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Full Paper

Adoption of Rice Crop Insurance in the Philippines: Lessons from Farmer's Experience

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Crop insurance is one of the mitigating mechanisms that farmers can use to cope with reduced rice production and income due to typhoons, floods, landslides, droughts, and pests and diseases. However, few Filipino rice farmers insure their crops. This study assessed the rice farmer's perception and awareness level about crop insurance. Determinants of crop insurance adoption were identified using probit estimation. One out of 10 farmers had enrolled in rice crop insurance at least once from 2007 to 2011. The major reasons for enrollment are attractive remuneration policy and facilitating access to credit. The key reasons for non-enrollment are added financial burden and lack of understanding about insurance. Probit estimation revealed that the area planted to rice, farmer's sex, access to remittances and capital, and participation in seminars related to rice farming are significant and positively affect the probability of adopting insurance.

Keywords: adoption, crop insurance, Philippines, rice

INTRODUCTION

Rice farming is one of the most risky agricultural endeavors particularly in a calamity–stricken country like Philippines. Based on the World Risk Index, the Philippines ranked third as the most disaster–prone countries in the world (ADW 2011). For the period 1948-2006, an average of 19-20 tropical cyclones occurred annually within the Philippine Area of Responsibility, of which 8-9 have made landfall and wreak havoc across the country (PAGASA 2013). Aside from typhoons, Philippines is also exposed to other natural hazards such as floods, landslides, and droughts (Yusuf and Francisco 2009). The incidence of such hazards is expected to be more frequent and intense given the projections of climate change (IPCC 2007). Unfortunately, these can significantly reduce rice production in the Philippines.

From 2001 to 2011, flashfloods and typhoons have contributed to a cumulative damage of around 2.9 Mt of paddy rice amounting to more than PhP 37.1 B. Another leading cause of crop damage particularly during occurrence of El Niño phenomenon is drought, which accounted for almost 1 Mt of rice loss worth PhP 12.3 B in the same decade. Aside from natural disasters, biotic stresses, such as pests and diseases, are also significant causes of rice production loss in the country albeit at smaller magnitude. More than 82,000 t of rice was lost due to incidence of pests and diseases during the same period (PhilRice-BAS 2013).

The enumerated risks in rice production can shift farmer's production from a year of bumper harvest to one of crop failure. Unfortunately, for most smallholders like rice farmers in the Philippines, crop failure can lead to chronic poverty as this can force them to dispose productive assets. Farmers may need to sell or mortgage their land, farm animal or machine just to survive when faced by such income shocks. Some less fortunate farmers may completely stop from rice farming due to loss of working capital.

The potential of crop failure can also induce farmers to invest less in risky but profitable technology, leading to an overall underinvestment in production-increasing inputs and misallocation of resources (Huijsman 1986). While other risk-mitigating strategies could be available to farmers, crop insurance is one mechanism that can help farmers manage risks associated with rice farming. Crop insurance gives farmers the right to claim a fixed compensation when faced with crop loss (Suresh Kumar et al. 2011). With a guaranteed payment in the event of crop failure, farmers can make optimal decisions in adopting new technologies and investing in inputs that can increase their production and income. The assured compensation can also insulate farming households from consumption shocks brought about by severe decline in production and income (Gine et al. 2008).

Crop insurance program in the Philippines has been available since the 1980's through the Philippine Crop Insurance Corporation (PCIC). Despite its existence for more than 3 decades, this risk–mitigating mechanism has not been widely adopted by rice farmers. From 1981 to 2012, PCIC was only able to insure a total of 3.4 M rice farmers. Hence, it is important to understand farmer's view about crop insurance and the factors that could lead them to its adoption. It is in this respect that this study hopes to contribute in

generating information that could be used as basis in fine tuning existing crop insurance services in the country by determining the risk-mitigating behavior of Filipino rice farmers in general and their utilization of crop insurance in particular. This paper discuss the general coverage of rice insurance and the types of insurance policies offered by the Philippine Crop Insurance Company. The perception and level of awareness of rice farmers about crop insurance were also assessed. Similarly, the determinants of crop insurance adoption were identified. Through this, the study generated policy recommendations that can improve the provision of crop insurance services in the Philippines.

Crop Insurance in the Philippines

Created by the Presidential Decree (PD) 1467 and amended by PD 1733 (1980) and Republic Act 8175 in 1995, the Philippine Crop Insurance Corporation is the sole government entity that manages and implements the agricultural insurance program in the country. It aims to help farmers achieve a more stabilized farm income and reverse the —risk-aversell nature of farmers (PCIC 2014). The PCIC began operating nationwide in May 1981 initially covering the rice crop only. In the following year, corn was included as part of the covered commodity. At present, PCIC also provides other insurance packages for high-value commercial crops, livestock, and non-crop agricultural assets (Bangsal and Mamhot 2012). Premium subsidy in the Philippines ranges 48-63% under the multi-peril crop insurance or MPCI (PCIC 2014). On other hand, the premium share of government under the natural disaster cover ranges 46-62%.

The Rice Insurance Program

Crop insurance for rice is one of the top traditional insurance lines offered by PCIC. This insurance program covers the cost of production inputs per farm plan and budget with an additional amount of cover (at the option of the farmer). The coverage is up to a maximum of 20% of the value of the expected yield, subject to the prescribed cover ceilings. The PCIC offers two types of insurance. One is the multi-risk cover that has a comprehensive coverage against crop loss caused by natural disasters, and infestation of pests and diseases. The second type limits the coverage against crop loss caused by natural disasters only. All accredited rice varieties by the National Seed Industry Council (NSIC) are considered as insurable variety.

