



Crop insurance as a risk management tool in agriculture: The case of silk farmers in northern Iran



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ABSTRACT

Crop insurance is an important risk coping mechanism in agriculture, but its role in the sense of security has not been yet institutionalized in small farmers' culture. Farmers' preferences and factors affecting the adoption of silkworm insurance were explored in Guilan Province of northern Iran. Over half of the farmers (59.5%) mentioned the low indemnity rate paid by insurance companies as the main problem of insurance services. In addition, the long period of indemnity payment was reported as another major problem of insurance services. A sizeable proportion of the farmers (35.6%) were willing to pay for insurance only at indemnity reception. Most farmers (79.4%) had a risk-taking propensity. Informing silk farmers about damage assessment schedules and about indemnity payment in a timely manner were the most important factors rated by the farmers for insurance adoption. High income and small distance of insurance affiliates from the silk farms was associated positively with insurance adoption. By contrast, income from sources other than silk farming was associated negatively with insurance adoption. The study provides baseline data on farmers' stated preferences and willingness to pay for silkworm insurance, filling a knowledge gap in farmers' behaviour towards insurance adoption. It also answers the question of what drives farmers to adopt insurance schemes for protection of silkworm raising in the area of northern Iran. The information provides useful policy insights on the development of silkworm insurance as a financial facet of a risk mitigation strategy in northern Iran or in other areas where silkworm raising exists and offers insights on what is desirable for silk farmers as far as provision of silkworm insurance is concerned. To improve insurance adoption by silk farmers, it is important to have a fair premium proportional to farmers' income and to pay indemnity to the damaged insured farmers in a timely manner.

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1. Introduction

Agricultural production in all sectors is inherently a risky business; farmers face a great variety of weather, pest, disease, input supply, and market-related risks resulting in the instability of their income (Hazell, 1992; Hardaker et al., 2004; Zulficar et al., 2016). The prevalence of risk in agriculture is not new and farmers have, over generations, developed ways of reducing and coping with risk. Crop insurance is a coping mechanism and ex-ante adaptation measure by which protection from potential risk is transferred from

the insurance organization to the insurer. Crop insurance compensates the farmer if there is ultimately crop failure in spite of all the precautionary measures taken by him. In this mechanism, a payment of a certain small amount of premium ensures usually the receipt of a larger amount of compensation, depending upon the occurrence of an unpredictable adverse event. The acceptance of insurance services in the agricultural sector is low as compared with other sectors of the economy. Farmers often view insurance as an unnecessary expense instead of an investment to curtail future risk, especially given the small size of their holdings.

Raising silkworm has a special niche in the agricultural sector of Guilan Province in northern Iran and is the direct source of income for several farmers. Like all other agricultural products, the production of fresh cocoon is exposed to several risks, so that insurance service has a lot to do with mitigating potential hazards. Hence,

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mechanisms should be in place to motivate silk farmers to adopt insurance as an innovation. In this context, it is important to identify factors affecting the adoption of silkworm insurance and to determine their relative importance. The development of silk farming can help in the development of invaluable handicraft industries, like carpet-weaving, paving the way for the devise of new industrial initiatives. Silkworm farming allows the development of local silk industries, including textile industry and intermediary industries between production and end products. These activities are related to cocoon drying, cocoon boiling, filament extraction, filament weaving, bleaching, and degumming, which all together cover a wide range of rural and urban occupations in different parts of Iran, creating job opportunities in silk production and processing chain (Research Fund for Development of Silk Farming and Silk Industries in Iran, 1990).

Silkworm insurance in Guilan Province was started in 2003 with 5474 boxes and 971 users, covering 8.5% of the silkworm eggs distributed in the province. In total, the relatively good performance of monitoring of insurance agents and experts of Iranian Silkworm Farming Corporation as well as the settlement of insurance claims in a timely manner resulted in growing satisfaction of policy holders, so that silkworm insurance was spread to other silk farming regions, including provinces of Razavi Khorasan, Golestan, and Mazandaran. In 2014–2015 growing season, silkworm insurance covered 7211 boxes of 12,750 silk egg boxes distributed in Guilan Province, i.e., 57% of the distributed silk eggs were insured. Also, from 8057 users, 3047 farmers, i.e., 38%, were covered by silkworm insurance (Insurance Fund for Agricultural Products of Guilan Province, 2015). Silkworm insurance that has been just recently launched is a relatively new initiative for fresh cocoon producers. So, understanding factors impacting its adoption by silk farmers and attitudes towards it, can help understanding the challenges of insurance plans, facilitate their implementation, and assist the development of silk farming.

