. Systematic and institutionalized efforts need to be held to minimize the risk of losses due to threats that occur in the agricultural sector. Insurance is offered as one of the funding

schemes to share risks such as crop failure. Agricultural insurance relates to financing of farming with third parties (private insurance companies or government agencies) with a certain amount of premium payments (World Bank, 2008 *in* Pasaribu 2010). The agricultural insurance program is mandated by Law No. 19 of 2013 concerning the Protection and Empowerment of Farmers. The law requires the central government and local governments to provide protection to farmers against losses from harvest failure. The law was implemented legally starting in 2015 with the issuance of Minister of Agriculture Regulation No. 40 of 2015 concerning Facilitation of Agricultural Insurance. As a form of implementation of Law No. 19 of 2013, the government through the Ministry of Agriculture and the Ministry of Finance established an agricultural insurance program as a national food security program. The agricultural insurance program began to be applied extensively in 2015 through cooperation with PT. Asuransi Jasa Indonesia (Jasindo) which was appointed as the executor of the rice farm insurance (RFI) program (Nurhananto and Mutiara 2016).

The RFI program participants in Bali province are *subak* (a traditional organization for managing water and/or plant at farm level) members while the RFI program participants in other provinces in Indonesia are members of farmer group (Darmawan *et al.* 2018). The object of coverage that will be borne in the RFI program is the irrigated rice fields and rain-fed rice fields available with water sources that are cultivated by the members of farmer group (or *subak* members) and are located in one stretch. A RFI policy is issued for one planting season (around four months) with a term the time of coverage starts on the estimated planting date and ends on the estimated date of the harvest. The coverage value is up to IDR6,000,000 per hectare with the premiums to be paid is as much as IDR180,000 per hectare in one planting season. The RFI premiums payment gets subsidies from the Central Government by 80% (IDR144,000) and the remaining 20% (IDR36,000) is paid for independently by farmers. If the area of the insured land is more or less than one hectare, then the amount premiums (and compensation) are proportionally calculated. The coverage value is as much as the rice farm costs per hectare in one planting season. Thus, the farmers can continue their rice farming in the next planting season, despite the current crop failure. The risks guaranteed by RFI program include floods, droughts and plant disrupting organisms when rice has passed 10 days after transplanting or 30 days after planting seeds directly and the intensity of the damage and the damaged area reached greater than or equal to 75%. The insured will receive compensation for a maximum of 51 days after the damage indications occurred or 14 days after the Minutes of Damage Audit Results were issued (Directorate General of Agricultural Infrastructure and Facilities of Ministry of Agriculture, 2016). The pest include rats, planthopper, rice bug, steam borer, and armyworm; while diseases include blast, tungro, brown spot, steam rot, and rice ragged stunt (http://www.knowledgebank.irri.org). The most rice farming risks to failure during the first phase implementation of the RFI program in Bali Province were pests and diseases, such as blast (43.75%), rats (37.5%) and brown planthoper (6.25%). Drought during the planting season also caused 12.5% of harvest loss (Ambarawati et al. 2018).

The RFI program was implemented in Bali Province from October 2015 to September 2017 which was divided into four phases, i.e.: phase-1 (October 2015 to March 2016) with coverage area of 6,087.84 ha; phase-2 (April 2016 to September 2016) with coverage area of 21,510.25 ha; phase-3 (October 2016 to March 2017) with coverage of 1,657.19 ha; and phase-4 (April 2017 to September 2017) with coverage area of 14,699.70 ha. Both phase-2 and phase-4 of the RFI program implementation involved many rice farmers since the April to September period is dry season. Thus, the rice farmers tend to protect their rice farms from drought during dry season besides protection from pests and diseases. The total area of rice fields in Bali in 2017 was 78,626 ha, so the highest relational of the four phases of RFI program implementation was achieved in phase-2, which is 27.36% (https://bali.bps.go.id). This achievement indicated that the level of farmers' participation in insuring their rice farming is still low (Jasindo 2017). In reality, 80% the RFI premiums was paid through the Central Government subsidy and just 20% was paid by the rice farmers. The willingness

