

Stepping stone or stumbling block: Anchoring effect of crop insurance subsidies

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Funding information

NSFC-BMGF Joint Agricultural Research Project, Grant/Award Number: 72261147758; National Natural Science Foundation of China, Grant/Award Number: 72273065; Major Project of the National Social Science Foundation of China, Grant/Award Number: 23&ZD108

Abstract

This study examines how the anchoring effect created by long-term high premium subsidies leads to irrational crop insurance purchasing behavior among farmers. Using a randomized controlled trial, we show that the insurance experience of low premium generates an intrinsic anchoring effect and inhibits farmers' willingness to pay for new crop insurance through two main channels: price and perception. At the same time, farmers with small crop scale, limited disaster experience, and a diverse income structure are more susceptible to intrinsic anchoring impacts. In addition, the results suggest that the anchoring effect of high premium subsidies on farmers is difficult to change. This distortion of value perceptions counteracts the potential external anchoring effect of favorable information and further inhibits farmers' willingness to pay.

KEYWORDS

anchoring effect, crop insurance, willingness to pay

JEL CLASSIFICATION

D12 Q11 Q18

Résumé

Cette étude examine comment l'effet d'ancrage créé par des subventions élevées et durables aux primes d'assurance entraîne un comportement irrationnel chez les agriculteurs dans leurs choix d'assurance-récolte. À l'aide d'un essai contrôlé randomisé, nous montrons que l'expérience d'une assurance à faible prime génère un effet d'ancrage intrinsèque et freine la volonté des agriculteurs de payer pour une nouvelle assurance-récolte par deux canaux principaux: le prix et la perception. Par ailleurs, les agriculteurs exploitant de petites superficies, ayant une expérience limitée des sinistres et disposant de sources de revenus diversifiées sont plus sensibles à ces effets d'ancrage intrinsèques. De plus, les résultats indiquent que l'effet d'ancrage des subventions élevées sur les agriculteurs est difficile à modifier. Cette distorsion dans la perception de la valeur neutralise l'effet d'ancrage externe potentiel d'une information favorable et freine encore davantage la volonté de payer des agriculteurs.

1 | INTRODUCTION

Natural disasters consistently exert severe impacts on agricultural production. Crop insurance serves as an effective tool for risk management and can stabilize agricultural income (Key et al., 2008). The implementation of government subsidies on premiums is regarded as a strategic approach to encourage the adoption of crop insurance, thereby contributing to income stabilization and food security (Gunnsteinsson, 2020; Tuo, 2016).

However, the expanding scale of subsidies faces multiple challenges. While it is true that increasing subsidies can effectively boost the demand for crop insurance (Du et al., 2017; Matsuda & Kurosaki, 2019; Wong et al., 2020), an indiscriminate expansion of subsidies creates significant fiscal pressure, reduces social welfare (Hueth, 2000; Lusk, 2017), exacerbates moral hazard issues (Glauber, 2013; Goodwin & Smith, 2013), and can distort crop market prices, leading to a loss of resource allocation efficiency (Hueth, 2000; O'Donoghue et al., 2009). Furthermore, the increase in subsidies has not effectively improved farmers' knowledge and understanding of the value of crop insurance (Wang et al., 2020), and has failed to achieve the intended objectives of insurance subsidy policies. The question of how excessive premium subsidies might distort farmers' crop insurance demands and alter their value judgments regarding insurance is urgent.

Farmers' value judgments regarding crop insurance are influenced by various external factors. These include community communication (Cai et al., 2016, 2015), government messaging (Tang et al., 2022), personal experiences (Fu et al., 2022), and risk tolerance (Feng et al., 2020; King & Singh, 2020; Shin et al., 2022). Anchoring effect, an important part of prospect theory, have been studied in detail in a number of areas such as consumer purchasing behavior (Stewart, 2009; Zong & Guo, 2022), market prognostications (Ariely et al., 2003; Kaustia et al., 2008), and common-sense issues (McElroy & Dowd, 2007). However, there is a distinct lack of relevant research in the field of crop insurance that specifically addresses the anchoring effect. A long history of high premium subsidy policies may have led farmers to associate crop insurance with low costs, distorting their perception of the value of insurance and leading them to ignore the large financial subsidies behind low prices (Oppong Mensah et al., 2023). In addition, if the cost of insurance is too low, farmers may become indifferent to the actual content of the insurance; once the government promotes a new crop insurance, due to the lack of knowledge about insurance, farmers will rely more on their previous experience to evaluate the new insurance. These ingrained perceptions of value and product will have a significant anchoring effect and influence farmers' WTP and therefore crop insurance (Oppong Mensah et al., 2023). Therefore, there is a need to determine whether the experience of crop insurance under high premium subsidy policies leads to anchoring effect that distort farmers' insurance purchasing decisions, and ultimately to explore how anchoring effects affect farmers' insurance demand.

This study analyses the distorting effect of crop insurance experience under high premium subsidy policies on farmers' future insurance purchasing behaviour. It finds that long-term high premium subsidies can significantly distort farmers' value judgments regarding crop insurance, alter their purchasing decisions, and lead to intrinsic anchoring effects. This effect occurs primarily through historical price and insurance cognition. The extent of these distorting effects varies, with more pronounced impacts observed among farmers who place less emphasis on insurance. Additionally, we conduct an experiment on extrinsic anchoring effects, demonstrating that farmers are more susceptible to external influences that result in a lower willingness to pay (WTP) for insurance. The distorting impact of this experience with inexpensive insurance is challenging to overcome, making it more difficult to increase farmers' WTP.

Compared to previous studies, the marginal contributions of this research are as follows: First, it elucidates for the first time the distorting effect of excessive premium subsidies on farmers' crop insurance purchasing behavior. Second, it demonstrates that the impact of misperceived insurance value on farmers' crop insurance purchasing decisions is long-lasting and further inhibits their WTP for insurance. Third, this study makes a detailed distinction between the various pathways and degrees of distortion caused by the anchoring effect on farmers' insurance purchasing decisions, providing a theoretical foundation for understanding the causes of low willingness to purchase insurance.

The following is the planned content arrangement for the remainder of this paper. Section 2 describes the relevant background and the theoretical framework of the study. Section 3 describes the experimental design and data sources. Section 4 describes the regression model and experimental data. Section 5 presents empirical results and conducts relevant analysis. Section 6 provides conclusions.

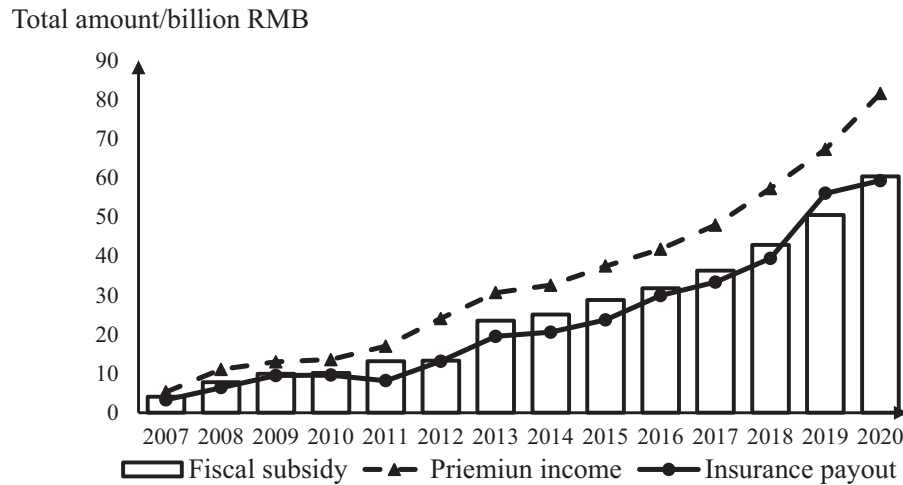


FIGURE 1 Development of crop insurance in China. The data comes from the China statistical yearbook.

