

# Demand for New Loan Product by Farming Households in Northwest China: Case Study of Shaanxi and Gansu Provinces<sup>\*</sup>

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Based on a survey of 897 farming households in Shaanxi and Gansu provinces, our results show that while farming households had high demands for capital, 47.7% have experienced having their application for a Rural Credit Cooperative (RCC) loan denied because of their low income. Agricultural production and income are significantly influenced by weather risks, and agricultural income accounts for the majority of farming households' annual income, especially poorer households. Furthermore, in Gansu province, fluctuations in traditional crop yields and income caused by weather risks were higher than fluctuations in Shaanxi province. To improve the confidence of formal financial institutions to loan to farming households and to stabilize agricultural production and income, this research combined both formal financing and weather insurance to produce a new product, and analyzed the level of farming households' interest in this new product and its influence factors, 51.1% of the farming households were interested in this product. Overall, agricultural acreage and debt showed a negative influence on farming households' interest. Farming households in Gansu were more concerned with the distance between their village and the RCC office, while farming households in Shaanxi province stated that too long a RCC loan approval period reduced their interest in the product.

*Keywords:* formal financing, weather risks, new loan product, new weather insurance product, ordinal regression model, northwest China

## Introduction

Uninsured weather risks are significant constraints on wealth accumulation. These risks also contribute both directly and indirectly to the existence of chronic poverty, especially for those living in rural areas that are either engaged in agricultural activities or have their livelihoods tied to the well-being of the farming sector (Yaron, Benjamin, & Piprek, 1997; Barrett et al., 2008; Skees, 2008a). Poorer households in developing rural

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areas often lack access to formal financial markets that can facilitate agricultural production. While microfinance has shown significant promise in some settings, this success has been limited in rural areas and for farming activities that require longer-term loans than customary in microfinance (Armendáriz & Morduch, 2005; Barrett et al., 2008; Skees, 2008b).

In rural China, despite the rapid development of microfinance and its growing support of agriculture, it is still difficult for farming households who mainly rely on agricultural production to borrow money from formal financing institutions, especially in developing areas such as northwest China. In these areas, a higher percentage of farmers rely on farming that has suffered more weather-related natural disasters than other parts of China. When providing loans to those farming households, formal financing institutions will take the risk that the loan will not be repaid on time or in full.

This problem has been well described by many researches. Cao and Sawada stated that in developing areas of China, natural disasters were the main reasons for the micro-credit operations of farmers result in bad loans (60%-70%)(Cao, 2007; Sawada, 2007). Rural financial agencies in Huaian, in the Chu Zhou District, lack confidence to lend to agricultural producers because agricultural production is vulnerable to natural disasters (Niu, 2006). Based on 1,564 farming households in west and central China, Turvey and Kong illustrated that weather risks always reduce the income of disadvantaged farmers, and those farmers were in turn late to meet loan payments or had to default on their loans (Turvey & Kong, 2010).

To improve the ability of farming households to obtain formal financing and to stabilize agricultural production and income, the adoption of weather-risk-related insurance is an effective choice. However, agricultural insurance is not currently popular in China and does not provide for fluctuations in agricultural production caused by weather risks. While weather insurance, which can spur rural financial markets by transferring risks, is very popular in many other countries, it has only just been trialed in China, by 1,471 households, covering 854 Hectares in Changfeng and Huaian counties, Anhui province (the trials ended May 2011). In addition, researchers have begun to explore the potential for using weather insurance to provide risk management opportunities to the rural poor. Kong et al. found that crop producers would be willing to pay more for insurance than livestock producers (Kong, Turvey, He, Ma, & Meagher, 2011). Turvey et al. found that the greater risk for farmers was drought, followed by excessive rain, heat, and then cool weather, and that there was equal interest in insurance for planting, cultivating, and harvesting (Turvey, Kong, Belltawn, & Wisconsin, 2009; Turvey & Kong, 2010). Turvey and Kong, and Yuan and Kong both provided a preliminary assessment of farmers' willingness to pay for drought insurance (Turvey & Kong, 2010; Yuan & Kong, 2010). Their results showed that while there is significant demand, price may be an issue, and suggested that to gain a wide adoption of such a product there may be the need for governmental intervention (Kong & Yuan, 2010).