Certain studies have been carried out on factors affecting various types of the insurance adoption throughout the world, such as livestock insurance adoption by commercial dairy farmers in Eritrea (Mohammad and Ortman, 2005) or by cattle farms in Western Kenya (Otieno et al., 2006), crop insurance purchase in France (Enjolras and Sentis, 2011), hail insurance decisions in Switzerland (Finger and Lehmann, 2012), the demand for agricultural insurance in Spain (Garrido and Zilberman, 2008), crop insurance decisions in the US (Sherrick et al., 2004) and in China (Yang et al., 2015) as well as crop insurance adoption in Iran (Qorbani et al., 2000; Dadras Moghaddam and Zamanipour, 2010; Karami, 2011). These analyses showed that the adoption of various agricultural insurance programs is determined by a variety of factors. In spite of the vital importance of insurance for the farmers and its role in the sense of security of production, insurance has not been yet improved in rural areas of Iran and has not been institutionalized in farmers' culture. In Guilan Province, the main silkworm production region in Iran, factors related to the adoption of insurance by silk farmers have not been studied. Therefore, it is of importance for planners and policy-makers in the agricultural sector to know the factors influencing crop insurance adoption in silk farming raising.

The general aim of the present study was to identify farmers' preferences about silkworm insurance and examine factors influencing insurance adoption by silk farmers in Guilan Province of northern Iran. The results might provide useful insights to better understand farmers' behaviour towards crop insurance and contribute towards more sustainable crop insurance schemes for silk farmers in the future.

2. Methodology

2.1. Study area and sample selection

The present study was carried out with silk farmers in Guilan Province of northern Iran. The statistical population composed of all silk farmers in Guilan Province (8057 farmers) in 2015. Since the number of silk farmers differs in different counties and there are farmers who are insurance adopters and farmers who are non-adopters, a two-phase stratified sampling method was applied. The sample size of the study was determined by the following equation (Bartlett et al., 2001):

$$n = \frac{\frac{z_{\alpha}^2 pq}{d^2}}{1 + \frac{1}{N} \left[\frac{z_{\alpha}^2 pq}{d^2} - 1 \right]}$$

where n = sample size, N = population size (in this case $N=8057$ farmers), p = estimated proportion of the population ($p=0.5$), $q=(1-p)$ (i.e., $q=0.5$), d = one half of the desired interval width ($d=0.05$), and z = the value of the standard normal distribution for the selected confidence level of 95% ($z = 1.96$). From the above equation, the sample size was calculated to 376 farmers.

2.2. Data collection

The research tool was a questionnaire that was designed based on authors' experience. It included sections for personal, agricultural, and economic characteristics of the silk farmers, factors affecting insurance adoption, such as the main problems about silkworm insurance, willingness to pay for silkworm insurance, contacts with insurance and extension agents, affiliate distance from the farm (rated on a scale from 0 = not important to 5 = very much important), and risk-taking propensity of the farmers on twelve statements (rated with 1 = affirmative or 2 = negative). The content validity of the questionnaire was evaluated and confirmed by a panel of academic professors and experts from Iran Silkworm Research Center (ISRC). The reliability of the questionnaire was estimated to be 0.84 using Cronbach's alpha, according to which the questionnaire was accepted as a reliable research tool for the study.

2.3. Data analysis

Basic descriptive statistics (frequencies, percentages, means, and standard deviations) of the sample were calculated. Inferential statistics, including t -test and Mann-Whitney test, were used to determine the relationships between measured variables. The relationships between the quantitative variables with the nominal variable of adoption were examined with correlation tests and the relationships between nominal variables were examined with the chi square (χ^2) test. To determine quantitative relationships between the dependent variable (0 = non-adopter and 1 = adopter) and the independent variables, logit regression analysis was used. Logit regression is used for prediction of the probability of occurrence of an event. Predictor variables may be either numerical or categorical. The logistic model is typically used when the dependent variable can take on two values. In this case, these are: 1, indicating adoption of silkworm insurance and 0, indicating non-adoption of silkworm insurance. The forward selection approach was used in this study. In the output of the analysis in the results section, estimates for the beta (b) are not presented. Instead, the

exp(B) values are reported for ease of interpretation. These values represent the change in the odds that the dependent variable has the value 1, when the respective predictor variable increases by one unit. All data were analyzed by SPSS₂₂ and MS-Excel software packages.