of farmers to pay for RFI premiums is to guarantee rice farming sustainability. The willingness of farmers to pay for 20% of RFI premiums means the RFI program that protects the rice farm from failure was implemented. The more farmers WTP, the more rice fields protected from the risk of the rice farm failure as well as more rice farming to be continued in the next planting season. This study sought to estimate the farmer WTP for the RFI premiums and analyze the interaction between socio-economic characteristics of farmers and their decision to join in the RFI program. Based on this study, we want to know WTP of farmer above the minimum premiums payment of IDR36,000 per hectare as well as to know whether the government subsidy may reduced to less than IDR144,000 per hectare in one planting season.

RESEARCH METHODOLOGY

Study location. The study was conducted in all regencies or city in Bali Province, considering that each regency or city has experience in the RFI implementation as stated in Table 1.

Table 1. Coverage area of insured rice farm in Bali Province for the period of 2015 to 2017.

No.	Regency/City	Coverage area (Ha)			
		Phase I	**Phase II**	**Phase III**	**Phase IV**
1	Denpasar	279.00	1,131.72	-	2,224.96
2	Gianyar	-	4,062.42	-	1,486.92
3	Tabanan	2,978.74	5,150.14	1,490.32	3,782.81
4	Buleleng	143.94	4,313.21	-	1,281.62
5	Jembrana	1,982.71	2,013.40	-	1,068.38
6	Karangasem	-	1,000.20	-	1,349.14
7	Klungkung	516.00	2,561.40	143.21	1,895.91
8	Badung	187.45	277.77	10	1,483.74
9	Bangli	-	1,000.00	13.66	126.22
	Total	6,087.84	21,510.25	1,657.19	14,699.70

Source: Jasindo 2017

Type and method of data collection. The types of data needed in this study include both primary and secondary data. The secondary data consistsed of the names of *subak*, the number of farmers and the land area per *subak* in each regency or city that have included in RFI program during the period as presented in Table 1. These data are collected by the literature study method or documentation study especially from the Jasindo and the Regional Financial Services Authority 8 Bali and Nusa Tenggara.

The primary data relating to the farmer willingness to pay for RFI premiums were collected through a CVM survey from 11 to 18 September 2018 by involving nine enumerators. This survey used closed-ended dichotomous choice in a single-bounded and double-bounded format. The choice of this format is based on theoretical foundation factors, estimation efficiency, ease of elicitation, and availability of analysis software (Wibowo et al. 2011). The questionnaire was firstly tested for its validity and reliability before being used for field survey. There were 22 questions asked in the questionnaire consisting of four groups, including the profile of respondents (Q1-Q9), matters relating to paddy fields that were cultivated (Q10-Q12), respondents' understanding of crop failure (Q13-Q15), and WTP the RFI premiums (Q16-Q22) (Fig. 1). The survey was carried out by face to face interview (direct interview with respondent) with the aim of maximizing the respondent's response rate.