Throughout the 31 years of PCIC's service, about 3.4 M farmers have benefitted from the rice insurance program covering a total sum of about PhP 39.5 B (Table 1). From 1981 to 2012, the total premiums received were about PhP 3.99 B and generally has an increasing trend throughout the period considered. For the period 1983 to 1990, indemnity claims exceeded the premiums received with the highest difference in 1989 of about PhP 91 M (Figure 1). On other hand, from 2002 to 2010, rice crop insurance program gained higher premium collection over the damage claims. PCIC received the highest premium collection

Table 1. Number of insured rice farmers, area covered, amount covered and premium paid, Philippines, 1981-2012

Year	Borrowing Farmer	Self-financed Farmer	Total Insured Farmers	Area Covered (ha)	Amount Covered (M PhP)	Premium (M PhP)
1981	106,807	1,721	108,528	199,333	265	33
1982	145,015	25,958	170,973	303,947	410	35
1983	129,545	50,590	180,135	308,743	446	30
1984	75,803	54,485	130,288	205,486	462	31
1985	120,329	39,474	159,803	279,557	865	63
1986	71,940	54,119	126,059	225,965	773	54
1987	47,897	63,879	111,776	191,446	666	44
1988	53,173	96,628	149,801	242,335	865	71
1989	94,278	125,443	219,721	356,345	1,296	96
1990	173,104	40,865	213,969	350,931	1,616	116
1991	291,121	10,833	301,954	494,538	2,839	250
1992	217,671	7,032	224,703	355,232	2,217	232
1993	170,847	6,665	177,512	288,057	1,883	190
1994	120,693	11,556	132,249	222,859	1,497	151
1995	76,749	4,565	81,314	139,252	983	90
1996	93,258	3,746	97,004	156,671	1,383	103
1997	60,241	3,787	64,028	110,583	1,093	80
1998	42,650	5,984	48,634	86,445	878	78
1999	46,391	10,011	56,402	95,398	995	72
2000	38,822	6,519	45,341	75,481	846	70
2001	27,838	2,563	30,401	52,900	581	58
2002	24,509	4,853	29,362	50,212	551	43
2003	25,692	5,301	30,993	52,502	591	65
2004	27,348	7,707	35,055	58,677	670	75
2005	28,712	8,711	37,423	56,118	689	78
2006	26,854	5,500	32,354	53,312	689	80
2007	27,039	6,403	33,442	61,727	828	90
2008	39,406	16,451	55,857	88,209	1,517	169
2009	58,287	32,287	90,574	141,325	2,924	313
2010	62,995	25,848	88,843	142,403	2,998	317
2011	75,050	34,108	109,158	165,286	3,461	373
2012	41,382	6,466	47,848	76,428	1,729	439
All Years	**2,641,446**	**780,058**	**3,421,504**	**5,687,704**	**39,507**	**3,990**

M PhP – in million Pesos
Source: PCIC

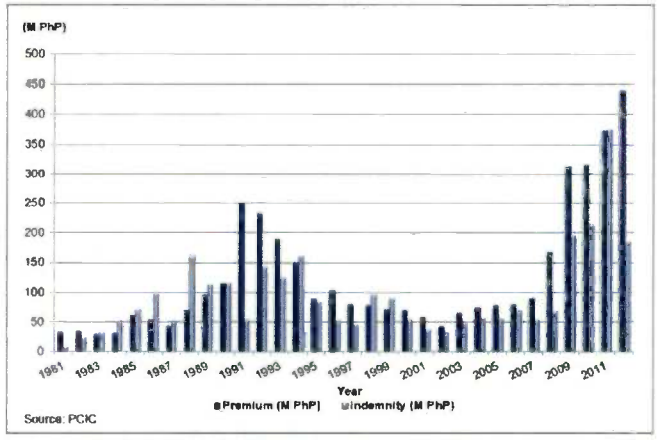

Figure 1. Comparison between premiums and indemnity under rice crop insurance (M PhP), Philippines, 1981-2012

in 2012 which amounted to PhP 439 M from about 47,848 farmers covering an area of about 76,428 ha.

In terms of indemnity payments, the rice crop insurance was able to provide a cumulative sum of about PhP 3.03 B to 990,668 farmers from 1981 to

2012 (Table 2). The highest percentage of indemnity claimants was in 2012, with approximately 58% of the total farmers insured during that period. However, the peak indemnity claims paid was in 2011 which amounted to PhP 375 M, rewarded to about 44% of the total insured farmers.

From 1981 to 2012, the number of rice insurance policies written has a similar decreasing trend with that of the insured area covered for rice with its peak in 1991 (Figure 2). According to PCIC, the decline in the number of insured farmers was due to the contraction of the self-financed market. Table 3 shows that majority of the insured farmers came from borrowing farmers which constituted about 77% of the total insurance policies written from 1981 to 2012.

On average, about 8-9 tropical cyclones have made landfall and caused major damage in the Philippines annually. This was also the major cause of rice production losses as reflected in the indemnities paid by PCIC which amounted to PhP 1.7 B from 1981 to 2012 (Table 3). Figure 4 also shows that the highest indemnity paid due to typhoons/floods was in 2011 with PhP 281 M. It can be recalled that in 2011 alone, the country was hit by 19 tropical cyclones, including the most destructive storm Sendong (International code: Washi) (PAGASA 2013). From 1981 to 2012, pest problems ranked second among the causes of rice production losses, which constituted 21.4% to the total indemnities paid to farmers (Table 3).

Weather-based Index Insurance

Crop insurance offered by the PCIC are the traditional types or those based on crop yields. One of the disadvantages of the traditional types is the high transaction costs incurred during the conduct of individual field inspections to assess crop damage. In addition, this type of insurance has not been successful in addressing the extreme risks brought about by variability in weather conditions. Due to climate change, unpredictability in weather events has increasingly caused risks in crop production. However, most of these hazards are not directly addressed by the traditional insurance especially in the developing countries. Hence, the Weather-Based Index Insurance (WBII) was developed as an alternative to the conventional insurance. Currently, the WBII is being piloted separately by the PCIC and MicroEnsure in collaboration with other local insurance providers.