To improve the confidence of formal financing institutions in greater numbers of farming households and to increase northwest China farming households' interest and willingness to pay for weather insurance, this article first analyzes 897 farming households in the Shaanxi and Gansu provinces and the current condition of their formal financing, especially those farming households that loan money from the main rural formal financial institute the Rural Credit Cooperative (RCC). Second, this study estimate fluctuations in agricultural production and farming households' income caused by weather risks. Third, because farming households have a high demand for money and cheaper weather insurance, this study then analyze their interests in a product combining formal financing and weather risks reduction, termed a new loan product or new weather insurance product (Yuan, Kong, & Turvey, 2011) (hereafter "new loan product") and use an ordinal regression model to

determine the influence factors for this interest.

The article is divided into four sections. The first section is the introduction part. Section two introduces the methodology, including hypothetical questions, study areas, and the characteristics of the farming household sample, including a general overview of the farming households and the current situation of their formal financing. This section also examines the effects of weather risks on agricultural production and farming households' income, and their demand for the new loan product. The third section presents the results of those factors influencing the interest in the new loan product for all farming households by using an ordinal regression model, and then compares results between the two provinces. Finally, the article closes with a discussion of the applications of the new loan product and a look to the future.

This paper mainly discusses the linkage between formal financing and weather risks and analyzes an agriculture-related formal financing and weather insurance product designed to fit the special circumstances of lower income poor in northwest China, where rural and agricultural financial markets are largely undeveloped. This is the first paper to analyze the influence factors of Chinese farming households' interest in a combined formal financing and weather risks reduction product using an ordinal regression model. Thus, the results will assist us in putting forward some helpful policies and suggestions to the Chinese government and relevant institutions to enhance the ability of farmers to obtain formal financing ability, and to facilitate northwest rural financing, insurance, and agriculture and rural economic development.

## **Materials and Methods**

### **Hypothetical Question**

Hypothesis: here is a "new loan product", which is a combination of formal financing and weather insurance. It has a built-in insurance mechanism, which means if farmers want to borrow money from a formal financial institution, they have to first buy weather insurance for their farm. When a severe drought occurs, the amount of debt farmers have to repay decreases as the intensity of the drought increases. At the same time, the payment amount received by farmers from the weather insurance institution increases as the intensity of the drought increases. In this case, theoretically, farmers can use this payment to pay their debts or the weather insurance institution can pay the formal financing institution directly, both of which reduce the burden of farmers and increase the repayment rate for formal financial institutions, which could further improve the lending confidence of the financial institutions, and therefore facilitate the development of both agriculture and the rural economy.

Question: "Would you be interested in such a loan product even if it required an increased interest rate?"(Please select only one response).

- (1) "Not at all interested".
- (2) "Moderately interested".
- (3) "Very interested".

### **Study Areas**

This study was based on two typical agricultural provinces in northwestern China, Shaanxi and Gansu. Shaanxi is one of China's fruit provinces, and Gansu relies mainly on traditional crops. Compared with Shaanxi province, Gansu suffers more natural disasters, and agricultural production relies more heavily on nature because there is little corresponding agriculture infrastructure.

Data were collected by 40 trained graduate students studying at Northwest A&F University. After

randomly selecting samples, the questionnaires were completed in face-to-face interviews. Nine hundred questionnaires were given to respondents, and 897 were valid responses.

### Sample Farming Households' Characteristics

**General overview.** Table 1 provides a general overview of the sample farming households. It shows that farming households in Gansu province had a higher agricultural acreage (0.48 Hectare) than in Shaanxi province (0.3 Hectare). However, the mean agricultural income in Gansu province (251.92\$) was very low compared with Shaanxi province (2,803.25\$) (1\$ = 6.83 RMB in 2009). There was also a big gap between the mean annual income (2,943.67\$) in Shaanxi and Gansu provinces' farming households. In other words, the average annual income of farming households in Gansu province (1,923.09\$) was 40% of Shaanxi province (4,866.76\$). The main income of farmers in Shaanxi province came from agriculture (57.6%), but in Gansu only 13.1% of income was from agriculture. Although farming households' in Gansu province had more agricultural acreage, agricultural production efficiency, agricultural income, and annual income were very low. Therefore, there is room for a significant improvement in farming households' income via improvements in agricultural production. Table 1 shows that agriculture made a significant contribution to farming households' income in Shaanxi province compared with Gansu province. Because most farming households in Shaanxi province depend on agriculture, ways to further develop agriculture are important to increase farming households' incomes.