3. Results

The majority of the silk farmers (88%) were male (Table 1). The age group of more than 60 years had the highest frequency (32.2%), whereas the age group up to 30 years had the lowest frequency (6.1%), indicating a sample of experienced farmers. Most silk farmers, i.e. 34.3%, were illiterate, whereas a small proportion (6.9%) had academic education. Most silk farmers (88.6%) were married and most (50.8%) had a family with 3–6 people. The majority of the silk farmers had 21–30 years of experience in silk farming, whereas a small proportion (5.3%) had silk farming experience greater than 50 years.

Most participants (74.2%) mentioned farming as their main job, whereas small parts of the sample were at the same time civil servants (5.6%), livestock farmers (9.6%), and self-employed (10.6%) (Table 2). Almost half of the silk farmers (50.8%) had an income of 11–30 million IRR (1 US dollar \approx 32,000 IRR), whereas only a small proportion (2.7%), i.e. 10 farmers, had an income more than 60 million IRR from silk farming in the previous year. Almost half of the silk farmers (49.2%) had an income of 100–200 million IRR from activities other than silk farming. Most participants (64.9%) had not attended extension courses, whereas a small proportion had already attended extension courses more than three times. Among participants, 80.3% had not used bank credits. Also, a sizeable proportion (14.9%), i.e., 56 participants had received a loan of more than 30 million IRR.

Table 1
Frequency distribution of farmers' personal characteristics.

Characteristic	A		NA		Total	
	FQ	%	FQ	%	FQ	%
Gender						
Male	117	84.2	214	90.3	331	88.0
Female	22	15.8	23	9.7	45	12.0
Age (years)						
Up to 30	9	6.5	14	5.9	23	6.1
From 31 to 40	8	5.7	32	13.5	40	10.6
From 41 to 50	35	25.2	72	30.3	107	28.5
From 51 to 60	37	26.6	48	20.3	85	22.6
More than 60	50	36.0	71	30.0	121	32.2
Education						
Illiterate	53	38.1	76	32.0	129	34.3
Elementary school graduate	29	20.9	53	22.4	82	21.8
Intermediate school graduate	27	19.4	59	24.9	86	22.9
High school graduate	21	15.1	32	13.5	53	14.1
University graduate	9	6.5	17	7.2	26	6.9
Marital status						
Single	10	7.2	33	13.9	43	11.4
Married	129	92.8	204	86.1	333	88.6
Family size (individuals)						
From 1 to 2	51	36.7	112	47.3	163	43.3
From 3 to 6	75	53.9	116	48.9	191	50.8
More than 6	13	9.4	9	3.8	22	5.9
Silk farming experience (years)						
Less than 10	21	15.1	37	15.6	58	15.4
From 10 to 20	31	22.3	62	26.2	93	24.7
From 21 to 30	35	25.2	62	26.2	97	25.8
From 31 to 40	26	18.7	46	19.4	72	19.2
From 41 to 50	15	10.8	21	8.8	36	9.6
More than 50	11	7.9	9	3.8	20	5.3

A: adopters; NA: non-adopters; FQ: frequency.

Table 2
Frequency distribution of farmers' economic characteristics.

Characteristic	A		NA		Total	
	FQ	%	FQ	%	FQ	%
Main job						
Civil servant	9	6.5	12	5.0	21	5.6
Farming	107	77.0	172	72.6	279	74.2
Self-employed	13	9.3	27	11.4	40	10.6
Livestock farming	10	7.2	26	11.0	36	9.6
Income from silk farming (million IRR)						
Up to 10	60	43.2	102	43.0	162	43.1
From 11 to 30	66	47.5	125	52.8	191	50.8
From 31 to 60	9	6.5	4	1.7	13	3.4
More than 60	4	2.8	6	2.5	10	2.7
Income from sources other than silk farming (million IRR)						
Zero	1	0.7	0	0.0	1	0.3
Less than 100	65	46.8	89	37.5	154	40.9
From 100 to 200	64	46.0	121	51.1	185	49.2
More than 200	9	6.5	27	11.4	36	9.6
Attendance of extension courses						
Affirmative	54	38.8	78	32.9	132	35.1
Negative	85	61.2	159	67.1	244	64.9
Number of extension courses attended						
Zero	93	66.9	160	67.5	253	67.3
From 1 to 3 times	38	27.4	56	23.7	94	25.0
More than 3 times	6	4.3	10	4.2	16	4.2
No response	2	1.4	11	4.6	13	3.5
Use of bank loans						
Affirmative	28	20.1	46	19.4	74	19.7
Negative	111	79.9	191	80.6	302	80.3
Loan size (million IRR)						
Zero	110	79.1	191	80.6	301	80.0
Less than 10	2	1.4	2	0.8	4	1.1
From 10 to 30	6	4.3	9	3.8	15	4.0
More than 30	21	15.2	35	14.8	56	14.9

A: adopters; NA: non-adopters; FQ: frequency.