2 | BACKGROUND AND THEORETICAL FRAMEWORK

2.1 | Background

2.1.1 | Development of crop insurance programs in China

Since 1982, China has been actively developing crop insurance. Initially, the country adopted a commercial operational model. However, challenges in promoting crop insurance prompted a shift to a policy-driven model supported by government subsidies (Boyd et al., 2011; Wang et al., 2016). This strategy has significantly accelerated the development of agricultural insurance, positioning China as a global leader in this field. Between 2007 and 2020, the total premium income for crop insurance surged from RMB 5.3 billion to an impressive RMB 81.5 billion¹. Meanwhile, government subsidies for crop insurance premiums rose to RMB 60.4 billion, resulting in a subsidy rate of nearly 80%, which highlights the government's substantial investment in this sector².

Crop insurance coverage in China has expanded dramatically, bolstered by substantial subsidies. Official figures indicate that by 2022, insurance coverage for the country's major food crops is expected to exceed 70%. As the insurance industry evolves, the Chinese government has implemented measures to introduce and develop new varieties of crop insurance (as shown in Figure 1).

As a pioneer in crop insurance in China, Jiangsu Province ranks among the top regions in the country in terms of insurance scale. By 2022, the crop insurance premium income in Jiangsu reached RMB 6.428 billion, bolstered by RMB 3.267 billion from higher levels of government support, positioning the province among the leaders nationwide. During that year, Jiangsu not only enhanced its crop insurance program, achieving a depth ratio of 1.21%, but also attained 84% coverage for the three major staple grains—rice, wheat, and corn. This initiative provided 8.18 million farmers across the region with risk protection valued at RMB 161.5 billion.

Starting from 2021, Jiangsu Province promoted high-coverage insurance³ to promote food production stability. This insurance model surpasses traditional insurance by raising the potential payout ceiling and significantly enhancing farmers' income security and the stability of food production. According to the terms of the insurance policy, farmers can claim compensation from the insurance company if natural disasters, accidents, or epidemics lead to a yield reduction of more than 10%. The compensation amount increases linearly with the extent of the loss, up to a maximum of RMB 1000 per

¹ The exchange rate between the U.S. dollar and the Chinese RMB on April 16, 2024, will be 1 U.S. dollar to 7.24 Chinese RMB

² According to the No. 3486 Recommendation of the Second Session of the 13th National People's Congress, the proportion of premium subsidies for crop insurance provided by the Chinese government at all levels has reached nearly 80%

³ China's Central Document No. 1 of 2020 proposes to develop high-coverage insurance with higher levels of protection than the old insurance. The new crop insurance referred to in this study is the new insurance promoted by the Chinese government.

mu⁴. Thanks to joint subsidies from the central, provincial, and local governments, which cover 70% of the costs, farmers are only required to pay RMB 12 per mu.

2.1.2 | Challenge of misvaluation of crop insurance

Despite strong support from the Government of China, challenges persist in the development of crop insurance due to excessive subsidies and irregularities. In economically developed provinces such as Jiangsu, local governments often increase subsidy rates to meet ambitious crop insurance coverage targets. At times, the government fully subsidizes farmers' premiums to enhance their WTP. The strategy employed by insurance companies and the government involves refunding premiums to farmers who have not incurred losses, effectively covering the entire cost of insurance (Hou et al., 2011; Park et al., 2020). This approach may diminish farmers' perception of the true value of crop insurance, leading them to regard it as merely an investment. Furthermore, practices that violate regulations—such as mandatory insurance, village governments purchasing insurance on behalf of farmers, and collective signing of policies—may hinder farmers from fully understanding the value of insurance and generating genuine demand for it (Ghosh et al., 2021).

2.2 | Theoretical framework

Low premiums, supported by a long history of high subsidies, may have masked the true value of crop insurance and discouraged farmers' WTP for crop insurance. Even if the government tries to introduce new high-quality crop insurance policies, it will be difficult to change this effect, which is fundamentally due to the distorted perception of the value of insurance and the inability of farmers to rationally evaluate different crop insurance policies. In addition, this value distortion, which is rooted in the subconscious, may be difficult to reverse and may inhibit farmers' demand for insurance in the long run.

Because of the problems of high premiums and low coverage, governments have used high premium subsidies as a policy tool to enable farmers to buy crop insurance at very low cost. However, the longevity of this policy has led to two key implications that can arise when governments introduce new crop insurance policies. First, the low prices themselves distort farmers' perceptions of the value of insurance. While the premium subsidy may have reduced the financial pressure on farmers, at the same time the price has become a key factor in distorting farmers' WTP. Chronically low prices directly limit farmers' valuation of insurance, anchoring farmers' WTP at a low level and leading to minimal additional costs that farmers are willing to pay for crop insurance, even if it improves quality.

On the other hand, high subsidy policies that encourage farmers to purchase crop insurance do not actually promote the improvement of farmers' insurance knowledge. When confronted with new insurance, farmers' lack of knowledge about new insurance leads them to rely too much on their past experience, which in turn reduces their WTP and inhibits their acceptance of new insurance products (Bystranowski et al., 2021; Yang et al., 2018). This irrational behavior in the purchase of new insurance due to one's own insurance experience is influenced by the intrinsic anchoring effect. Of course, based on the theories of Tversky and Kahneman (1974) and Zong and Guo (2022), this study defines the intrinsic anchoring effect as the influence of past experiences or cognitions on the subconscious during the decision-making process, which leads to distortions in an individual's current behavioral decisions.

In addition, once farmers develop misperceptions about crop insurance, it becomes increasingly difficult to reverse these perceptions and increase their WTP. Theoretically, extrinsic anchors that contribute to the perceived value of insurance can increase farmers' WTP (Thorsteinson et al. 2008). However, due to the distorted perceptions of insurance value, efforts to increase farmers' WTP through extrinsic anchoring effect⁵ are often ineffective. In particular, when farmers receive external information unfavorable to the value of insurance, the inherent impression of low crop insurance value left by historical experience deepens. This leads them to believe that even if the government introduces high quality insurance, it will not be able to provide effective risk diversification.

⁴ 1 hectare = 15 mu

⁵ The extrinsic anchoring effect refers to the phenomenon of cognitive bias in which an individual's final judgement is systematically biased towards an externally provided initial reference value when making numerical estimates or decision-making judgments. Its key feature is that the source of the anchor point is completely independent of the individual's own knowledge or internal expectations, and the effect remains significant even when the anchor point is clearly irrelevant or random.

Overall, the continued high level of premium subsidies significantly distorts farmers' valuation of crop insurance. Historical insurance experience, through low premiums and cognitive deficits, creates strong anchors that influence farmers' insurance choices and significantly limit their WTP. This subconsciously biased behavior is difficult to correct, and even if the government were to provide higher quality insurance, it would still be a non-trivial task to change farmers' inherent perceptions.