Table 1

*Overview of Sample Farming Households*

Region	Index	Agricultural acreage (Hectare)	Annual income (\$)	Agricultural income/Annual income (%)	Total (\$)	borrowing (\$)	Formal financing (\$)
Shaanxi (473)	Mix.	0.05	61.49	0	0	0	0
	Max.	1.07	117,130.31	100	109,809.66	109,809.66	109,809.66
	Mean	0.39	4,866.76	57.6	2,318.46	1,570.61	1,570.61
	S.D.	0.15	7,657.88	30.4	6,491.11	6,180.88	6,180.88
Gansu (424)	Min.	0.07	146.41	0	0	0	0
	Max.	4.00	29,282.58	100	43,923.87	43,923.87	43,923.87
	Mean	0.48	1,923.09	13.1	2,558.54	1,443.76	1,443.76
	S.D.	0.33	1,957.34	20.7	4,571.35	3,955.52	3,955.52
Total (897)	Mix.	0.05	61.49	0	0	0	0
	Max.	4.00	117,130.31	100	109,809.66	109,809.66	109,809.66
	Mean	0.43	3,475.33	36.6	2,431.95	1,510.64	1,510.64
	S.D.	0.25	5,904.51	34.4	5,663.56	5,245.52	5,245.52

Overall, the amount of borrowed money per farming household in Gansu province (2,558.54\$) was slightly higher than in Shaanxi province (2,318.46\$). In terms of loan source structure, the amount of formal financing owed by Shaanxi farming households (1,570.61\$) was higher than for Gansu farming households (1,443.76\$). However, the mean of non-formal financing in Gansu was 366.93\$ higher than in Shaanxi (747.85\$). Non-formal financing, such as borrowing from friends, relatives, and moneylenders, is very popular in Gansu. Compared with Shaanxi province, farming households in Gansu province prefer non-formal financing. The results show that in both Shaanxi and Gansu provinces there are a substantial demand by farming households for capital to use on productive and nonproductive expenditure.

**Current situation of farming households' formal financing.** Tables 2 and 3 show the results concerning farming households' applications to the RCC for loans—whether or not they were denied a RCC loan and the major reasons they were denied (respondents could give more than one answer if necessary).

Among the 897 farming households in Table 2, nearly half (47.7%) have been denied a RCC loan; in Gansu province 53.5% were denied a loan, which is more than 10% higher than in Shaanxi province. According to the survey, some of the lower income farming households in Gansu province does not like to borrow money from formal financing institutions because they know that these formal institutions will not lend money to them. However, non-formal financing cannot always meet the needs of farming households. To maintain their standard of living and met daily needs, these households feel they have to borrow money from the RCC.

Table 2

*Ratio of Farming Households Denied a Loan by RCC*

Whether or not	Shaanxi		Gansu		Total	
	Frequency	%	Frequency	%	Frequency	%
No	267	56.4	183	43.2	450	50.2
Yes	201	42.5	227	53.5	428	47.7
Total	468	98.9	410	96.7	878	97.9
Missing	5	1.1	14	3.3	19	2.1
Total	473	100	424	100	897	100

Table 3

*Main Reasons for Denied Credit*

Reason		Shaanxi		Gansu		Total	
		Frequency	%	Frequency	%	Frequency	%
Direct	RCC does not believe that I earned enough income	200	99.5	190	86.8	390	92.9
	Failed to repay the loan in the past	21	10.4	18	8.2	39	9.3
	Insufficient collateral	35	17.4	63	28.8	98	23.3
	Could not find someone to guarantee loan	53	26.4	62	28.3	115	27.4
Indirect	Crop yield risk caused by extreme weather	4	2.0	24	11.0	28	6.7
	Price risk of crops	2	1.0	6	2.7	8	1.9
	Repayment schedule required by RCC does not match the timing of sales from farm	5	2.5	8	3.7	13	3.1
Valid Sample		201	100	219	96.5	420	98.1
Missing		0	0	8	3.5	8	1.9
Total		201	100	227	100	328	100