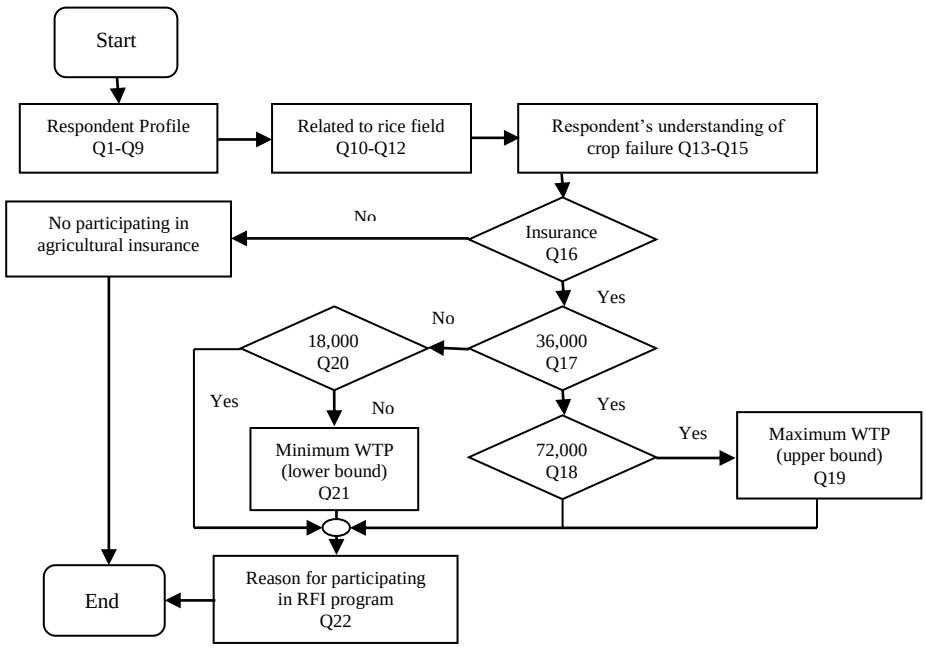

Fig. 1. Question flow of questionnaire for CVM survey

The population targeted in this survey was the farmers as the *subak* members who have participated in the RFI program in the Province of Bali. Socialization of the RFI program was firstly conducted by Jasindo to the targeted group of farmers before it would be implemented to their rice farm. Sampling was conducted non-proportionally on a probability sampling framework. Firstly, the sampling uses a clustered multi-stage technique in which a *subak* was determined for each regency or city with the widest coverage area of insured land. Then, based on secondary data (Jasindo, 2017) and non-proportional random sampling technique, 30 representative farmers whose participated in phase-4 (April 2017 to September 2017) of the RFI program were chosen from each selected subak to be interviewed. All selected *subaks* were new participants for the 4th phase of the RFI program. The expected sample size for this CVM survey were 270 persons (Table 2).

Table 2. Selected *subak* and the number of sample who participating in the 4th phase of RFI program

No.	Regency/ City	Name of Subak	Coverage Are of Insured Land (Ha)*	Number RFI Participants (person)*	Number of Sample (person)
1	Denpasar	Kerdung	192.00	203	30
2	Gianyar	Pejajah Culeg II	24.77	50	30
3	Tabanan	Penatahan	141.27	347	30
4	Buleleng	Lawas Ambengan	61.50	148	30
5	Jembrana	Yeh Embang	183.99	283	30
6	Karangasem	Selat	120.00	393	30
7	Klungkung	Dawan	138.00	311	30
8	Badung	Sangeh	150.00	486	30
9	Bangli	Bambang Let	40.75	124	30
		Total Sample			270

Source: * Jasindo, 2017

Data analysis. The data collected through CVM survey were transformed into output in the form of an estimated WTP of farmers for paying the RFI premiums. The estimation of the WTP was carried out using the software of STATA 11.0 version with standard stages including variable definitions, codification, tabulation, summarizing, and computing (Wibowo et al. 2011). Furthermore, to understand the influence of socio-economic variables on the farmers' decision to follow RFI program, was classified by using the Chi-squared Automatic Interaction Detector (CHAID) method (Kass, 1980) as a growing technique commonly applied in the marketing field. In principle, this technique partitions the data into both mutually exclusive subset and mutually exhaustive which best describes the dependent variable. Single-bounded calculations are facilitated by the SINGLEB module (Lopez-Feldman, 2011) which is based on the Cameron and James (1987) model while the double-bounded choice model calculation is facilitated by the DOUBLEB module (Lopez-Feldman 2010) based on the Hanemann et al. (1991) with the normality assumption for WTP (Wibowo et al. 2011). As a comparison and to determine confidence intervals, the WTPCIKR module was developed by Jeanty (2007). In addition to estimating WTP, bid function parameters need to be interpreted to evaluate whether the relationship occurs according to expectations and whether the parameter coefficients are statistically significant (Wibowo et al. 2011).