3 | EXPERIMENTAL DESIGN AND IMPLEMENTATION

In this study, we conducted a randomized controlled trial (RCT) to assess the anchoring effect of inexpensive insurance experiences on farmers' future decisions regarding the purchase of crop insurance in seven major grain-producing counties⁶ in Jiangsu Province, China. We randomly selected villages and farm households based on the following criteria. First, we chose villages from three prefecture-level cities: Huai'an, Suqian, and Yancheng, located in northern Jiangsu Province. The selected villages were situated within the seven primary grain-producing counties of these three cities, where the main crops cultivated by local farmers are wheat and rice. Second, the sample farmers had to be wheat farmers who either currently purchase or have previously purchased wheat insurance and possess a basic understanding of crop insurance. Additionally, these farmers are expected to remain engaged in agricultural production activities in the future to ensure that their crop insurance needs do not change significantly. Third, farmers must be capable of clear thinking and communication, allowing them to interact effectively with the researchers and comprehend the questions posed during the experiment. Ultimately, we randomly selected 365 farm households from 36 villages within the experimental area.

The randomized intervention trial was conducted in March 2023, in collaboration with the local insurance company to ensure the smooth execution of the trial. Additionally, we partnered with the local government to notify village chiefs, facilitating the research team's efforts to gather villagers and arrange the research site at the village office of each community. This setup allowed us to concentrate on the farmers and conduct the experiment at the same time. To prevent the exchange of information among farmers in different villages, we organized the field operations of the Randomized Controlled Trials (RCT) in various villages within the same county continuously and without interruption. To ensure significant variability in data quality across areas, research teams in different villages were randomly selected. Sample farmers were also chosen randomly from the local population, with approximately ten farmers per village.

Questionnaires were administered on a one-on-one basis, and prior to administration, farmers were informed about the purpose and duration of the questionnaire, as well as the importance of providing truthful responses regarding themselves and their families. During the completion of the questionnaire, farmers were prohibited from consulting others, either verbally or by telephone, to ensure the validity of the sample data and to mitigate the issue of homogeneity. To eliminate potential bias and avoid information overlap between the intrinsic and extrinsic anchoring effects tests, we included a survey on participants' family background, agricultural production, and personality traits between the two tests. The entire questionnaire took between one and one-and-a-half hours to complete, with no breaks allowed, and farmers were required to finish the questionnaire in one sitting. It is important to note that the insurance products introduced in the two trials were distinct; they are referred to as wheat insurance and rice insurance, respectively, with differing maximum indemnity amounts. This differentiation was implemented to prevent any direct influence of one trial on the other, thereby enhancing the integrity of the trials.

The design of the intrinsic anchoring effects experiment⁷ is illustrate in Figure 2. The experiment was structured with two types of intervention information: an insurance price intervention and an insurance knowledge intervention⁸. Consequently, farmers were randomized into four groups to receive different interventions. Control group (A1): farmers were directly asked about the WTP of the new crop insurance; they did not receive any additional informational interventions, but only basic information about the product. Price group (A2): After presenting basic information about the insurance, the interviewer asked farmers about the price of the wheat insurance they purchased in the previous period. If the farmer did not purchase insurance in the previous period or forgot the price, the interviewer asked them about the price of other crop insurance they had previously purchased. The interviewer then proceeded to ask them about their WTP for the new

⁶ China's administrative divisions are categorized into three main levels, ranked from highest to lowest: provincial-level, prefecture-level, and county-level. The three cities where the research was conducted are classified as prefecture-level administrative districts, while the seven primary grain-producing counties are designated as county-level administrative districts, operating under the jurisdiction of their respective city governments.

⁷ The experimental questionnaire for the intrinsic anchoring effect is displayed in Appendix B.

⁸ The test questions used to test farmers' level of knowledge about crop insurance are displayed in Appendix D

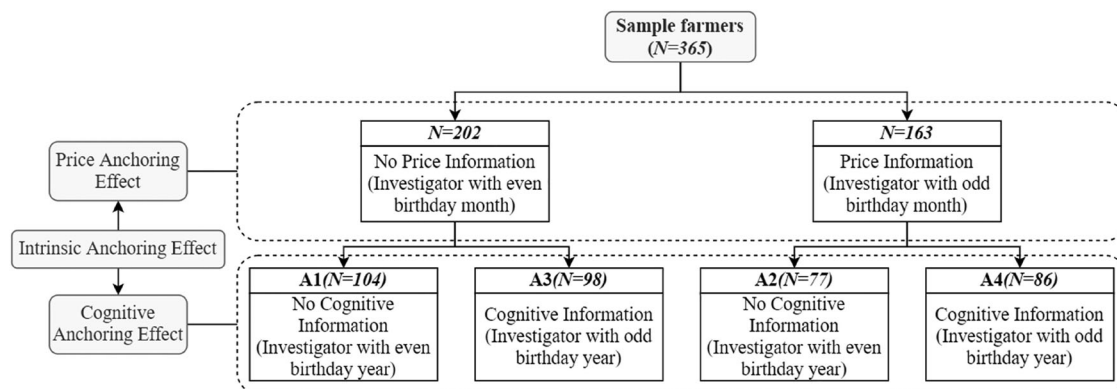


FIGURE 2 Intrinsic anchoring effect experiment design. The number of sample farmer in each group is shown in parentheses.

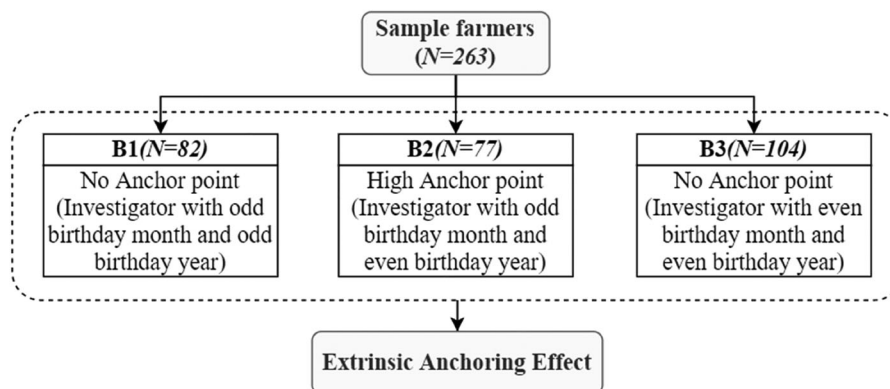


FIGURE 3 Extrinsic anchoring effect experiment design. The number of sample farmer in each group is shown in parentheses.

insurance policy. Knowledge group (A3) was asked a series of questions about their knowledge of insurance prior to learning about the insurance product, as detailed in Appendix D. The questions dealt with the basic elements of an insurance contract, and farmers were not told whether their answers were correct or incorrect after answering the questions, but were simply reminded of their previous insurance experience, usage, familiarity, and so forth, by the knowledge test. Subsequently, their WTP was assessed. The crossover group (A4) received two types of information interventions. The farmers were first asked questions about experience, followed by asking the farmers what was the price of the wheat insurance they had purchased, and then finally asking them about their WTP for a new insurance. Similarly, farmers in this group who were completely unable to articulate the price of the insurance they had purchased in the past were excluded in order to ensure that the results of the experiment were valid.