As shown in Table 3, of the 420 respondents denied loans, 390 (92.9%) considered that this was because of their “lower income”, 39 (9.3%) because they “failed to repay the loan in the past”, 98 (23.3%) believed their “lack of collateral” was the issue, and 115 respondents (27.4%) considered “lack of guarantee” as being a major reason. More than 90% of those farming households denied a loan regarded insufficient income as the limiting condition to obtain formal financing, especially in Shaanxi province (only one respondent did not think so). Among the indirect reasons, “crop yield risk caused by extreme weather” was considered slightly more important than other factors. Weather risks were considered to have a greater influence on crop yield (which indirectly influences access to formal financing) by 11% of respondents in Gansu and 2% in Shaanxi. These

percentages are significantly lower than for direct reasons. That is, most farming households considered low income as the determinant for being denied a loan, and just a few respondents considered weather risks to reduce their formal financing ability by decreasing their agricultural incomes.

### **Influence of Weather Risks on Agricultural Production and Farming Households' Income**

To determine the yield and income fluctuations caused by weather risks, the survey asked farmers to “point out the number 1 (according to income) crop grown in the past 12 months”, and identify “the lowest yield (per Hectare)”, “the most likely yield”, and “the highest possible yield” they believed possible in the next crop year. The survey also asked the respondents to estimate the price that they believed was most likely to be received in the next year. At the same time, to estimate the influence, the research put forward the following hypotheses: first, because there was a significant difference in crop types between the two provinces, in this article, crops are classified as two types: traditional crop (TC) and cash crops (CC); second, to maximize the use of farm land, every farming household only plants one crop that contributes to the highest revenue; third, there is only one factor, weather risks, influencing crop output, which means fertilizers and other factors are fixed; fourth, there are three yield types: the lowest possible yield (LPY), the most likely yield (MLY), and the highest possible yield (HPY), representing bad weather, moderate weather, and good weather, respectively.

Corn, wheat, and kiwi are the main crops in Shaanxi and Gansu provinces (see Table 4), this study only focused on the fluctuations of those three crops.

Table 4

#### *Distribution of Main Crop Species*

Type		Shaanxi		Gansu		Total	
		Frequency	%	Frequency	%	Frequency	%
CC	Corn	25	5.3	111	26.2	136	15.2
	Wheat	65	13.7	151	35.6	216	24.1
EC	Kiwi	281	59.4	0	0	281	31.3
Others		79	16.7	16	3.8	95	10.6
Missing		23	4.9	146	34.4	169	18.8
Total		473	100	424	100	897	100

Tables 5 and 6 show the fluctuations of agriculture' output and income, respectively, during bad weather, moderate weather, and good weather.

Table 5

#### *Yield Fluctuation Caused by Weather Risks (kg)*

Area	Type(n)	$\sum[(HPY-MLY) * \text{Agricultural acreage}]/\text{Number}$	$\sum[(HPY-LPY) * \text{Agricultural acreage}]/\text{Number}$	$\sum[(MLY-LPY) * \text{Agricultural acreage}]/\text{Number}$
		①	②	③
Shaanxi	TC(90)	1,626.5	872.5	754
	CC(281)	3,250	1,250	2,000
Gansu	TC(262)	1,002	432.5	569.5
Total	TC(352)	1,162	545	616.5
	CC(281)	3,250	1,250	2,000

Table 6

*Income Fluctuation Caused by Weather Risks*

Area	Type	Average of price (\$/kg)	Income fluctuation (\$)			Average of annual income (\$)	Percentage of income fluctuation (%)		
		④	⑤ = ① * ④	⑥ = ② * ④	⑦ = ③ * ④	⑧	⑨ = ⑤/⑧	⑩ = ⑥/⑧	⑪ = ⑦/⑧
Shaanxi	TC(90)	0.49	795.37	426.59	368.78	4,866.76	16.3	8.8	7.6
	CC(281)	0.81	2,630.67	1,011.80	1,618.87		54.1	20.8	33.3
Gansu	TC(262)	0.45	447.55	193.19	254.36	1,923.09	23.3	10.0	13.2
Total	TC(352)	0.46	531.39	249.30	282.11	3,475.33	15.3	7.2	8.1
	CC(281)	0.81	2,630.67	1,011.80	1,618.87		75.7	29.1	46.6

Note. ①, ②, and ③ are from Table 5; ⑧ is from Table 1.