RESULTS AND DISCUSSION

Socio-economic characteristics of farmers. The socio-economic characteristics of the respondents included male or female status (GENDER), farmer's age (AGE), mastery status by farmers (STATUS), number of family members (NU-FAM), farmer's education level (EDU), rice farm size (SIZE), years of rice farming experience (Y-RFEX), the location of paddy fields to irrigation water source (LOC), cropping pattern (CROP), rice farm productivity (PROD), and rice farm income (INCOME) (Table 3). Based on 270 representative participants of the RFI program, 255 persons (94%) are male and 15 persons (6%) are female with an average farmer's age of 56 years old and with an average years of rice farming experience for 21 years. The mastery status by farmers were mostly cultivator or worker (49%), followed by owner-cultivator or owner-worker (30%), and owner (21%). The average number of family members was three persons. The education level of farmers was dominated by graduating from elementary school (38%) followed by graduating from high school (20%), graduating from junior high school (19%), not graduating from elementary school (17%), and graduating from higher education (6%). The average size of rice farm was about 0.49 ha which were mainly (43%) located in middlestream of the irrigation network in the Balinese *subak* system followed by upstream paddy fields (33%) and the downstream paddy fields (24%).

Table 3. The socio-economic profile of the respondents

No.	Socioeconomic Characteristics					
1	GENDER (%)	Male (94)	Female (6)			
2	AGE (year)	Maximum (72)	Minimum (30)	Average (56)		
3	STATUS (%)	Owner (21)	Owner-Cultivator (30)	Cultivator (49)		
4	NU-FAM (Person)	Maximum (7)	Minimum (0)	Average (3)		
5	EDU (%)	Non-graduate Elementary School (17)	Graduate Elementary School (38)	Graduated Junior High School (19)	Graduated from High School (20)	Graduated from Higher Education (6)
6	SIZE (0.01 ha)	Maximum (500)	Minimum (6)	Average (49)		
7	Y-RFEX (year)	Maximum (55)	Minimum (1)	Average (21)		
8	LOC (%)	Upstream (33)	Middlestream (43)	Downstream (24)		
9	CROP	R-R-R	R-R-SC	R-R-F	R-SC-R	R-F-R

No.	Socioeconomic Characteristics					
	(%) *	(45)	(15)	(7)	(23)	(10)
10	PROD	Maximum	Minimum	Average		
	(Kg/0.01 ha)	(100)	(24)	(56)		
11	INCOME	Maximum	Minimum	Average		
	(IDR)	(38,666,670)	(2,040,000)	(18,405,680)		

Notes: * R-R-R = rice–rice–rice; R-R-SC = rice–rice–2nd crops; R-R-F = rice–rice–fallow; R-SC-R = rice–2nd crops–rice; and R-F-R = rice–fallow–rice cropping patterns

The effectiveness of irrigation water distribution into terraced paddy fields especially in the balineses *subak* system is strongly depended on the location of paddy fields that categorized into three locations: firstly, the nearest paddy fields to the water source location called the upstream paddy fields; secondly, at the center location called the middlestream paddy fields; and at the distant location called the downstream paddy fields. These category is common in paddy field irrigation management. The cropping pattern applied by farmers in their rice fields was dominated by rice–rice–rice cropping patterns (45%), followed by cropping patterns of rice–2nd crops–rice (23%), rice–rice–2nd crops (15%), rice–fallow–rice (10%), and rice–rice–fallow (7%). The average rice productivity of respondents was 5.6 tons harvested dry paddy with an average income of rice farming as much as IDR18,405,680 for each hectare of paddy fields in one planting season.

Willingness of farmers to pay the RFI premiums. The survey was conducted for one week from 11 to 18 September 2018 involving nine surveyors. Each surveyor has been provided with knowledge related to the implementation of the CVM survey. The target locations for the survey were the nine selected *subaks* as stated in Table 2. The number of respondents successfully interviewed in accordance with the target set were 270 persons. Based on the number, 245 (91%) respondents gave a positive response to the RFI program, while the remaining 25 respondents (9%) gave a zero-response. Figure 2 shows a grouping of survey results in the willingness of farmers to pay the RFI premiums in Bali Province.