The design of the extrinsic anchoring effect experiment⁹ is shown in Figure 3. Following the conventional setup of previous studies, we set high and low anchor point based on the collected data to test the effect of random irrelevant information on farmers' WTP for new insurance. In another field experiment we conducted on crop insurance in 2021, farmers' average WTP for crop insurance at that time was around RMB 25. Therefore, the high anchoring point was set to be twice the average WTP, at RMB 50, while the low anchoring point was 1/2 the average WTP, at RMB 12.50, rounded to RMB 10. It is important to note that the specific values of the high and low anchoring points do not affect the experimental results of this study.

In order to ensure the reasonableness of the high and low anchoring point settings, we only set the anchoring point based on our previous data experience to avoid setting too outrageous a value that would lead to bias in the experimental results. Therefore, the high anchoring point can be set to any number above the average WTP, while the low anchoring point can also be set to any number below the average WTP. However, in order to ensure that the high and low anchoring points are not too high or low relative to farmers' actual WTP, this study statistically analyses the WTP of farmers in the control group of the intrinsic anchoring effect experiment and the control group of the extrinsic anchoring effect experiment. The

⁹ The experimental questionnaire for the extrinsic anchoring effect is displayed in Appendix C.

results show that the number of farmers in the control group of the intrinsic anchoring effect experiment whose WTP for insurance is less than RMB 10 per mu is 20, accounting for 19.23%, and the number of farmers whose WTP is more than RMB 50 per mu is 24, accounting for 23.08%. In the outer anchoring effect experiment, the number of farmers in the control group whose WTP for insurance is less than RMB 10 per mu is 15, accounting for 18.29%, and the number of farmers whose WTP is more than RMB 50 per mu is 24, accounting for 29.27%. This shows that setting high and low anchoring points does not make the external anchoring effect disappear because it is too extreme.

Before the start of the experiment, we explicitly informed farmers that the upcoming insurance product was for rice crops and confirmed that all participants had experience in growing rice. Farmers were then randomly assigned to three different groups to receive different information interventions. In the experiment, the investigator first presented participants with information about rice insurance and subsequently inquired about their WTP for the insurance. Uniquely, before asking about their WTP, the researcher asked them whether they thought the rice insurance was below or above RMB 50 or 10 per mu, and then asked them what the maximum price they would be willing to pay for this insurance was. This approach builds on previous relevant research and is appropriately adapted for crop insurance (Adaval & Wyer, 2011; Bergman et al., 2010; Jacowitz & Kahneman, 1995; Yoon et al., 2019). The exact experimental procedure is detailed in Appendix B. Furthermore, the study was designed to ensure that the extrinsic anchoring effect on farmers' WTP arises solely from the influence of irrelevant anchoring values, rather than from prior insurance experience. Consequently, farmers were only asked whether they were willing to buy insurance at a specified price, without providing any additional positive or negative information about that price. The specific groupings are outlined below.

Control group (B1): After presenting the basic information about the rice insurance product, the interviewer directly asked the farmers about their WTP for the product. High anchor point group (B2): After presenting the basic information about the insurance product, the interviewer first asked the farmers whether they were willing to purchase the insurance at the high anchor point price. Subsequently, interviewers continued to ask farmers about their WTP, whether or not they were willing to purchase insurance at a high anchor point price. Low Anchor Point Group (B3): After presenting the information about the insurance product, the interviewer first asked the farmers if they were willing to purchase the insurance at a low anchor point price. The interviewer then continues to ask them about their WTP.

This experiment was designed to identify the effects of arbitrarily set high and low prices (extrinsic anchoring effect) on farmers' decision-making process for purchasing new crop insurance, thus providing insights into how extrinsic anchoring effects distort farmers' valuation and purchasing behavior.

The randomized grouping of the two experiments adhered to the methodology proposed by Angsist & Krueger (1991). This approach leveraged the lack of correlation between respondents and farmers for random grouping, thereby enhancing the validity of the data. To distinguish the experimental group from the control group, the study randomized participants based on the parity of their birth year and month. This strategy ensured the randomization of the experimental data and minimized potential bias. By employing this uncorrelated and arbitrary attribute for grouping, the study aimed to enhance the completeness and reliability of the findings while reducing the likelihood of systematic bias in the results of the intervention that could influence farmers' WTP for new crop insurance.

4 | ESTIMATION STRATEGY AND DATA SUMMARY

4.1 | Estimation strategy

To analyze the influence of the intrinsic anchoring effect due to cheap insurance experiences on farmers' purchase decisions, the model is formulated as follows.

$$WTP_{1i} = \alpha_0 + \alpha_1 Price_i + \alpha_2 X_i + \epsilon_{1i} \quad (1)$$

$$WTP_{2i} = \beta_0 + \beta_1 Cog_i + \beta_2 X_i + \epsilon_{2i} \quad (2)$$

$$WTP_{3i} = \gamma_0 + \gamma_1 Price_i + \gamma_2 Cog_i + \gamma_3 Price_i \cdot Cog_i + \gamma_4 X_i + \epsilon_{3i} \quad (3)$$

Equation (1) is employed to examine the impact of price anchor point on farmers. The dependent variable WTP_{1i} represents farm i 's WTP for the experimental insurance, and $Price_i$ indicates whether the farm i is queried about the price of the previous insurance, with 0 denoting no and 1 denoting yes. Equation (2) is used to analyze the impact of cognitive

TABLE 1 Summary statistics of insurance WTP.

Group number	Wheat insurance				Rice insurance				No. of observations
	WTP		Percentage change	p-Value A1 = AX	WTP		Percentage change	p-Value B1 = BX	
	Mean	S.D.			Mean	S.D.			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
All sample	27.297	22.550							365
A1	33.423	26.838							104
A2	25.582	20.943	23.46%	0.035**					77
A3	23.844	20.508	28.67%	0.005***					98
A4	25.360	19.147	24.12%	0.021**					86
All sample					31.317	25.105			263
B1					36.323	29.584			82
B2					33.870	25.901	6.75%	0.580	77
B3					25.479	18.993	29.85%	0.003***	104

Note: Columns (1), (2), (3), and (4) show data from the intrinsic anchoring effects experiment. Columns (5), (6), (7), and (8) show data from the extrinsic anchoring effects experiment. Columns (1), (2), (5), and (6) show the mean and standard deviation of WTP for wheat insurance and rice insurance for each group. Columns (3) and (7) present the percentage change in the mean value of WTP of farmers in each experimental group as compared to the mean value of WTP of the respective control group. Columns (4) and (8) present the *t*-tests of each experimental group against their respective control groups, where AX = A2, A3, A4, BX = B2, B3. ****p*<0.01. ***p*<0.05. **p*<0.1.

anchor point on farmers. Model (3) is used to analyze the joint impact of cognitive anchor point and price anchor point on farmers. In these formulas, WTP_{2i} and WTP_{3i} represent farm i 's WTP for insurance, while Cog_i in Equation (2) signifies whether farm i has undergone a knowledge assessment of crop insurance, where 0 signifies no and 1 signifies yes. Equation (3) is used to verify the combined effect of the numerical anchor point (insurance price) and the non-numerical anchor (insurance knowledge) on farmers' WTP. To mitigate potential variations in WTP due to individual differences, this paper controls for the individual characteristics of farmers denoted as X_i . ϵ_{1i} , ϵ_{2i} , ϵ_{3i} are the unobservable random error terms.