In Table 5, HPY was used, for example, minus MLY; the difference is then multiplied by the agricultural acreage of each farming household to calculate the agriculture yield fluctuation of every farming household. The end result is the per capita variation of crop output by weighted average.

Table 6 shows that the fluctuating percentage of agricultural income caused by the weather risks according to farming households' annual income. The ranges of traditional crops for the two provinces were from 7.6% to 16.3% (Shaanxi province) and 10.0% to 23.3% (Gansu province). That is, for traditional crops, weather risks had bigger influence on agricultural production in Gansu province than in Shaanxi province. In addition, cash crops were strongly influenced by weather risks and widely fluctuated because of these risks, ranging from 20.3% to 54.1%. If these weather risks can be effectively distributed, mitigated, or if the loss of agricultural production caused by bad weather condition could be compensated on time, then farming households' income could be increased, especially the income of farming households with cash crops. However, on the other hand, because cash crops can make more money than tradition crops, more and more farmers would like to plant cash crops to increase their income. Therefore, distributing weather risks is an important way to improve farmers' income and therefore increase their abilities to obtain formal financing.

China currently lacks effective methods to improve the ability of northwest farming households to obtain formal financing and to reduce the influence of weather risks on northwest agriculture production. As such, this article analyzes a new loan product that can disperse the influence of weather risks to agricultural production, or stabilize and increase farming households' income, and then improve their ability to obtain formal financing.

Table 7

*New Loan Product (%)*

Area	Not at all interested		Moderately interested		Very interested	
	Frequency	%	Frequency	%	Frequency	%
Shaanxi (473)	194	41	198	41.9	81	17.1
Gansu (424)	191	45	166	39.2	67	15.8
Total (897)	385	42.9	364	40.6	148	16.5

**Demand for a New Loan Product**

Although Turvey and Kong believed that the conceptual basis of weather insurance may be difficult for northwest China farmers to understand because agricultural insurance itself was underdeveloped, our results are encouraging (Turvey & Kong, 2010). The results in Table 7 indicate that 40.6% of farming households were moderately interested in the new loan product, while 42.9% had no interest in this product. In total, 57.1% of

the surveyed farmers were interested in this kind of product even if it required an increased interest rate. Moreover, Shaanxi province had a slightly higher percentage of both moderately and very interested (59%) farmers than Gansu province (55%). This indicates that the majority of China's northwest farming households were not adverse to this new product, and some even were very interested in it.