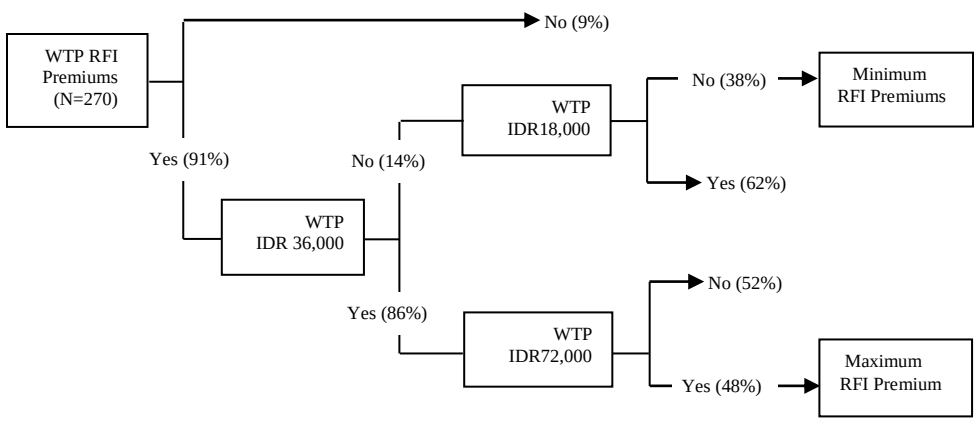

Fig. 2. Categorizing the WTP of farmers for paying the RFI premiums

Based on the 245 respondents who have WTP for the RFI premiums, about 211 (86%) respondents stated willingness to pay for RFI premiums of IDR36,000 per hectare in one planting season. This condition is opposite of a study results by Ambarwati et al. (2018) who concluded that only 15% of farmers who participated in phase-1 of RFI program in Bali Province were willingness to pay for RFI premiums of Rp36,000. So, the farmer WTP for RFI premiums in phase-4 was better than phase-1. When the bid value was increased to IDR72,000 per hectare per season, about 102

respondents (48%) still stated that they were willingness to pay while the rest were not. The follow-up questions for those who were still willingness to pay to be asked questions to find out the maximum premiums they were willingness to pay with the results of the survey show that maximum value ranges from IDR108,000 to IDR180,000 per hectare in one planting season. For the respondents who were willingness to pay the maximum premiums, there were 20 respondents (16.95%) willingness to pay as much as IDR180,000 per hectare in one planting season. For those who would not like to pay the premiums of IDR36,000 per hectare per season, bid was reduced to IDR18,000 per hectare and for this bid, 21 respondents (62%) expressed their agreement, and the rest provided zero response. For the respondents who were not willingness to pay the premiums of IDR18,000 per hectare were given further questions regarding the minimum premiums they were willingness to pay. Apparently, the average minimum premiums of their willingness to pay was IDR10,385 per hectare per season with a range between IDR5,000 to IDR15,000.

Decision tree analysis of the WTP of farmers for paying the RFI premiums. Based on the 11 identified socio-economic variables, the best predictor to explain farmers' decision to be willing to pay the RFI premiums includes the cropping pattern (CROP), mastery status of farmers (STATUS), male or female status (GENDER), and the rice farm productivity (PROD) (Fig. 3)