Table 3
Farmers' main problems about silkworm insurance.

Insurance problems	A		NA		Total	
	FQ	%	FQ	%	FQ	%
Low indemnity	76	54.7	146	62.4	222	59.5
Long indemnity payment period	50	36.0	73	31.2	123	33.0
High premium	1	0.7	2	0.9	3	0.8
All choices	12	8.6	13	5.5	25	6.7

A: adopters; NA: non-adopters; FQ: frequency.

Table 4
Farmers' willingness to pay for silkworm insurance.

Willing to pay for insurance	A		NA		Total	
	FQ	%	FQ	%	FQ	%
At danger	23	16.5	11	4.6	34	9.0
At indemnity reception	100	71.9	34	14.3	134	35.6
After extension agents' recommendation	6	4.3	3	1.3	9	2.4
All choice	10	7.3	0	0.0	10	2.7
No-response	0	0.0	189	79.8	189	50.3

A: adopters; NA: non-adopters; FQ: frequency.

Over half of the silk farmers (59.5%), i.e. 222 people, mentioned the low indemnity rate paid by insurance companies as the main problem of silk farming insurance services. The long period of indemnity payment was reported as another problem of silk farming insurance services (Table 3). While almost half of the farmers (50.3%) did not express their opinion regarding their willingness to pay for insurance, 35.6% of the silk farmers expressed their willingness to pay for the insurance at the reception of indemnity (Table 4). Most silk farmers (43.9%) had a moderate level of contact with insurance and extension agents, while almost 17% of the farmers had poor levels of contact (Table 5). By contrast, only 3 participants (0.8%) had a close relationship with insurance and extension agents. While more than half of the farmers (51.3%) did not provide information about affiliate distance from the farm, most affiliates of insurance companies were located in the distance of 1–8 km from silk farms (Table 6).

Risk-taking propensity of both adopters and non-adopters with respect to profession security and crop insurance is shown in Table 7. Although mixed answers were obtained, farmers expressed a highly risk-taking behaviour in many of the aspects examined (Table 7). To better estimate risk-taking propensity among participants, the statements were summed up and the result was regarded as the risk-taking propensity of silk farmers. The frequency distribution is presented in Table 8, where it can be clearly seen that most farmers (78.7%) were characterized as risk takers.

Table 7
Frequency distribution of risk-taking propensity indices.

Index	A		NA		Total	
	Yes%	No%	Yes%	No%	Yes%	No%
I follow hard goals in my personal affairs.	27.0	73.0	29.2	70.8	28.4	71.6
If I had 10 million IRR, I would prefer to buy stocks instead of putting it in a long-term bank account.	77.4	22.6	78.0	22.0	77.7	22.3
I prefer to have a permanent job with reasonable earning and job security, rather than a job I may lose in case of poor performance.	18.2	81.8	14.8	85.2	16.1	83.9
If the chance for the success in a job is 50-50, I will do it.	56.9	43.1	63.1	36.9	60.9	39.1
If I need money for a high-income job, I will try to lend money for it.	65.7	34.3	73.3	26.7	70.5	29.5
If there is a chance of failure in a job, I will prefer not to do it.	79.1	20.9	78.8	21.2	78.8	21.2
Before doing a job, I would like to learn all things about, even if it is time-consuming.	13.7	86.3	14.0	86.0	13.4	86.6
Before any decision, I would like to know the agreement and disagreements.	79.1	20.9	75.4	24.6	77.2	22.8
I choose jobs that provide better conditions for me, not the jobs that I only enjoy.	89.2	10.8	94.5	5.5	93.0	7.0
It is hard to me to ask others about their interests.	21.2	78.8	25.0	75.0	23.6	76.4
It is easier for me to do jobs that I am accustomed to.	94.9	5.1	91.9	8.1	93.0	7.0
I would like to start new, risky businesses.	86.9	13.1	86.4	13.6	86.6	13.4

A: adopters; NA: non-adopters.