Using an extrinsic anchoring effect experiment to measure the impact of external interventions on farmers' insurance purchase decisions, the following model was developed:

$$WTP_{4i} = \theta_0 + \theta_1 High_i + \theta_2 Low_i + \theta_3 X_i + \epsilon_{4i} \quad (4)$$

WTP_{4i} represents the WTP of farmers for the experimental insurance in the extrinsic anchoring effect experiment. $High_i$ and Low_i are dummy variables indicating whether the farm i is influenced by the high and low anchor points, respectively. To control the potential variations in WTP arising from individual differences, this model controls for the individual characteristics of farmers denoted as X_i . ϵ_{4i} is the unobservable random error term.

4.2 | Data summary

4.2.1 | Insurance WTP

Given the challenges of market pricing of crop insurance (Heinzen & Bridges, 2008), the Contingent Valuation Method (CVM) was utilized to capture farmers' genuine WTP. Employing a binary choice method to align with farmers' actual WTP, Table 1 presents the average WTP for wheat and rice insurance. The maximum payout for wheat insurance stood at RMB 1000 per mu, while for rice insurance, it was RMB 1300 per mu. Farmers exhibited a higher average WTP for rice insurance (RMB 31.32 per mu) compared to wheat insurance (RMB 27.30 per mu). This indicates that farmers can assess their perceived insurance value based on different product contents. Even when solely comparing the two experimentally untreated control groups, the WTP for rice insurance was RMB 36.32 per mu, exceeding the RMB 33.42 per mu for wheat insurance.

The intrinsic anchoring effect experiment showed a significant difference in WTP between the intervention and control groups. Figure 4 depicts the probability density distribution of WTP for wheat insurance, which is significantly clustered at a lower level of WTP for farmers in the experimental group compared to the control group. Table 1 demonstrates the

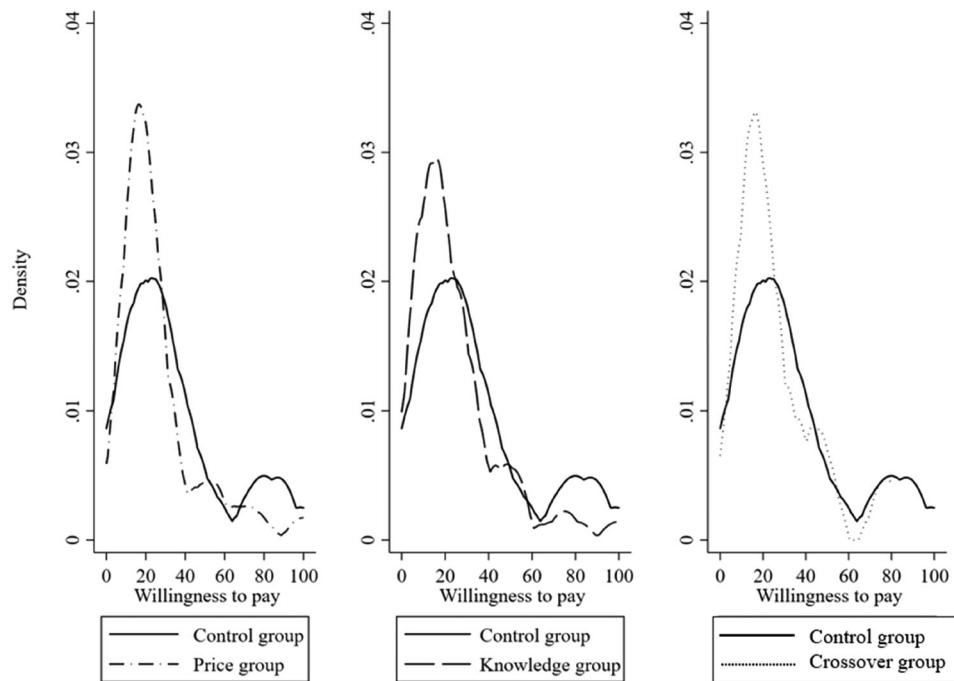


FIGURE 4 WTP in intrinsic anchoring effect experiment. In the three figures, the titles of the vertical axes are unified, with a single title positioned on the far left side for clarity. Each figure displays the probability density curves of the control group, which remain consistent across all figures. To avoid information overlap, each figure incorporates a unique set of experimental groups. The control group in each figure is the A1 group in the intrinsic anchoring effect experiment; the Price group is the A2 group, in which farmers are subjected to the price information intervention; the Knowledge group is the A3 group, in which farmers are subjected to the cognitive information intervention; and the Crossover group is the A4 group, in which farmers are subjected to both the price and cognitive information interventions.

WTP analysis for different groups of farmers in the two rounds of the anchoring effect experiment. Specifically, farmers' WTP was significantly lower in group A2 at RMB 25.58/mu, which was 23.46% lower than the control group. Among all the intervention groups, group A3 had the lowest WTP of RMB 23.84 /mu, which was 28.67% lower than the control group. Group A4 had a WTP of RMB 25.36/mu, which was 24.12% lower than the control group. These findings emphasize the profound impact of farmers' previous experience with low-cost insurance on their future decisions to purchase new crop insurance. Notably, the simultaneous application of the two types of interventions did not further reduce WTP. In fact, the cognitive intervention alone produced the lowest average WTP, suggesting that an overabundance of information may cause farmers to ignore or minimize the impact of this information, thus reducing the effectiveness of the information intervention (Lee & Morewedge, 2022). However, this issue is beyond the scope of the current study and will not be explored further.

The results of the intervention groups in the extrinsic anchoring effects experiment varied. Figure 5 shows the probability density plot of WTP for rice insurance in the extrinsic anchoring effect experiment. The average WTP for group B2 was RMB 33.87 per mu, which was only a 6.75% decrease from the control group, while group B3 had a WTP of RMB 25.48 per mu, which was a significant decrease of 29.85% from the control group. These results suggest that farmers are more sensitive to low anchor point but less responsive to high anchor point. Thus, it appears that the intrinsic anchoring effect from farmers' prior insurance experience has a spillover effect on the extrinsic anchoring effect. Detailed regression analyses in subsequent parts of the study are expected to shed further light on the complexity of these effects.