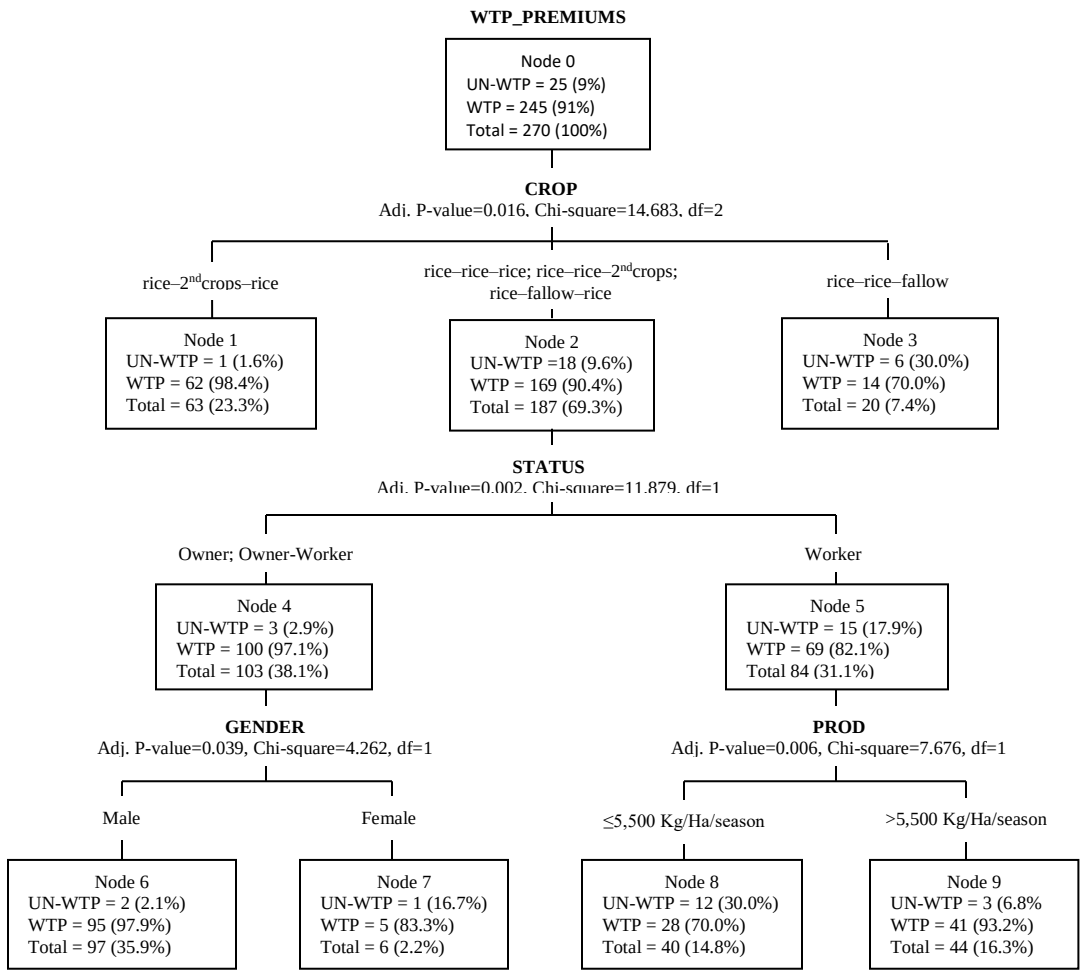

Fig. 3. Dendrogram analysis of the WTP

Estimating the WTP of farmers. The amount of WTP was shown by the coefficient of Beta, which was IDR60,039.35 per hectare in one planting season with a lower and upper limit of IDR53,756.97 and IDR66,321.73 respectively at 95% of confidence intervals (Table 4).

Table 4. WTP estimation without socio-economic variables by DOUBLEB module

	Coef.	Std. Err.	z	P>z	[95% Conf. Interval]	
Beta _cons	60039.35	3205.355	18.73	0.000	53756.97	66321.73
Sigma _cons	46703.04	3790.157	12.32	0.000	39274.46	54131.61

The regression analysis resulted in Wald$\chi 2$ = 78.11 with p = 0,000, means the model is statistically significant. The socio-economic variables that have a significant effect were mastery status of farmers (STATUS), farmer's education level (EDU), and rice farm productivity (PROD) with p = 0.000. A farmer with mastery status as owner of insured paddy fields has powerful in decision making to join the RFI program. The higher level of farmer education indicated the bigger their WTP for the RFI premiums. The smaller rice farm productivity effected by droughts condition, the pests or diseases attacks indicated the bigger WTP of farmer to pay the RFI premiums (Table 5).

Table 5. Double bounded regression coefficients calculated by DOUBLEB module.