Table 5
Farmers' contacts with insurance and extension agents.

Contact with insurance and extension agents	A		NA		Total	
	FQ	%	FQ	%	FQ	%
Very low	13	9.4	14	5.9	27	7.2
Low	7	5.0	29	12.2	36	9.6
Moderate	67	48.2	98	41.4	165	43.9
High	50	36.0	82	34.6	132	35.1
Very high	2	1.4	1	0.4	3	0.8
No-response	0	0	13	5.5	13	3.4

A: adopters; NA: non-adopters; FQ: frequency.

Table 6
Affiliate distance from the farm.

Affiliate distance from the farm (km)	A		NA		Total	
	FQ	%	FQ	%	FQ	%
From 1 to 8	61	43.9	33	13.9	94	25.0
From 9 to 16	67	48.2	16	6.8	83	22.1
From 17 to 24	4	2.9	2	0.8	6	1.6
No-response	7	5.0	186	78.5	193	51.3

A: adopters; NA: non-adopters; FQ: frequency.

Most farmers (78.7%) were characterized as risk takers.

Factors affecting the adoption of insurance by silk farmers are summarized in Table 9. 'Informing silk farmers about damage assessment schedules in a timely manner' (M=4.40) was found to be the most important factor affecting insurance adoption by the insured silk farmers. 'Informing silk farmers about indemnity payment in a timely manner' (M=4.22) and 'informing silk farmers about policy purchase in a timely manner' (M=4.15) were the next most important factors affecting insurance adoption. 'The use of extension lectures about insurance' (M=2.59), 'Insurance premium payment by an installment plan' (M=2.14), and 'Use of crop insurance journals' (M=2.03) were reported to be the least important factors.

With respect to farmers personal characteristics, the *t*-test and Mann-Whitney test were used to compare adopters and non-adopters of silkworm insurance. There were significant differences between adopters and non-adopters in mean age and family size ($P < 0.05$) (Table 10). The adopters of silkworm insurance were older and had larger families than non-adopters. By contrast, no significant differences were observed in farming experience, frequency of participation in extension courses, income from silk farming in the

Table 8
Grouping farmers based on risk-taking propensity.

	A		NA		Total	
	FQ	%	FQ	%	FQ	%
Risk-averse (1–6)	25	18.0	52	21.9	77	20.5
Risk-taker (7–12)	112	80.6	184	77.6	296	78.7
No-response	2	1.4	1	0.5	3	0.8
Total	139	100.0	237	100.0	376	100.0

A: adopters; NA: non-adopters; FQ: frequency.

previous year, and income from sources other than silk farming. Mann-Whitney test showed that adopters and non-adopters did not significantly differ in education and knowledge of insurance objectives and usefulness in terms of rank mean (data not shown).

The results of the logit model are presented in Table 11. In logistic regression, the -2 log likelihood is used as a measure of the goodness of fit of the model. Logit model is satisfied with the reduction of this statistic during insertion of variables into the equation. The value of this statistic was reduced from 163.452 at the first step to 143.514 at the third step, showing the fitness of the model. Also, regression results indicated that when the first variable (distance from insurance affiliate) was included, 84% of all respondents were separated correctly; when the second variable (income from

sources other than silk farming) was included, 83.4% were separated correctly; and when the third variable (income in the previous year) was included, 83.4% were separated correctly (Table 12). So, the model could predict a high percentage of dependent variable values on the basis of the variables included in the equation. Thus, the variables of distance from insurance affiliate, income from sources other than silk farming, and silk farmers' income in the previous year had a significant impact on insurance adoption. Income in the previous year had a positive effect on insurance adoption by silk farmers, but income from sources other than silk farming had a negative impact on insurance adoption confirmed at $P < 0.01$. Also, distance from insurance affiliate influenced the adoption positively and significantly. Exp(B) odds ratio revealed that among variables included in the regression equation, income in the previous year had the largest contribution in predicting adoption, so that as income in the previous year is improved, the likelihood of the adoption of silkworm insurance is increased by 2.278 times. According to the constant and B coefficients in Table 11, the optimum equation describing insurance adoption is the following:

$$\text{Adoption} = 0.155 + 0.823 (\text{previous year income}) - 0.143 (\text{income from sources other than silk farming}) + 0.229 (\text{distance from insurance affiliate})$$

Table 9
Frequency distribution of insurance adoption factors indices (n = 139).