4.2.2 | Insurance prices

In order to thoroughly assess the impact of crop insurance pricing on the results of the study, the price at which each group of farmers purchased crop insurance was carefully analyzed. This step was critical in determining whether there were significant differences between the groups that could have biased the results. It is important to note that farmers who were not previously asked about the price of crop insurance will receive additional questioning in subsequent questionnaires. By comparing the prices of crop insurance that have been purchased by each group of farmers, it is possible to circumvent the

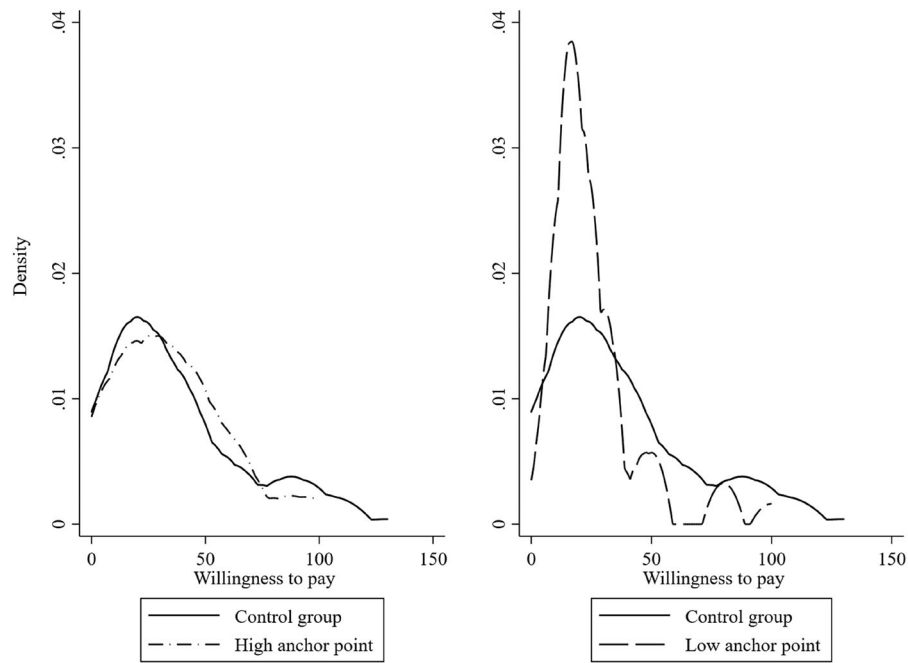


FIGURE 5 WTP in extrinsic anchoring effect experiment. In the two figures, the titles of the vertical axes are unified, with a single title positioned on the far left side for clarity. Each figure displays the probability density curves of the control group, which remain consistent across all figures. To avoid information overlap, each figure incorporates a unique set of experimental groups. The control group in each figure is the B1 group in the extrinsic anchoring effect experiment; the High anchor point group is the B2 group, in which farmers are subjected to the high anchor point intervention; the Low anchor point group is the B3 group, in which farmers are subjected to the low anchor point intervention.

TABLE 2 Summary statistics of purchased insurance prices.

Group number	Wheat insurance premium			Rice insurance premium			No. of observations
	Mean	S.D.	<i>p</i> -Value	Mean	S.D.	<i>p</i> -Value	
	(1)	(2)	A1 = AX (3)	(4)	(5)	B1 = BX (6)	
All sample	12.034	6.086					365
A1	11.985	6.785					104
A2	11.504	4.345	0.586				77
A3	11.234	6.210	0.413				98
A4	13.482	6.230	0.118				86
All sample				13.698	11.445		263
B1				14.048	11.121		82
B2				13.031	6.810	0.491	77
B3				13.917	14.186	0.946	104

Note: Columns (1), (2), and (3) show premium data for wheat insurance purchased by farmers. Columns (4), (5), and (6) show premium data for rice insurance purchased by farmers. Column (7) shows the sample size of each group. Columns (1), (2), (4), and (5) show the mean and standard deviation of premium for wheat insurance and rice insurance. Columns (3) and (6) present the *t*-tests of each experimental group against their respective control groups, where AX = A2, A3, A4, BX = B2, B3. ****p* < 0.01. ***p* < 0.05. **p* < 0.1.

possibility that the insurance experience of farmers in one group is fundamentally different from that of farmers in other groups. This approach supports the validity of the experimental data for the intrinsic anchoring effect. Also, it ensures that these details do not interfere with the assessment of the extrinsic anchoring effect, which presupposes the influence of irrelevant external information.

As shown in Table 2, a detailed review of the data indicates that there are no substantial differences in the prices paid for wheat and rice insurance across groups. This suggests that any initial bias associated with insurance pricing did not exist

between the experimental groups. In the next step, the study will use regression analysis to rigorously verify the validity of the random sampling and the overall integrity of the experimental design. This phase of analysis is critical to ensure that the observed results can be attributed to the experimental intervention and not to pre-existing differences in insurance pricing or other uncontrolled variables.

4.2.3 | Individual characteristics

To assess the impact of anchoring effects on farmers' decisions to purchase crop insurance, we carefully considered relevant characteristics of farmers (see Table S5). This comprehensive examination included a range of individual characteristics. The demographic composition of the survey participants was predominantly male, and most respondents did not hold any position in the village. The average level of insurance awareness among farmers was 0.52. In addition, we considered attributes related to farmers' risk awareness. The mean score for disaster experience was 0.52. The results of farmers' risk appetite assessed according to the methodology of Belissa et al. (2020) showed that the mean risk attitude score of farmers was 4.175, indicating a general preference for risk aversion among the farmer group¹⁰. Finally, the analysis also considered farmers' production-related characteristics. The data showed that farmers, on average, cultivated 147.8 mu¹¹. The main source of income for the respondents was agricultural production, with non-agricultural income accounting for 22.9% of their total annual income.

4.3 | Statistical analysis

In this section, we will assess the randomness of the sample using the Probit estimation model, and the specific results are presented in Table S6. The regression test is conducted with the following equation:

$$\text{Group}_{ij} = \gamma_0 + \gamma_1 X_k + \epsilon_{5k} \quad (4)$$

Where Group_{ij} denotes the combination of farmers in groups i and j , where $i = A1, A2, A3$ and $j = A1, A2, A3, A4$, and $i \neq j$. In Group_{ij} , farmers from group i are assigned 0, and those from group j are assigned 1. X_k encompasses the characteristics of farmer k , including basic individual features such as gender, age, education level, village cadre status, Communist Party membership, and having relatives working in financial institutions related to insurance companies. It also includes planting features like the average annual output value per mu of wheat in the past 3 years, the scale of wheat cultivation, and whether they have experienced natural disasters in the past 3 years. Additionally, risk features include whether there has been a shortage of funds in the past 3 years and the farmer's risk attitude. The regression results showed that the differences in characteristics between groups were generally not significant, which ensured that the results of the follow-up study were not affected by significant differences between groups. This also highlights the effectiveness of randomized grouping on trial data in both trials.

5 | RESULTS AND DISCUSSIONS

To assess the impact of anchoring effects on farmers' decisions to purchase crop insurance, this section will first explore how the intrinsic anchoring effect affects farmers' propensity to purchase new crop insurance. Then, this section will examine how differences among farmers alter the distorting effects of the anchoring effect based on farmer heterogeneity. In addition, this analysis will examine the role of extrinsic anchoring effects in distorting farmers' insurance WTP. We

¹⁰ We measured farmers' risk preferences by designing a gambling game where they had to choose between two options. One option involved a guaranteed amount of money, while the other option had a 50% chance of receiving a certain amount of money and a 50% chance of receiving nothing. The specific rules of the game will be presented in Appendix A

¹¹ According to the definition criteria for large-scale agricultural operating households in the third national agricultural census plan of China, in regions with one crop per year, households with a planting area of 100 mu or more are considered large-scale cultivation households. In areas with two or more crops per year, households with a planting area of 50 mu or more are considered large-scale cultivation households. The geographical location of Jiangsu determines that its crops generally have two to three harvests per year, hence the criteria for large-scale households are planting areas of 50 mu or more

TABLE 3 The impact of intrinsic anchoring effects on farmers' insurance WTP.