Table 8

*Variables Included in the Ordinal Regression Model*

Type	Variable (Expected sign)	Description	Mean (S.E.)		
			Shaanxi	Gansu	Total
Agricultural production	$Y$	New loan product (not at all interested = 1, moderately interested = 2, very interested = 3)	1.76 (0.033)	1.71 (0.035)	1.74 (0.024)
	$X_1(+)$	Agricultural acreage (Hectare)	0.39 (0.101)	0.48 (0.240)	0.43 (0.127)
	$X_2(+)$	Rented agricultural acreage (Hectare)	0.09 (0.170)	0.03 (0.079)	0.06 (0.098)
Debt	$X_3(+)$	Increase farm size (strongly disagree = 1, disagree = 2, agree = 3, moderately agree = 4, strongly agree = 5)	3.32 (0.063)	2.59 (0.066)	2.98 (0.047)
	$X_4(-)$	Denied a loan by RCC (no = 0, yes = 1)	0.43 (0.023)	0.55 (0.025)	0.49 (0.017)
	$X_5(-)$	Debt (no = 0, yes = 1)	0.64 (0.022)	0.69 (0.022)	0.66 (0.016)
RCC	$X_6(+)$	Last debt for production agriculture (no = 0, yes = 1)	0.25 (0.021)	0.1 (0.017)	0.19 (0.014)
	$X_7(-)$	Too far to travel (strongly disagree = 1, disagree = 2, agree = 3, moderately agree = 4, strongly agree = 5)	1.71 (0.037)	1.71 (0.040)	1.71 (0.027)
	$X_8(-)$	Too long in approving loan (strongly disagree = 1, disagree = 2, agree = 3, moderately agree = 4, strongly agree = 5)	2.78 (0.062)	2.9 (0.059)	2.84 (0.043)
Risk	$X_9(-)$	Too much paper work (strongly disagree = 1, disagree = 2, agree = 3, moderately agree = 4, strongly agree = 5)	2.81 (0.062)	2.75 (0.060)	2.78 (0.043)
	$X_{10}(+)$	Accepting greater production risks to increase the chance of higher profits (not willing to = 1, not very willing to = 2, neutral = 3, slight willing to = 4, willing to = 5)	3.68 (.066)	3.38 (.079)	3.54 (.051)
	$X_{11}(-)$	Sex of respondent (male = 0, female = 1)	0.26 (0.020)	0.33 (0.023)	0.29 (0.015)
Basic characteristics	$X_{12}(+)$	Education (never = 0, elementary school = 1, completed elementary school = 2, high school = 3, completed high school = 4, university or college = 5, completed university or college = 6)	3.01 (0.059)	2.28 (0.078)	2.66 (0.050)
	$X_{13}$	Province (Gansu = 0, Shaanxi = 1)	-	-	0.53 (0.017)

**Ordinal Regression Model**

Suppose response variable  $Y$  has  $k$  ordered outcomes, 1, 2, ...,  $k$ , given a vector of covariates  $x$ , the  $j$ th outcome has a probability of  $\pi_j(x) = P(Y = j/X = x)$ , where  $\pi_1(x) + \dots + \pi_k(x) = 1$ . Let  $\tau_j(x) = P(Y \leq j/X = x) = \pi_1(x) + \dots + \pi_j(x)$  be the  $j$ th cumulative probability. The proportional odds model is defined as

$$\text{Logit}\{\tau_j(x)\} = \ln\{\tau_j(x)/(1 - \tau_j(x))\} = a_j - \beta X, j = 1, \dots, k - 1 \quad (1)$$

It is not a mistake that there is a minus sign instead of the customary plus sign before the coefficients for the predictor variables. A minus sign is used in this model to ensure the probability that the higher level of the outcome is increased by the greater value of  $\beta X$ .

Each logit has its own  $a_j$  term but the same coefficient. That means that the effect of the independent variable is the same for different logit functions. The  $a_j$  terms, called the threshold values, are often of little



interest. They are like the intercept in a linear regression and are used in the calculations of predicted values.

Because an ordinal regression model is defined in terms of the log odds of the cumulative probability, a proportional odds model is also known as a cumulative odds model.

In this article, the dependent variable, “would you be interested in the new loan product”, had three interval levels: “Not at all interested” = 1; “Moderately interested” = 2; “Very interested” = 3.

To explore the influence factors on whether or not farming households were interested in the new loan product, this paper hypothesized that there were five variable categories, including 13 variables that had a significant influence on the interest of farming households. Variable selection and information are shown in Table 8.

## Results and Discussion

Table 9 shows the degree of influence that the factors had all farming households’ interest in the new loan product.

Among the variables of agricultural production,  $X_1$  is negative, significant at the 10% level, representing that the greater the agricultural acreage owned by farming households, the less interest they showed in the new loan product. In contrast,  $X_3$  is statistically significant at the 1% level; therefore, those farming households who wanted to increase their farm size when they had the opportunity to do so, was statistically positive, significant at the 1% level. However, the number of rented farm land properties ( $X_2$ ) did not show a significant influence on the interest of farming households’ in the new loan product. The reason for this result is that the interest did not have a close relationship with the scale of agricultural acreage, but did with agricultural production efficiency. When agricultural production is efficient, farming households like to try new methods to further increase or maximize production efficiency.