Originating from the international weather derivative market, WBII is designed against the defined adverse effect of climatic condition in a certain farm area rather than performing a costly and time-consuming evaluation of each farm's crop losses (World Bank 2011). The WBII is provided based on measurement of an objective, and a given parameter that is considered to be correlated with the actual crop loss experienced by a farmer (GFDRR- World Bank 2011). Indemnities are given to affected farmers whenever the identified parameters, such as amount of rainfall (either too low or so high) or drought, have breached a predetermined threshold regardless of its effect on yield. Thus,

Table 2. Insurance coverage and claims paid for rice, Philippines, 1981-2012

Year	Insurance Coverage		Claims Paid	
	Number of Farmers/ Policies Written	Sum Insured (M PhP)	Number of Farmers Paid	Indemnity (M PhP)
1981	108,528	265	7,627	7
1982	170,973	410	25,759	25
1983	180,135	446	42,500	33
1984	130,288	462	51,372	53
1985	159,803	865	46,102	71
1986	126,059	773	46,486	98
1987	111,776	666	35,708	53
1988	149,801	865	74,560	162
1989	219,721	1,296	58,382	113
1990	213,969	1,616	78,291	116
1991	301,954	2,839	35,009	53
1992	224,703	2,217	60,509	143
1993	177,512	1,883	49,086	124
1994	132,249	1,497	57,993	162
1995	81,314	983	29,352	84
1996	97,004	1,383	16,895	53
1997	64,028	1,093	10,647	46
1998	48,634	878	16,151	96
1999	56,402	995	18,902	90
2000	45,341	846	12,503	54
2001	30,401	581	9,510	37
2002	29,362	551	7,625	32
2003	30,993	591	10,547	48
2004	35,055	670	12,254	56
2005	37,423	689	12,399	57
2006	32,354	689	14,599	69
2007	33,442	828	11,443	54
2008	55,857	1,517	12,304	68
2009	90,574	2,924	24,817	196
2010	88,843	2,998	25,782	213
2011	109,158	3,461	47,945	375
2012	47,848	1,729	27,668	186
All Years	**3,421,504**	**39,507**	**990,727**	**3,029**

Source: PCIC

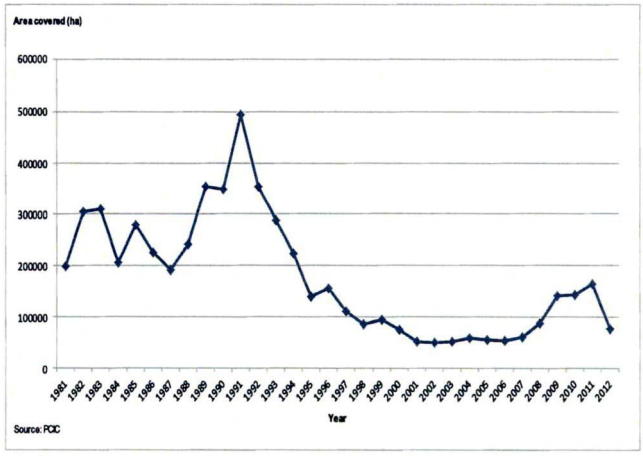

Figure 2. Insured rice area, Philippines, 1981-2012

pay-outs are provided without the need to conduct on-site inspection, making WBII less expensive to administer as compared to conventional insurance (Hazell et al. 2010). It also solves the problems of moral hazard and adverse selection since the payment of indemnities is based on accredited weather gauging stations regardless of the farmers' actions (Lansigan 2013). The WBII has some weaknesses however, one of which is its non-coverage of non-weather related risks like pests and diseases. Considering the high risk

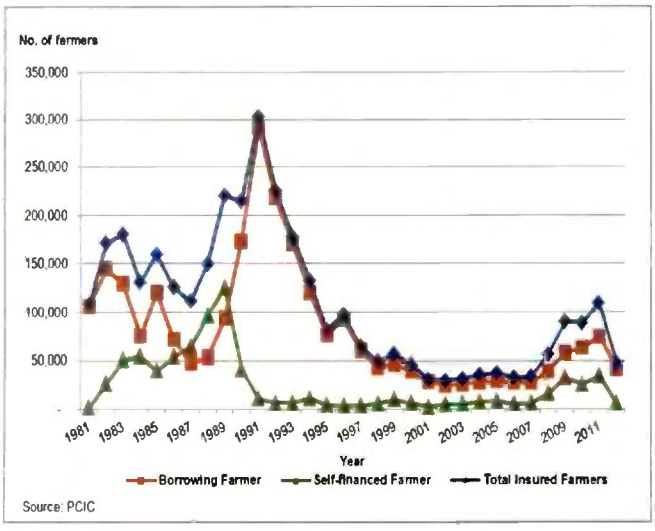

Figure 3. Number of insured rice farmers, Philippines, 1981-2012

Table 3. Causes of production losses for rice as reflected in indemnities paid (M PhP), Philippines, 1981-2012