Indices	Percentage						Mean
	NO	VL	L	MO	H	VH	
Informing silk farmers about damage assessment schedules in a timely manner	0.0	0.0	1.5	13.0	29.8	55.7	4.40
Informing silk farmers about indemnity payment in a timely manner	0.0	0.8	6.1	16.8	22.9	53.4	4.22
Informing silk farmers about policy purchase in a timely manner	0.0	1.5	6.9	13.7	31.3	46.6	4.15
Insurance and Agribank officials' behaviour with customers	1.5	2.3	5.4	16.0	28.2	46.6	4.07
Silk farmers' guidance by insurance and Agribank officials	0.8	1.5	7.6	20.7	38.9	30.5	3.87
Insurance experts' visit of damage in a timely manner	1.5	0.8	5.3	24.4	42.0	26.0	3.82
Speed and manner of indemnity payment by insurance company	0.8	13.0	6.1	15.2	34.4	30.5	3.61
Contact with insurance experts	0.8	3.8	12.2	35.9	29.0	18.3	3.44
Payment of a part of premium by government	3.1	6.9	14.5	29.7	30.5	15.3	3.24
Familiarity with the activities of crop insurance fund	0.8	5.3	20.6	42.0	26.0	5.3	3.03
Holding extension training courses	0.8	8.4	30.5	36.6	16.8	6.9	2.81
Using extension lectures about insurance	2.3	6.9	40.5	36.6	7.6	6.1	2.59
Premium payment in an installment manner	16.8	18.3	29.0	14.5	13.0	8.4	2.14
Using crop insurance journals	6.1	28.2	30.5	27.5	6.9	0.8	2.03

NO: none; VL: very low; L: low; MO: moderate; H: high; VH: very high.

Table 10
Comparison of personal characteristics between insurance adopters and non-adopters.

Characteristics	Mean	SD	t-test	P-value
Age (year)			-1.99	0.047
Adopters	54.53	13.86		
Non-adopters	51.64	13.36		
Family size (individuals)			-2.51	0.013
Adopters	4.11	1.79		
Non-adopters	3.68	1.50		
Farming experience (year)			-0.78	0.437
Adopters	27.60	13.89		
Non-adopters	26.47	13.30		
Number of extension courses attendance in the last 3 years			-0.45	0.649
Adopters	0.85	1.33		
Non-adopters	0.79	1.38		
Income from silk farming in the previous year			-1.16	0.246
Adopters	1.58	1.58		
Non-adopters	1.38	1.70		
Produced fresh cocoon in the previous year			-1.74	0.083
Adopters	66.68	41.33		
Non-adopters	59.88	33.51		
Income from sources other than silk farming			1.58	0.114
Adopters	10.97	5.28		
Non-adopters	11.85	4.82		

* Significant at $P < 0.05$; ns: non-significant.

Table 11
Coefficients of logistic regression model.

Variable	B		S.E.	Wald	P-value	Exp(B)
Income in the previous year	0.823	**	0.306	7.259	0.007	2.278
Income from sources other than silk farming	−0.143	**	0.046	9.701	0.002	0.867
Distance from insurance office	0.229	**	0.052	19.667	0.000	1.258
Constant	0.155		0.739	0.044	0.833	1.168

−2 log likelihood (1) = 163.452; −2 log likelihood (2) = 156.355; −2 log likelihood (3) = 143.514.

** Significant at $P < 0.01$.

Table 12
Prediction of observations inclusion in the regression model.

	Observations		Prediction		Correctness %
			NA	A	
First step	Insurance status	NA	20	24	45.5
		A	3	122	97.6
	Total percentage				84.0
Second step	Insurance status	NA	25	19	56.8
		A	9	116	92.8
	Total percentage				83.4
Third step	Insurance status	NA	24	20	54.5
		A	8	117	93.6
	Total percentage				83.4

A: adopters; NA: non-adopters.