Among the variables of debt, the statistic results of  $X_4$  show there was no significant difference of interest between farming households that had been denied a loan and those that had obtained a loan. Compared with farming households who had outstanding debts ( $X_5 = 1$ ), farming households with no debt had very little interest in the new loan product, and is statistically significant at the 1% level. Meanwhile, the result for  $X_6$ , which is significant at the 5% level, shows us that if money was last borrowed for agriculture production, then most farming households were interested in the new loan product.

The two variables,  $X_7$  and  $X_8$ , among RCC variables, are statistically significant at the 10% and 5% level, respectively. Using this dataset, it is difficult to explain why “it is too far to travel to the RCC ( $X_7$ )” had a significantly positive effect on farming households’ interest in the new loan product. The probable reason is that the data for this value was not ideal. The variable, “RCC requires too much paper work” ( $X_9$ ) rarely influenced farming households’ interest, however, “a long time in approving the loan” ( $X_8$ ) reduced the interest level of households in the new loan product.

The variable  $X_{10}$ , which explains the farming households risk attitudes to agricultural production, is statistically significant at the 5% level. Farming households would like to accept greater production risks to increase the chance of higher profits, which means they prefer new farming tools and methods.

The basic characteristics of  $X_{11}$  and  $X_{13}$  are statistically positive, significant at the 5% level. In addition,  $X_{11}$  shows that male respondents were more interested in the new loan product than female respondents. The area variable ( $X_{13}$ ) shows that farming households in Gansu province had a greater interest in this product, perhaps because their farms suffer more weather risks than those in Shaanxi province. Education background

( $X_{12}$ ) was not a main factor that influenced farming households' interest. The probable reason for this result is because new technology is out of their reach, most farmers rely on their own experience when farming.

According to the above results (see Table 9), farming households in Shaanxi and Gansu showed different levels of interest in the new loan product. Table 10 explores the influence factors of these two provinces' farming households.

Table 9

*Results (Total)*

Type	Variable	Estimate	Std. Error
Agricultural production	Threshold (1)	-0.002	0.404
	Threshold (2)	2.008***	0.411
	$X_1$	-0.041*	0.022
	$X_2$	0.009	0.022
Debt	$X_3$	0.205***	0.052
	$X_4$	-0.167	0.142
	$X_5$	-0.466***	0.157
	$X_6$	-0.429**	0.183
RCC	$X_7$	0.171*	0.089
	$X_8$	-0.164**	0.081
	$X_9$	-0.027	0.079
	$X_{10}$	0.111**	0.048
Risk	$X_{11}$	0.36**	0.161
	$X_{12}$	-0.00037	0.050
	$X_{13}$	0.308**	0.157
(-2 Log Likelihood; Sig.)		(1498.679; 0.000)	

Note. \*, \*\*, and \*\*\* stand for 10%, 5%, and 1% respectively.

Table 10

*Results (Shaanxi and Gansu Provinces)*

Type	Variable	Shaanxi province		Gansu province	
		Estimate	Std. Error	Estimate	Std. Error
Agricultural production	Threshold (1)	-0.798	0.567	0.798	0.641
	Threshold (2)	1.299**	0.569	2.741***	0.659
	$X_1$	-0.044	0.042	-0.032	0.026
	$X_2$	0.014	0.024	0.009	0.063
Debt	$X_3$	0.183***	0.069	0.240***	0.081
	$X_4$	-0.297	0.191	0.017	0.219
	$X_5$	-0.714***	0.202	-0.082	0.253
	$X_6$	-0.552**	0.214	-0.059	0.377
RCC	$X_7$	0.108	0.120	0.274**	0.136
	$X_8$	-0.209**	0.105	-0.093	0.130
	$X_9$	0.008	0.102	-0.081	0.129
	$X_{10}$	0.054	0.067	0.164**	0.070
Risk	$X_{11}$	0.371*	0.218	0.336	0.243
	$X_{12}$	-0.040	0.074	0.005	0.070
(-2 Log Likelihood; Sig.)		(846.976; 0.000)		(641.452; 0.005)	

Note. \*, \*\*, and \*\*\* stand for 10%, 5%, and 1% respectively.