Year	Typhoon/ Flood	Drought	Pests	Diseases	Others	Total
1981	4.17	0.94	0.82	1.57	0.00	7.49
1982	13.72	3.26	2.62	5.12	0.00	24.72
1983	11.03	14.36	3.84	3.98	0.00	33.21
1984	19.27	5.39	17.16	11.27	0.00	53.09
1985	43.44	3.64	14.18	9.21	0.96	71.42
1986	69.17	4.73	13.20	9.26	1.78	98.14
1987	22.89	12.34	9.54	7.19	1.24	53.19
1988	88.14	25.65	30.07	15.15	3.14	162.15
1989	78.32	4.39	16.32	12.38	1.13	112.52
1990	63.75	20.15	17.42	12.14	2.14	115.60
1991	26.41	9.51	8.20	4.69	4.54	53.35
1992	58.02	57.13	15.66	7.08	5.12	143.00
1993	66.19	19.13	24.95	10.13	4.00	124.39
1994	113.02	7.35	26.04	13.12	2.59	162.12
1995	82.05	0.76	0.00	0.85	0.00	83.66
1996	47.01	4.73	0.27	1.17	0.00	53.18
1997	28.30	9.84	0.92	7.03	0.01	46.10
1998	59.42	27.10	4.84	4.98	0.01	96.35
1999	49.02	2.21	16.52	22.71	0.00	90.47
2000	19.29	0.78	20.91	13.03	0.40	54.42
2001	12.18	0.73	15.87	8.16	0.00	36.95
2002	6.23	3.00	13.30	9.90	0.00	32.43
2003	11.51	6.08	19.78	10.36	0.00	47.73
2004	17.37	4.28	22.32	11.70	0.00	55.67
2005	12.51	6.88	22.67	14.72	0.00	56.78
2006	23.67	1.50	27.59	14.76	0.00	67.51
2007	15.03	4.24	21.60	13.43	0.00	54.31
2008	22.63	1.23	26.73	16.98	0.00	67.57
2009	132.42	2.50	38.39	22.56	0.00	195.87
2010	80.63	42.47	62.26	27.72	0.00	213.08
2011	281.11	2.73	70.18	21.39	0.00	375.41
2012	95.22	9.16	63.84	17.63	0.00	185.86
All years	1,673.13	318.19	648.01	361.35	27.03	3,027.71

posed by pest and disease infestation particularly in rice, many farmers have shown hesitancy to enrol in such program.

METHODOLOGY

Theoretical Framework

Dichotomous choice model is usually employed in analyzing farmer's decision to adopt a technology or practice. As such, the choice between adopters and non-adopters are assumed to be influenced by some set of characteristics. The process of farmer's choice, whether to insure or not insure their crop, is modeled using the expected utility framework (Valendia et al. 2009; Singerman et al. 2010; Kolady and Lesser 2006. Autor (2004) explained that under expected utility theory, consumer choices may be selected among risky bundles.

The Von Neuman-Morgenstern (VNM) expected utility function is assumed to model the utility of the farmers and that the *i*th farmer seek to maximize this such that if expected utility with insurance $E(U_{Ai})$ is greater or equal to the expected utility without insurance $E(U_{Ni})$, then the *i*th farmer would prefer $E(U_{Ai})$ to $E(U_{Ni})$ or that they would be indifferent.

Since the expected utility of farmers cannot be directly observed and measured, observable measures can be defined as factors that influence the distribution, thus can be used as a vector of explanatory variables (farmers' characteristics and fixed inputs), *X*, of a choice made by an individual farmer *i*, and a random disturbance term (Thou et al. 2010; and Coble et al. 1996).

Following the discussion of Coble and co-workers (1996) on discrete choice analysis, in order to limit the non-linearity in the likelihood function, it is assumed that $E(U_{Ai})$ and $E(U_{Ni})$ may be mathematically expressed as follows:

$$E(U_{Ni}) = \beta'_N X_i + \varepsilon_{Ni} \quad (1)$$

$$E(U_{Ai}) = \beta'_A X_i + \varepsilon_{Ai}. \quad (2)$$

In addition, the difference in expected utility from equations (1) and (2) may then be written as:

$$\begin{aligned} E(U_{Ai}) - E(U_{Ni}) &= (\beta'_A X_i + \varepsilon_{Ai}) - (\beta'_N X_i + \varepsilon_{Ni}) \\ &= (\beta'_A - \beta'_N) X_i + (\varepsilon_{Ai} - \varepsilon_{Ni}) \\ E(U_{Ji}) &= \beta' X_i + \delta_i \end{aligned} \quad (3)$$

where: $E(U_{Ji}) = E(U_{Ai}) - E(U_{Ni})$, $\beta' = (\beta'_A - \beta'_N)$, and $\delta_i = (\varepsilon_{Ai} - \varepsilon_{Ni})$. Farmers will decide to adopt insurance $E(U_{Ai}) - E(U_{Ni}) > 0$, and farmer will choose not to adopt insurance if $E(U_{Ai}) - E(U_{Ni}) < 0$.

Data Gathered

Data on rice farmers' awareness, perception, and adoption of crop insurance were gathered from three major rice-producing provinces in the country namely: Nueva Ecija, Iloilo, and Leyte. In 2013, Nueva Ecija was the top rice producing province with 1.7 M t of rice produced. Iloilo ranked 5th with 0.8 M t while Leyte

landed in 9th rank with about 0.5 M t of rice production (BAS 2014). Prior information also indicates that PCIC has an active crop insurance program in the selected provinces.

The survey was conducted as a ride-on to the Rice-Based Farm Household Survey (RBFHS) led by the Philippine Rice Research Institute (PhilRice) in collaboration with the Bureau of Agricultural Statistics (BAS). Primary data were collected through a cross-section survey using a modified PhilRice-BAS questionnaire instrument during the 2012 dry season. A total of 353 farmers were interviewed consisting of 151 farmers from Nueva Ecija, 116 farmers from Iloilo, and 86 rice farmers in the province of Leyte.

Characteristics of the respondents, awareness and adoption of crop insurance, and hazards leading to yield loss in rice farming were obtained. Different strategies of managing crop failure were also gathered using the Likert scale method.

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The Probit Model

A probit model was estimated in order to determine the factors affecting rice farmers' adoption of crop insurance. The probit model is one of the convenient functional forms used for models with a binary response variable (Johnston and Dinardo 1997), and is widely used in adoption studies (Varadan and Kumar 2012; Etoundi and Dia 2008; Rahman 2008; and Kassie et al. 2012).

The probit model assumes that some variable ***y*** takes on the values of 0 and 1. However, there is a latent, unobserved continuous variable y* that determines the value of y such that:

$$y_i^* = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \ldots\ldots + \beta_j X_{ji} + \mu_i \qquad (4)$$

and that:

$$y_i = \begin{cases} 1 \; if \; y_i^* > 0 \\ 0 \; otherwise \end{cases} \qquad (5)$$

where: X_{ji} is the set of characteristics that determine the farmer's propensity to adopt, and β_j is the set of parameters. It is also assumed that μ represents a random disturbance term.