4. Discussion

This study provides a snapshot of farmers' preferences about silkworm insurance and of the factors affecting the adoption of silkworm insurance in Guilan Province of northern Iran. Besides need-based research, keeping in view the status of the silk farmers and their requirements can lead to attraction in sericulture. Informing silk farmers about damage assessment schedules and the indemnity payment in a timely manner were the most important factors rated by the farmers for insurance adoption. A logit regression model showed that silk farmers' income, income from sources other than silk farming, and distance of insurance affiliates from the silk farms were effective factors in predicting insurance adoption. Data on the adoption of crop insurance by farmers are limited in the international literature. Therefore, the study provides several important contributions to the existing body of literature on crop insurance and household risk management strategies. First, the study contributes to the thin body of literature, owing to the fact that evidence on the determinants of silkworm insurance adoption does not exist. Second, it provides baseline data about farmers' stated preferences for silkworm insurance in the study area. Finally, information about farmers' willingness to pay for farm insurance products is collected and critical points of intervention for the promotion of insurance adoption are identified. Therefore, the study offers important policy insights for an ex-ante design of crop insurance schemes in the study area. For example, it offers useful insights on what is desirable for the farmers as far as provision of crop insurance is concerned. This is an important first step to understand how to better formulate policies that may efficiently promote the adoption by farmers and then implement targeted interventions. Despite the fact that several policies touch on the issue of agricultural insurance, none of them propose concrete and targeted strategies on how to improve the adoption of agricultural insurance. Additionally, the results of the study could provide a benchmark for future comparisons of insurance adoption among silk farmers in other areas with similar growers' profile and draw attention to the association between agricultural extension and farmers' management behaviour.

Over half of silk farmers (59.0%) mentioned the low indemnity rate paid by insurance companies as the main problem of insurance services. The long indemnity payment period was reported

as another major problem of insurance services. Producers often complain that premiums are excessive when compared with the amount of coverage they receive. Thus, they think that the crop insurance costs them more and does not fully cover the generally high value of their production. The main reason for farmers to complain about insufficiencies of the insurance system seems to be its failure in providing a sufficient safety net in the event of natural disaster or abrupt revenue reduction. This is because basic coverage is often low and not all farmers are buying high levels of coverage. In addition, current insurance products do not protect farmers against low prices that carry over annually because they are based on expected market prices established at the beginning of the growing season. On the other hand, farmers who experience several years of adverse weather conditions may be unable to obtain acceptable insurance coverage because the available coverage level is normally linked to, and often limited by, their actual production history.

A sizeable proportion of the farmers (35.6%) were willing to pay for insurance only at indemnity reception and also most farmers (79.4%) had a risk-taking propensity. These attitudes indicate that farmers would not accept to be involved in insurance programs as a risk mitigating mechanism; on the other hand, they would be willing to maintain or even expand their silkworm business, despite any risks. Therefore, farmers may be not involved in actual insurance purchases, because households have already identified some means of risk coping over the years and they prefer to continue investing lower amounts of money in insurance only to cover the left-over risks. Many researchers have found that the majority of the farmers are risk averse and the risks hamper farmers' willingness to take high-expected-return investment decisions, sacrificing profit-maximizing portfolios for lower risks (Yesuf and Bluffstone, 2009; Binswanger-Mkhize, 2012). Insurance was reported to have an inducing effect on farmers to invest in risky, but remunerative, agricultural activity (Cai, 2013), showing a positive impact of insurance on raising the production inputs used among tobacco farmers in China and promoting food security (Boyd et al., 2011). Also, encouraging insurance purchases could have a positive long-term effect on the income and welfare of rural households in China (Liu et al., 2013). All the abovementioned cases have an important policy perspective. Enlightening households on the long-term impacts of their existing mechanisms of risk mitigation and how these may

fail in certain circumstances is required. Educating farmers on the significance and merits was associated with insurance in a broad sense, by specifically laying emphasis on farm exigency factors that ultimately stimulate farmers' willingness to accept insurance policies, must be largely considered.

Informing silk farmers about damage assessment schedules and about indemnity payment in a timely manner were the most important factors rated by the farmers for insurance adoption. Demand of insurance is often low as many smallholder farmers ignore or depreciate some risks, have low levels of education, distrust insurance organizations, and rely on traditional coping mechanisms, such as selling assets or borrowing from relatives after a shock (Ayinde et al., 2008). Also, life for most rural smallholder farmers is often marred by difficulties as many constraints limit their economic potential. There is a great variety of challenges, including uncertain weather conditions, affecting harvests. These challenges may include insecure land ownership restricting farmers' tendency to invest, poor access to capital and farm inputs, unfavorable trade policies, and significant price fluctuations. Consequently, financial innovations that improve risk diversification may play a significant role in boosting growth and real incomes in emerging market economies. Attractive packages on the part of insurance companies in terms of flexible insurance policies, formation of farmers' insurance association that will enable them communicate effectively with the insurance companies and execute supervision on the part of the government would ensure that the interest and objectives of the farmers are of paramount concern.