As shown in Table 10,  $X_1$  and  $X_2$  are insignificant, and  $X_3$  is positive, significant at the 1% level in the two provinces. Compared with the regression results in Table 9, the reason for the insignificance of the agricultural acreage is because farming households in the same province have similar agricultural acreages.

Among the debt variables ( $X_4$ ,  $X_5$ , and  $X_6$ ), the results of Shaanxi province were similar with the results of

Table 9. However, in Gansu province, these three variables have little influence on farming households' interest in the new loan product.

There is some difference between Shaanxi and Gansu provinces regarding the three RCC variables. In Shaanxi province,  $X_8$  is negative, significant at the 5% level; however, in Gansu province,  $X_7$  is positive, significant at the 5% level. That is, farming households in Shaanxi province stated that the long time it took to approve the loan was the main reason for not having interest in the new loan product (rather than distance or excessive paper work). In contrast, in Gansu province, the long distance to the RCC office was the main constraint.

The influence of  $X_{10}$  on the interest of farming households in Shaanxi and Gansu provinces is different. It had an insignificant influence on farming households in Shaanxi province, but is significant at the 5% level in Gansu province.

The last two variables are  $X_{11}$  and  $X_{12}$ ; only  $X_{11}$  is significant at the 10% level in Shaanxi province, which is to say, compared with females, males in Shaanxi province were more interested in the new loan product. The differences between females and males were insignificant in Gansu province. The education level ( $X_{12}$ ) of the respondent did not show any significant influence on farming households' interest in the new loan product in both Shaanxi and Gansu provinces.

### Conclusions

To analyze the demand of northwest farming households for the new loan product, this article depicted the current formal financing situations of farming households in Shaanxi and Gansu provinces. This study especially focused on the main reasons why respondents were denied loans by the RCC, estimated the influence of weather risks on the output of staple crops and farming households' annual income, then determined the interest of farming households in the new product, and finally explored the influence factors for this new product, which is a combined formal financing and weather risks reduction production using an ordinal regression model.

According to our results, before the Chinese government, insurance institutions, formal financial institutions, and other relevant organizations develop or popularize a similar product, there is some groundwork to be done.

First, the Chinese government should develop relevant policies and subsidies to guide and support insurance and formal financing institutions, and local government has to support the larger farms and provide funds for subsidies.

Second, as agriculture acreage increases, farming households' interest in the new loan product decreases, so formal or insurance institutions should provide discount premiums for larger farms. Such a move could stimulate the farmers to buy the new risk prevention product, and it could provide an incentive for the transfer of arable land, and maximize production efficiency.

Third, formal or insurance institutions should develop rules to support poorer farming households who also need formal financing for agriculture production, for example, by charging lower interest rates.

Fourth, insurance and formal financing institutions should set lower thresholds to suit to local farmers' needs. Furthermore, formal or insurance institutions should improve their current service conditions to suit the province in which they are operating. For example, farming households in Shaanxi province are concerned about timeframes, while farming households in Gansu province find it inconvenient to go to RCC offices

because of the distance. Therefore, formal financing institutions in Shaanxi province should improve their operating efficiency to ensure shorter timeframes, and formal financing institutions in Gansu province should establish more branches in towns and villages. At the same time, local government should improve rural roads to make traveling easier.

Furthermore, because farms in Gansu province grow mainly traditional crops and are dependent on weather conditions, graduate schools should pay more attention to the development of high-quality seeds to maximize land use in Gansu province. Local government should also strengthen the agricultural infrastructure.

Each province has its unique conditions, as well as differences in the interest levels of females and males to the new loan product. There are also farming households that do not fully understand the new loan product. As such, relevant institutions, like formal or insurance institutions, should enlarge and increase the number of pilot sites and carry out promotional activities, including brochures, TV, radio, and other forms of marketing before popularizing the new loan product. These actions would both promote the product and help peripheral farmers to better understand this new product.

Last but not least, a reinsurance system must be established. As Roth, Ulardic, and Trueb, said: “Even though weather insurance could be sold through RCC, there still needs a reinsurance mechanism to cover excess exposure to systemic risks” (Roth, Ulardic, & Trueb, 2008).

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