Variables	Insurance WTP						Intrinsic anchoring effect	
	A1+A2		A1+A3		A1+A4		(7)	(8)
	(1)	(2)	(3)	(4)	(5)	(6)		
Price	−7.841** (3.685)	−6.512* (3.850)					−7.841** (3.352)	−7.499** (3.354)
Knowledge			−9.579*** (3.376)	−10.034*** (3.472)			−9.579*** (3.139)	−9.518*** (3.139)
Price and knowledge					−8.063** (3.450)	−6.410* (3.617)	−8.063** (3.250)	−6.389* (3.253)
Control variable		Controlled		Controlled		Controlled		Controlled
Constant	33.423*** (2.403)	22.945** (11.524)	33.423*** (2.351)	25.606*** (10.316)	33.423*** (2.321)	18.903*** (9.922)	33.423*** (2.186)	19.695*** (7.109)
No. of observations	181	181	202	202	190	190	365	365
R ²	0.02	0.15	0.04	0.16	0.03	0.13	0.03	0.12

Notes: Columns (1) and (2) separately tested the anchoring effects of the price information group, where Column (1) did not include control variables, and Column (2) included control variables. Columns (3) and (4) individually examined the anchoring effects of the cognitive information group, with Column (3) without control variables and Column (4) including control variables. Columns (5) and (6) independently assessed the anchoring effects of the price and cognitive groups, where Column (5) lacked control variables, and Column (6) included control variables. Columns (7) and (8) simultaneously tested the anchoring effects of all three experimental groups, where Column (7) did not include control variables, and Column (8) included control variables. The numbers in parentheses are standard errors. *** $p < 0.01$. ** $p < 0.05$. * $p < 0.1$.

also further investigate the interaction between intrinsic and extrinsic anchoring effects shaped by previous insurance purchase experiences.

5.1 | Baseline results

Table 3 examines the effect of anchoring effect on farmers' crop insurance WTP using ordinary least squares (OLS). From the results presented in Columns (1), (3), and (5), it is shown that prior crop insurance pricing and level of insurance knowledge significantly reduces farmers' WTP for future crop insurance purchases. The effect of price information is statistically significant at the 5% level, while the effect of insurance knowledge intervention is statistically significant at the 1% level. In addition, the combined effect of the joint intervention of both information on WTP was also recognized at 5% level of significance.

The regression results are made more precise by including relevant control variables and regional factors at the commune level. As shown in Columns (2), (4), and (6) of Table 3, the price intervention and the knowledge intervention have a significant negative impact on farmers' decision to purchase crop insurance, producing a significant anchoring effect. In addition, Columns (7) and (8) present a pooled analysis for the three experimental groups, the latter including control variables. The results are consistent with those derived from the individual regression models for each experimental group. Specifically, the insurance price information intervention significantly reduces farmers' crop insurance WTP by about RMB 7.50 per mu compared to the control group. Similarly, the insurance knowledge intervention based on past experience significantly reduced WTP by about RMB 9.52 per mu compared to the control group. Farmers' WTP in the experimental group with both price and knowledge interventions also significantly decreased by about RMB 6.39 per mu.

The findings suggest that when farmers are faced with the option of upgrading their crop insurance, they tend to utilize the premiums of previously procured crop insurance as a benchmark. The experience of acquiring insurance at a reduced cost invariably diminishes farmers' propensity to pay for new crop insurance. In addition to conventional numerical anchors, such as premium levels, non-numerical information, including an individual's experience, memory, or cognitive capacity, can also influence an individual's decision-making and behavior, thereby generating an anchoring effect. The study by Esch et al. (2009) suggests that consumers link product features to more recognizable brands and permanently change their perceptions. Qiu et al. (2024) demonstrated that low risk anchoring and a lack of experience with unintentional injuries significantly reduce workers' risk perceptions and increase their tendency to adopt unsafe behav-

TABLE 4 Robustness test for insurance WTP.

Variables	Insurance WTP			
	1% from both ends		5% from both ends	
	(1)	(2)	(3)	(4)
Price	−7.841** (3.352)	−7.507** (3.353)	−8.267*** (3.099)	−7.958** (3.108)
Knowledge	−9.579*** (3.139)	−9.520*** (3.140)	−10.107*** (2.902)	−10.061*** (2.910)
Price and knowledge	−8.063** (3.250)	−6.389* (3.253)	−7.716** (3.004)	−6.252** (3.014)
Control variable	Yes		Yes	
Constant	33.423*** (2.186)	19.636*** (7.100)	33.135*** (2.021)	21.169*** (6.580)
No. of observations	365	365	365	365
R ²	0.03	0.12	0.04	0.13

Notes: Columns (1) and (2) present the regression results for winsorizing 1% of the data from both ends on farmers' WTP for wheat insurance, where Column (1) did not include control variables, and Column (2) included control variables. Columns (3) and (4) present the regression results for winsorizing 5% of the data from both ends on farmers' WTP for wheat insurance, where Column (3) did not include control variables, and Column (4) included control variables. The numbers in parentheses are standard errors. *** $p < 0.01$. ** $p < 0.05$. * $p < 0.1$.

iors. Baryshevtsev et al. (2020) posited that individuals with stuttering problems will associate fear and anxiety with others based on their own experiences when they developed stuttering problems.

In light of this, this study aims to underscore the intrinsic anchoring effect. To this end, farmers will be administered an insurance knowledge test to elicit recollection of their own insurance experiences and thereby amplify the impact of these experiences on their perceptions. Additionally, the test will solicit their perceptions regarding the novel insurance, instilling a sense of uncertainty and prompting them to rely on their prior experiences with insurance products they have previously procured. This reliance will serve as a foundation for drawing analogies to the new insurance policy.

5.2 | Robustness tests

5.2.1 | Tail reduction

After considering the impact of outliers in the sample on the regression outcomes, this study initially carries out robustness checks via tail-trimming (refer to Table 4). Table 4 presents the adjusted regression findings. To ascertain the robustness of these results, we engaged in two rounds of tail-trimming: the first round involved trimming 1% from each end of the WTP distribution, and the second involved a 5% trim. The regression analyses reveal that the findings align with the primary regression outcomes, showing significant negative effects, even after adjusting for potential extreme values within the sample data. This consistency underscores the durability of our estimates, highlighting that farmers' inherent anchoring continues to significantly diminish their WTPs for crop insurance going forward.

5.2.2 | Exchange control group

In order to minimize experimental bias caused by differences between farmers, this study used a rotating control group approach to assess robustness (see Table 5). By designating a different experimental group as the control group and conducting regression analyses with other experimental groups and the original control group, this study aimed to isolate the effect of anchoring effects on WTP. Table 5 illustrates these regression results. Specifically, Columns (1) and (2) benchmark the price group against the other groups. Similarly, the knowledge group serves as the control group in Columns (3) and (4) for a similar comparative analysis. Finally, Columns (5) and (6) benchmark the crossover group against the other groups in a comparative analysis. The results of the analyses show that there is no significant difference in WTP between the experimental groups as a result of the intervention. However, the control group has a significantly higher WTP than the one of experimental group, highlighting the reliability of the estimates.

TABLE 5 Robustness test for substituting control group.