Taking on the assumption that the model uses the normal cumulative distribution function (CDF) which makes the predicted value lie between 0 and 1, the probit model can be mathematically written as:

$$prob(y_i = 1) = \Phi(Z) = \int_{-\infty}^{X_i\beta} \frac{1}{\sqrt{2\pi}} e\left(\frac{-z^2}{2}\right) dz \qquad (6)$$

where: $prob(y_i = 1)$ is the conditional probability of adaption, and the standard normal transformation $\Phi(\cdot)$ is the one that constrains the probability to lie between 0 and 1, or

$$\lim_{z \to +\infty} \Phi(z) = 1 \quad \text{and} \quad \lim_{z \to -\infty} \Phi(z) = 0.$$

Probit model predicts the probability of adoption. The estimated coefficients can be used to calculate the change in probability of adoption as a result of unit change of one factor conditional on holding other factors constant. This can be expressed in the following equation:

$$\hat{P}(y_i = 1) = f(\hat{\beta}_0 + \hat{\beta}_1 X_1 + \hat{\beta}_2 X_2 + \ldots\ldots + \hat{\beta}_j X_j) \qquad (7)$$

Empirical Model

The adoption model estimated in this study is as follows:

$$A = \lambda_0 + \lambda_1 FARMSIZE + \lambda_2 FARMEX + \lambda_3 GENDER + \lambda_4 EDUC + \lambda_5 REMACC + \lambda_6 BORROWER + \lambda_7 TENSTAT + \lambda_8 SEMINAR + \lambda_9 PROVNE + \lambda_{10} PROVILO + \lambda_{11} MEMBER + \mu$$

in which:

A	is dummy variable for adopters of agricultural insurance program (1 if adopter, 0 otherwise)
FARMSIZE	is the land area planted by the farmer in ha
FARMEX	is the length of farming experience in years
GENDER	is dummy variable for gender (1 if male, 0 otherwise)
EDUC	is dummy variable for the level of education reached by the farmer (1 if college level is reached, 0 otherwise)
REMACC	is dummy variable for the access to remittances either from OFW or local remittances (1 if received remittance, 0 otherwise)
BORROWER	is dummy variable for access to capital (1 if borrowed capital, 0 otherwise)
TENSTAT	is dummy variable for tenure status (1 if the land was owned, 0 otherwise)
SEMINAR	is dummy variable for farmer's participation in seminar or training (1 if the farmer has attended, 0 otherwise)
PROVNE	is dummy variable for Nueva Ecija province (1 if Nueva Ecija, 0 otherwise)
PROVILO	is dummy variable for Iloilo province (1 if Iloilo, 0 otherwise)
MEMBER	is dummy variable for membership in farmers' association (1 if member, 0 otherwise)

The average marginal effects of each explanatory variable to the probability of adoption were calculated by taking the derivative of the estimated probability distribution functions with respect to corresponding variable, holding other factors constant.

RESULTS AND DISCUSSION

Characteristics of Respondents

The characteristics of the respondents in the selected provinces are summarized in Table 4. The sample farmers have a mean age of 56, of which more than 80% are male. On average, these farmers have reached secondary level of education. They have also

been into rice farming for an average of 30 yr.

The area planted to rice is larger in Nueva Ecija with an average of 1.24 ha compared to Iloilo and Leyte that have 0.90 and 0.83 ha, respectively. Majority of respondents in Nueva Ecija (64%) owned their cultivated land, which contrasts with Leyte wherein two -thirds of respondents are tenants. Around 31% of rice farmers in Iloilo are lessee, while owner and tenants both constituted 27%.

About 77% of the respondents from Nueva Ecija have access to irrigation systems which is higher than in Iloilo and Leyte with only 13 and 35%, respectively. Rainfall is the major source of water for rice production of about 49% of respondents in Iloilo.

Membership in a rice-based farm organization does not significantly differ in the three provinces, ranging 33-38%. Majority of the farmers are members of farm associations (56%), followed by irrigator's association (34%), and cooperatives (17%). Less than 50% of the farmers in each province have attended seminars and/ or trainings related to rice farming. In Leyte alone, only 30% of farmers have participated on such event.

About 66% of farmers in Iloilo used their own capital in rice production, while most of the farmers from Nueva Ecija and Leyte had to borrow money in order to venture in rice farming. In addition, 58% of the respondents in the three provinces have non-farm income sources, while about 35% received remittances both from local and abroad.

Income from rice farming constituted the largest share of the farmer's total household earnings particularly in Nueva Ecija and Leyte (Table 5). Other sources of income come from other agricultural activities, non-farming, and overseas remittances.

Common Hazards in Rice Farming and Management Strategies

For the period 2007-2011, 33% of sample farmers in the selected provinces reported that pest and disease incidence was the main hazard causing yield reduction in rice farming (Table 6). This is particularly experienced in Leyte, wherein 71% of the respondents ranked pests and diseases as the major cause of yield loss. About 61% of Nueva Ecija respondents ranked strong winds and typhoons as the primary factor that damaged their rice crop. On the other hand, majority of sample farmers in Iloilo (54%), where rice faming is rainfed, reported drought as the common cause of reduced yield. Hence, risks affecting crop loss could be location-specific.

Since rice farming is associated with risks of crop failure arising from climate variability and pests and diseases infestation, farmers have a choice of alternative management strategies to reduce the effect of these production risks. The use of recommended technologies, and working together with other farmers are the common strategies that farmers often use to manage risks (Table 7).