	Coef.	**Std. Err.**	**z**	**P>z**	**[95% Conf. Interval]**	
Beta						
GENDER	11912.23	12173.13	0.98	0.328	-11946.65	35771.12
AGE	176.7093	310.4676	0.57	0.569	-431.796	785.2146
STATUS	-15243.5	3726.575	-4.09	0.000	-22547.47	-7939.565
NU-FAM	-1175.7	1804.429	-0.65	0.515	-4712.312	2360.92
EDU	9968.188	2598.444	3.84	0.000	4875.331	15061.04
SIZE	86.61045	224.3187	0.39	0.699	-353.0462	526.2671
Y-RFEX	142.8134	200.7201	0.71	0.477	-250.5907	536.2175
LOC	2141.557	3683.483	0.58	0.561	-5077.936	9361.051
CROP	-1052.47	2092.141	-0.5	0.615	-5152.993	3048.051
PROD	-1663.6	360.0063	-4.62	0.000	-2369.198	-957.9993
INCOME	0.000376	0.001085	0.35	0.729	-0.0017501	0.002503
Cons	133462.6	35117.47	3.8	0.000	64633.61	202291.6
Sigma __Cons	37267.22	3017.667	12.35	0.000	31352.7	43181.74

Notes: GENDER = male or female status, AGE = farmer's age, STATUS = mastery status by farmers, NU-FAM = number of family members, EDU = farmer's education level, SIZE = rice farm size, Y-RFEX = years of rice farming experience, LOC = the location of paddy fields to irrigation water source, CROP = cropping pattern, PROD = rice farm productivity, and INCOME = rice farm income.

The socio-economic variables affect the increase in the estimated value of WTP by as much as IDR1,242.22 from IDR60,039.35 to IDR61. 281,57 (Table 6).

Table 6. Estimating WTP with socio-economic variables by DOUBLEB module

	Coef.	**Std. Err.**	**z**	**P>z**	**[95% Conf. Interval]**	
WTP	61281.57	2791.167	21.96	0.000	55810.99	66752.16

CONCLUSION AND RECOMMENDATIONS

The socio-economic variables such as mastery status of farmers, farmer's education level, and rice farm productivity have affected significantly the WTP of farmers. The socio-economic variables that influence farmers' decision to follow the RFI program include cropping patterns, mastery status of farmers, gender and rice farm productivity. The RFI premiums as much as IDR60,000 per hectare could be charged to insured while governments' subsidy could be reduced to be IDR120,000 per hectare in one planting season. The farmer willingness to pay is equivalent to 1.0% of the RFI coverage value. This is still much smaller than the farmer WTP in Selangor, Malaysia that is equivalent to 7.6% of coverage value of crop insurance (Abdullah et al. 2014). Based on secondary data (https://www.liputan6.com/), the realization of RFI program in Indonesia in 2017 reached 997,961 ha (99.8%) of the RFI target and loss claims were recorded at 25,028 ha. So, with a similar budget of government expenditure, a reduction in the burden of government subsidies, 16.67% on the payment of RFI premiums per hectare, can be diverted to increase the area of insured paddy fields by as much as 20%. This study conducted only in Bali Province is one of the study limitations, so this necessitates a wider, similar analysis for policy improvement of RFI implementation by the government at the national level.

ACKNOWLEDGEMENT

The authors express gratitude to the Chairperson of Research and Community Services Institute of Udayana University for financial support through the Institutional Research Grant 2018 Budget Year Number: 4-718/UN14.4.A/LT/2018 for this research implementation. Thank you also to Prof. Dr. Ing. Habil Andreas Wibowo from RIHS-Agency for Research and Development, Ministry of Public Works and Housing, Bandung, Indonesia for his contribution in guiding authors to estimate WTP using software of STATA 11.0 version. We also express our gratitude to Chairpersons of Jasindo and the Financial Services Authority Regional O ffice 8 of Bali and Nusa Tenggara for their contribution in supplying secondary data related to the implementation of RFI program in Bali Province. A big thank you also goes to all enumerators who have recorded primary data and all respondents who were interviewed through the CVM survey in this study.

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