The adopters of silkworm insurance were older than non-adopters. This finding is consistent with previous research in Iran (Qorbani et al., 2000; Dadras Moghaddam and Zamanipour, 2010). Similarly, insurance users in Switzerland were usually older (Finger and Lehmann, 2012). Great age of the farmer implies knowledge gained over time and plays an integral role in forming the willingness to adopt an innovation (Baidu-Forson, 1999). Older farmers have gained experience in producing silkworm and thus are more likely to have better knowledge of risks than young farmers. It should be noted, however, that the opposite trend has been reported in the literature regarding the relationship between farmers' age and insurance adoption (Sadati et al., 2010; Hassanpour et al., 2013). In these studies, old farmers were associated with lower possibility of product insurance adoption. Probably due to risk aversion, old farmers show a tendency to reject various innovations, e.g. the insurance of products, and continue to use traditional ways of confronting the risk in their agricultural activities. By contrast, no significant relationship between age and rapeseed insurance adoption was reported in a study from Sari County in northern Iran (Kazemi et al., 2013). Regarding family size, the adopters of silkworm insurance had larger families than non-adopters. Probably, the large family size increases the responsibility of the farmer to avoid potential losses and hence increases his willingness to participate in a crop insurance scheme. This finding is consistent with previous research in Ghana (Kwadzo et al., 2013), but in contrast with previous research in Iran (Sadati et al., 2010). Overall, the above inconsistencies may be related to differences between communities and thus a general conclusion cannot be drawn.

According to the logit regression analysis, silk farmers' income in the previous year had a positive impact on the adoption of insurance, which can be explained by the fact that farmers making good money from their silk farms are more motivated and willing to insure their farms. So, income can be regarded as a motivator of insurance adoption. Also, the short distance of insurance affiliate from the silk farms had a positive influence on the adoption of insurance. Ready access to affiliates can provide conditions for silk farmers to insure their farms. Furthermore, insurance marketers can visit the farms, explain the advantages of insurance to farm-

ers, and motivate them to insure their farms. By contrast, income from sources other than silk farming was negatively associated with insurance adoption by the farmers. This finding shows that silk farmers whose subsistence does not solely depend on silk farming were less willing to pay for insuring their farms. Given the importance of the performance of crop insurance affiliates in the adoption of insurance by silk farmers, insurance affiliates are recommended to inform silk farmers about policy purchase and premium payment in a timely manner and to give them advice. In general, policy reforms in risk management should build on existing information and institutional arrangements, facilitating access to information. Crop insurance agents should be more in contact with silk farmers to make them informed. The improvements in information access through quality extension services and the provision of alternative risk management options are crucial to assist farmers in managing risks at the farm level (Zulfiqar et al., 2016). Since insurance extension plays a vital role, insurance agents are recommended to travel to silk farms and to hold extension courses to familiarize silk farmers with crop insurance. To improve insurance adoption by silk farmers, it is important to have a fair premium proportional to farmers' income and to pay indemnity to the damaged insured farmers in a timely manner. Non-adopters can be talked about their reasons for dissatisfaction with crop insurance to reduce ambiguities.

5. Conclusions

This study builds on previous agricultural risk management research by analyzing the factors influencing silkworm insurance adoption among silk farmers of northern Iran. The adoption decision was modeled using a standard logit regression model. The study fulfills its objective to identify farmers' preferences about silkworm insurance and to examine factors influencing insurance adoption in Guilan Province. Findings suggest that silk farmers' income, income from sources other than silk farming, and distance of insurance affiliates from silk farms were effective factors in predicting insurance adoption. Furthermore, an assessment of risk behaviour showed that most participants had a risk-taking propensity. The results provide useful insights to better understand farmers' behaviour towards crop insurance and contribute towards more sustainable crop insurance schemes for silk farmers in the future.

Agricultural insurance has the potential to address some production constraints by facilitating access to the means of production and changing farmers' behaviour by reducing uncertainty. To improve insurance adoption by silk farmers, it is important to have a fair premium proportional to farmers' income and to pay indemnity to the damaged insured farmers in a timely manner. Crop insurance agents should be in contact with silk farmers to inform them about policy purchase and premium payment in a timely manner and hold extension courses to familiarize silk farmers with crop insurance. The alternative is for governments to expand direct assistance programs, such as relief employment or food rations schemes, which with careful targeting, might prove a more cost-effective form of aid than current crop insurance programs.

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