Table 4. Socio-demographic characteristics of respondents by province

Characteristic	Province			All Provinces
	Nueva Ecija	Iloilo	Leyte	
Age (mean)	54	58	55	56
Sex (% of male)	89	82	88	87
Education (yr)	8	8	6	7
Farming experience (yr)	30	33	28	30
Household size (mean)	5	5	5	5
Farm size (ha)	1.24	0.90	0.83	1.04
Tenure (%):				
Owner/CLT[1] (fully paid)	64	27	25	43
Amortizing/CLT (partially paid)	10	6	1	7
Lessee	12	31	4	14
Tenant	4	27	67	28
Others	11	9	4	8
Source of water (%):				
NIS/CIS[2] (gravity/pump)	77	13	35	47
Other sources	12	38	46	29
Rain only	11	49	19	23
Membership in rice-based farm organization (%)	33	38	34	35
Type of organizations (%)[3]:				
Cooperative	21	9	21	17
Irrigators' association	40	32	28	34
Farm association	51	61	55	56
Others		7	67	6
Participation in seminar/ training (%)	41	47	29	41
Source of capital (%):				
Own capital	34	66	43	44
Borrowed	66	34	57	56
Access to non-farm income (%)	58	66	47	58
Access to remittances (%)	25	48	33	35

[1]CLT – certificate of land title; [2]NIS/CIS – National Irrigation System/; Communal Irrigation System; [3]Multiple responses;
Source: Personal survey, 2011

Table 5. Average income of farmers by source and province, July to December 2011

Source of Income	Province			All Provinces
	Nueva Ecija	Iloilo	Leyte	
	(PhP[1])			
On-farm rice farming	117,349	14,934	43,106	65,607
Off-farm rice farming	2,470	2,849	1,880	2,451
On-farm other farming	33,068	8,377	5,069	18,133
Off-farm other farming	937	256	1,120	758
Non-farming	40,244	36,100	5,760	30,481
OFW[2] remittances	5,483	6,966	279	4,703
Total household income	199,552	69,481	57,213	122,132

[1]PhP - Philippine pesos; [2]OFW - Overseas Filipino Workers
Source: Personal survey, 2011.

Table 6. Hazards that commonly cause yield reduction in rice farming by province, 2007-2011

Hazard*	Province			All Provinces
	Nueva Ecija	Iloilo	Leyte	
	(%)			
Pests and diseases	11.92	33.93	71.43	33.43
Drought	3.31	54.46	11.90	21.90
Strong winds/ typhoon	60.93	0.89	0.00	26.80
Flood	17.88	11.61	22.62	17.00
Others	1.99	1.79	1.19	1.73
None	5.96	0.00	0.00	2.59

*Multiple responses; Source: Personal survey, 2011

Crop insurance is not a popular means to manage risks in rice production among farmers. Only 3% of all respondents have indicated frequent use of crop insurance, while 89% claimed that they have never used it. Aside from crop insurance, majority of the farmers indicated that they have never engaged in risk -spreading activities, such as employing in non-agricultural activities and crop diversification. For instance, 74% of the respondents in the three provinces practiced double rice crop in a year, while 26% planted other crops aside from rice.

Adoption of Rice Insurance

To measure adoption, respondents were asked if they have availed of rice insurance at least once since 2007. Results revealed that adoption of insurance is generally low in all provinces, i.e. only 10% of the total respondents have participated in a rice insurance program from 2007 to 2012 (Figure 4). Among the three provinces, Nueva Ecija had the highest percentage of crop insurance adoption with 20%, followed by Leyte with 5%. Iloilo respondents are least adopters of insurance with less than 3% adoption.

About 68% of the farmers who participated in a rice insurance program have purchased the traditional type of insurance, while 27% have experienced enrolling their crop under a WBII program (Table 8). Nueva Ecija and Leyte were the only provinces with farmers who have adopted WBII. This could be the areas were PCIC and MicroEnsure had piloted WBII program in collaboration with other local insurance providers (Lansigan 2013).

In general, 39% of the farmers who insured their rice crop acquired information about insurance from bank or lending agencies (Figure 5). Other major sources of information about crop insurance are: PCIC (16%); cooperatives (14%); and micro-lending agency (17%), such as *Alalay Sa Kaunlaran Incorporated* or ASKI.

Farmers' reasons for enrolling in a rice insurance program are enumerated in Table 9. Thirty-eight percent of those who availed of insurance program indicated

Table 7. Strategies used to manage risks of rice crop failure, 2011

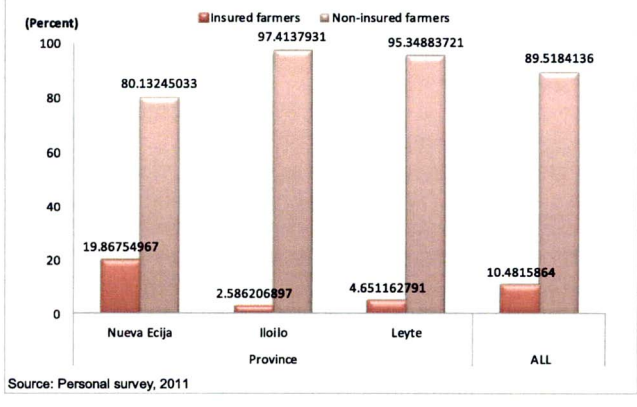
Strategy	% of Respondents					Mode
	Never	Rare	Some-times	Often	Very often	
Use own funds as capital	10.48	13.60	42.21	21.53	12.18	some-times
Engage in non-agricultural livelihood	44.16	10.54	21.37	14.81	9.12	never
Use crop insurance	87.82	2.83	2.83	3.40	3.12	never
Borrow funds for capital	18.98	7.37	33.99	30.03	9.63	some-times
Sell/pawn properties	78.69	8.52	9.66	2.56	0.57	never
Diversify crop pro-duction	57.35	16.71	16.14	5.19	4.61	never
Reduce input use	29.14	12.00	52.00	6.57	0.29	some-times
Use recommended technologies	5.41	3.42	31.91	52.99	6.27	often
Work together with other farmers	5.70	6.55	32.19	42.45	13.11	often

Source: Personal survey, 2011

Table 8. Distribution of respondents by type of insurance adopted, 2011

Type of Insurance	Province			All Provinces
	Nueva Ecija	Iloilo	Leyte	
			(%)	
Traditional	73.33	100.00	0.00	67.57
Weather-index based	20.00	0.00	100.00	27.03

Source: Personal survey, 2011



Source: Personal survey, 2011

Figure 4. Adoption of crop insurance, 2007-2011

attractive compensation as the top reason, while 32% of them cited accessibility to credit. Twenty-two percent of farmers who adopted insurance also considered sense of security in rice production investment as a motivating factor. Co-farmers have also great influence in farmer's decision to participate in an insurance program.

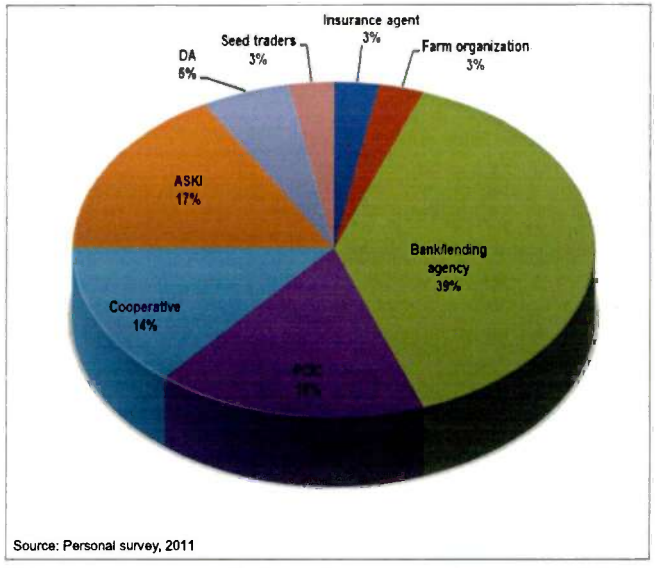
Table 9. Reasons for enrolling in crop insurance, 2011

Reason*	Province			All Provinces
	Nueva Ecija	Iloilo	Leyte	
		(%)		
Peace of mind/ security	20	66.67	0	21.62
Access to credit	36.67	33.33	0	32.43
Influenced by other farmers	16.67	33.33	75	24.32
Attractive policy	46.67	0	0	37.84
Just want to try	0	0	25	2.7
Subsidized by seed grower	3.33	0	0	2.7

*Multiple responses
Source: Personal survey, 2011

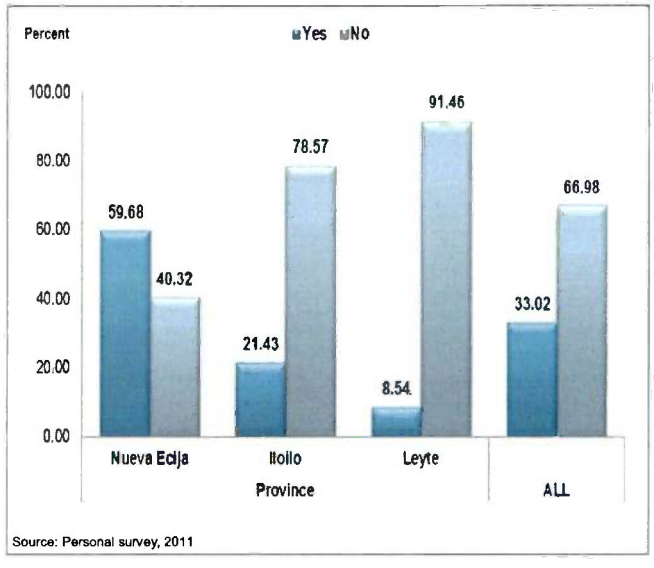
Two out of three farmers who did not enrol in any crop insurance before are hesitant to try it in the future. This is particularly true in Iloilo and Leyte where 79 and 91% of farmers are unwilling to try crop insurance (Figure 6). In contrast, 60% of Nueva Ecija farmers indicated willingness to try on crop insurance program in the next cropping seasons. Reasons of farmers for not adopting insurance are summarized in Table 10. About 35% of respondents in three provinces cited additional financial burden as the main reason for not enrolling in a rice insurance program. Lack of awareness on its existence was also noted to be a limiting factor in farmer's participation in this program as claimed by 25% of the respondents. On other hand, 28% of respondents stated that lack of funds to pay for the insurance premium was also a hindrance in the adoption of crop insurance.

Farmers' suggestions to improve the agricultural insurance system in the country are enumerated in Table 11. Nearly 50% of the total respondents suggested that information campaign on crop insurance should be enhanced. Farmers also recommended that insurance providers' premium rates of 24% should be reduced to ease them from financial burden. Other suggestions include proper implementation of the program, simplified requirements and procedure, and provision of calamity support.



Source: Personal survey, 2011

Figure 5. Sources of information on crop insurance, 2011



Source: Personal survey, 2011

Figure 6. Willingness to adopt crop insurance

The probit model estimation revealed that the area planted to rice, farmers' sex, access to remittances and capital, and participation in seminars related to rice farming are significant and positively affect the probability of adopting insurance. In contrast, membership in farmers' association is negatively associated with crop insurance adoption. Nueva Ecija farmers are more likely to adopt crop insurance compared to Leyte, which is the benchmark province. The model also correctly predicted 82% of the observations, based from the expected percent correctly predicted (ePCP) estimation.

Marginal effects were calculated in order to estimate the changes in the probability of adopting crop insurance given a unit change in the explanatory variable, conditional on holding other factors constant (Table 12). Result shows that the probability of adopting agricultural insurance increases by 5% per hectare increase in farm area. This can be explained by the fact that farmers who cultivate larger area face greater production and income loss given the event of a crop failure. Hence, farmers with larger farm size have higher probability to insure crops. This is similar to the results of Black and Dorfman (2000) who found positive correlation between farm size and adoption of crop insurance among cotton and peanut farmers in the United States.

Similarly, male rice farmers are 15% more likely to adopt crop insurance than women farmers, holding all other factors constant. This might be explained by the social norm that men are usually the main decision-maker in the household. Results also indicated that farmers' access to credit and remittances increase the chance of participation in crop insurance by 7% and 14%, respectively. Farmers who borrow capital need to assure creditors of their ability to pay in the event of crop failure, hence the need to insure their crops. On the other hand, farmers who received remittances are

Table 10. Reasons of farmers for not enrolling in crop insurance, 2011

Reason*	Province			All Provinces
	Nueva Ecija	Iloilo	Leyte	
	(%)			
Lack of awareness	14.00	36.36	20.00	25.35
Lack of funds	18.00	19.32	44.00	27.70
Additional production cost	42.00	15.91	53.33	35.21
No benefits	28.00	3.41	10.67	11.74
Bad experience with insurance	6.00	0.00	6.67	3.76
No access	10.00	26.14	8.00	15.96
Very tedious/many requirements	4.00	0.00	0.00	0.94
Not fair	4.00	0.00	0.00	0.94
No capacity to decide	0.00	4.55	12.00	6.10
Farm area is not qualified	0.00	9.09	6.67	6.10
Not interested	0.00	0.00	6.67	2.35
Looks like it can't help	2.00	0.00	0.00	0.47
Discontented	0.00	1.14	0.00	0.47

Source: Personal survey, 2011

Table 11. List of farmers' suggestions to improve crop insurance system, 2011

Suggestion	Province			All Provinces
	Nueva Ecija	Iloilo	Leyte	
	(%)			
Information campaign	29.41	53.85	55.56	48.72
Lower premium	0.00	36.54	0.00	24.36
Proper Implementation	29.41	0.00	44.44	11.54
Simplified requirements and procedure	17.65	5.77	0.00	7.69
Terminate insurance program	11.76	3.85	0.00	5.13
Provide calamity support	11.76	0.00	0.00	2.56

*Muitipie responses; Source: Personal survey, 2011

more financially capable of purchasing insurance services compared to those who have no additional income source.

Attendance to rice farming seminars or trainings also raises the probability of adopting crop insurance by 7%. Rice farming seminars expos farmers to additional knowledge and information regarding farm management strategies, including agricultural insurance. Hence, attendance to rice-related training may have created a positive effect on farmers' decision to adopt insurance.

Provincial location particularly in Nueva Ecija also has positive effect in the farmers' decision to enroll in crop insurance. Respondents who lived in Nueva Ecija are 19% more likely to adopt crop insurance compared to farmers in Leyte. Meanwhile, Iloilo farmers have similar propensity with those in Leyte in terms of availing of crop insurance. Many factors could have contributed to this but one stands out. Nueva Ecija is commonly traversed by tropical storms that enter the Philippine Area of Responsibility particularly during the

Table 12. Estimated marginal effects of determinants of crop insurance adoption

Variable	Adopters of crop insurance
Farm size (ha)	0.050***
	[0.003]
Farming experience (yr)	-0.002
	[0.231]
Sex (1 if male, 0 otherwise)	0.150*
	[0.061]
Education (1 if education is up to college level, 0 otherwise)	-0.019
	[0.739]
Access to remittances (1 received remittances, 0 otherwise)	0.072*
	[0.073]
Borrower (1 if respondent borrowed capital, 0 otherwise)	0.141***
	[0.003]
Tenurial status (1 if land is owned/CLT fully paid, 0 otherwise)	-0.04
	[0.358]
Participation in seminar/training (1 if has attended, 0 otherwise)	0.070*
	[0.065]
Nueva Ecija (1 if from Nueva Ecija province, 0 otherwise)	0.190***
	[0.001]
Iloilo (1 if from Iloilo province, 0 otherwise)	0.066
	[0.360]
Membership in farmers' association (1 if member, 0 otherwise)	-0.144**
	[0.021]
Number of observations	244

Note: in brackets are p-values: *** p<0.01, ** p<0.05, * p<0.1
Source: Personal estimation

wet season. Recognizing that strong wind and typhoons are major causes of rice damage, Nueva Ecija farmers could be sensitive to this hazard and enroll in crop insurance program.

It is interesting to note that membership in farmers' association reflected a negative effect in farmer's decision to adopt crop insurance. On average, members of farm association are 14% less likely to adopt insurance than non-members. It is possible that members of farmer's association find social and financial security within their organization and are thus less likely to invest in crop insurance.

CONCLUSION

Based on the results of this study, the adoption of crop insurance in the country particularly in rice production is still wanting. Targeting certain farmers with specific characteristics can enhance the adoption of crop insurance. In particular, male farmers, and those who have access to capital and remittances can be

targeted by crop insurance provider. In addition, information drive about crop insurance can be tied-up with rice production related training. Information dissemination is a critical step in increasing enrollment in crop insurance as suggested by 49% of the respondents. Lack of awareness and no perceived benefits are among the leading constraints to adoption and this can be solved by proper information campaign.

Crop insurance providers can also target, but not limited to, farmers with larger areas as there is a higher probability of adoption. Land area, and adoption of hybrid varieties and high quality inbred seeds were some of the contributing factors in increasing rice production (Bordey and Nelson 2012). With the adoption of crop insurance, increase in rice cultivated area also increases the probability of production growth in the Philippines. Adoption of hybrid varieties and high quality inbred seeds also requires proper farm management to be able to achieve the maximum attainable yield. However, aside from higher cost of seeds, these are often associated with production risks discouraging farmers from adopting. Farmers' enrollment in crop insurance program can mitigate this risk. Hence, crop insurance could also be an instrument in enhancing the adoption of good agricultural practice to intensify nationwide rice production.

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