Variables	Insurance WTP					
	Control group = A2		Control group = A3		Control group = A4	
	(1)	(2)	(3)	(4)	(5)	(6)
No intervention	7.841** (3.352)	7.507** (3.353)	9.579*** (3.139)	9.520*** (3.140)	8.063** (3.250)	6.389* (3.253)
Price			1.738 (3.396)	2.013 (3.390)	0.221 (3.498)	−1.118 (3.514)
Knowledge	−1.738 (3.396)	−2.013 (3.390)			−1.517 (3.295)	−3.131 (3.274)
Price and knowledge	−0.221 (3.498)	1.118 (3.514)	1.517 (3.295)	3.131 (3.274)		
Control variable		Yes		Yes		Yes
Constant	25.582*** (2.541)	12.129* (7.240)	23.844*** (2.252)	10.117 (6.937)	25.360*** (2.404)	13.248* (6.913)
No. of observations	365	365	365	365	365	365
R ²	0.03	0.12	0.03	0.12	0.03	0.12

Notes: This table shows the differences in insurance WTP among different experimental groups after using each group as a control group. Columns (1), (3), and (5) present the regression results without control variables, while columns (2), (4), and (6) present the results with control variables. The numbers in parentheses are standard errors. *** $p < 0.01$. ** $p < 0.05$. * $p < 0.1$.

5.2.3 | Control of historical premium

In order to verify that this intrinsic anchoring effect is not just caused by the experimental intervention, but is an effect that is pervasive and would naturally occur when farmers purchase insurance, this subsection incorporates the farmer's historical premium variable into the regression model to test whether it has a significant effect on the farmer's WTP, thus ensuring that the study's findings are robust. In addition, we also included the historical premium variable in the models of the price information intervention test and the cognitive information intervention test to clarify whether the price information intervention has an incentive effect on farmers through historical premiums, and whether there is an alternative mechanism of action between the cognitive information intervention and the influence pathway of historical premiums. Furthermore, to ensure that the only pathway through which the price information intervention has an impact is the historical insurance price, we also replace the dependent variable with the difference between the farmer's WTP and historical prices. The specific regression results are shown in Table 6.

Column (1) of the Table 6 shows that even if farmers are not subjected to any informational intervention, the premiums of the insurance policies previously purchased by farmers significantly and positively affect their WTP for new insurance policies, that is, the lower the price of the previously purchased insurance policies, the lower farmer's WTP. The results in Column (2) confirm that the price information intervention does affect farmers' WTP through the route of historical premiums, and when the variable of historical premiums is included, the significance of the price information intervention is absorbed by it and becomes insignificant. In other words, the anchoring effect does not depend on our reminders, but has been internalized in the behavioral decisions of farmers. In addition, we further conducted a Fisher's Permutation test on the coefficients of the historical price variables in Column (1) and Column (2). The results show that there is no significant difference in the coefficients between the two groups at the statistical significance level of 1%. The results in Column (3), on the other hand, suggest that the anchoring effect due to farmers' insurance perceptions follows a different pathway from that of historical prices, and that the cognitive information intervention still dampens farmers' WTP to purchase new insurance to some extent after the inclusion of historical premiums.

In Column (4), the effect of the price information intervention is not significant as the dependent variable is changed to the difference between WTP of insurance and historical premiums, which again confirms that historical prices themselves affect the WTP of insurance in the long run. The findings demonstrate that the influence of intrinsic anchoring effects is not dependent on external stimuli and is a universal phenomenon, enhancing the robustness of the findings. In other words, even without additional interventions with farmers, lower historical prices would significantly reduce farmers' WTP for new crop insurance.

TABLE 6 Robustness test for controlling historical premium.

Variables	Insurance WTP			WTP-Premium A1+A2
	A1 (1)	A1+A2 (2)	A1+A3 (3)	
Premium	1.233*** (0.440)	0.936*** (0.322)	0.695** (0.273)	
Price		−6.006 (3.774)		−5.972 (3.758)
Knowledge			−9.361*** (3.429)	
Control variable	Yes	Yes	Yes	Yes
Constant	5.490 (17.083)	12.133 (11.868)	18.955* (10.493)	11.399 (11.206)
No. of observations	104	181	202	181
R ²	0.21	0.19	0.19	0.14

Notes: This table shows the results of the regression with the inclusion of the historical premium variable. Column (1) regresses the control group sample alone, and columns (2) and (3) regress the price and knowledge groups separately from the control group sample. Column (4) uses the difference between WTP and premiums as an explanatory variable to test whether the price information intervention significantly reduces the gap between the two. The numbers in parentheses are standard errors. *** $p < 0.01$. ** $p < 0.05$. * $p < 0.1$.

5.3 | Heterogeneity analysis

5.3.1 | Planting scale

Differences in the likelihood of disaster determine differences in the need for crop insurance between large and small farmers. Large-scale farmers with mechanized farming are more vulnerable to natural disasters due to the large area under cultivation, and therefore crop insurance measures must be strengthened. In contrast, small-scale farmers, who are mainly intensive farmers, are more likely to invest their costs in farming activities and have a relatively weaker need for crop insurance.

Our analysis categorizes farmers based on the size of their operations. Farmers with less than 50 mu are considered small farmers, while those with 50 mu or more are categorized as large-scale growers. This study further investigates the effect of anchoring effect on different scales by gradually increasing 50 mu to determine a threshold value. Based on the regression results in Table 7, farmers were categorized by planting size as (1) and (2) representing 50 mu, (3) and (4) representing 100 mu, (5) and (6) representing 150 mu, and finally (7) and (8) representing 200 mu. The data suggest that small-scale farmers are primarily influenced by numerical anchors (insurance prices), while non-numerical anchors (insurance information) fail to influence their WTP for new insurance. In contrast, large-scale farmers show a significant anchoring effect in response to the information intervention, with price factors having a negligible effect on their WTP.

Small-scale farmers have a lower demand for crop insurance and tend to favor lower-priced policies because of the limited scope of their operations and the fact that they can reduce risk through individual farming practices. In addition, these farmers are less aware of the complexity of insurance, have a lower measure of its value themselves, and are susceptible to the price-anchoring effect. On the contrary, large-scale farmers face increasing risks due to the fact that they operate on a much larger scale than small farmers, and therefore must adopt more risk mitigation strategies and higher insurance coverage. As a result, these farmers need to incur higher crop insurance costs and be more knowledgeable about the nuances of insurance. This difference in knowledge leads large-scale farmers to disregard the price factor when purchasing insurance, but their pre-existing sense of insurance prevents them from evaluating new insurance products, which affects their WTP.

5.3.2 | Disaster situation

Crop insurance is an important tool for spreading the risks associated with agricultural production and cushioning income fluctuations caused by unfavorable events, and farmers' experience of disasters greatly influences their evaluation of crop insurance. For farmers who have never been exposed to natural disasters, pests, or diseases, the role of crop insurance

TABLE 7 Heterogeneity in the planting scale on farmers' insurance WTP.

Variables	Insurance WTP							
	50mu		100mu		150mu		200mu	
	<	≥	<	≥	<	≥	<	≥
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Price	−9.907*	−4.529	−8.731*	−6.409	−8.999**	−3.816	−9.536**	−4.079
	(5.272)	(4.498)	(4.701)	(5.044)	(4.367)	(5.125)	(4.205)	(5.442)
Knowledge	−6.124	−10.287**	−9.165**	−8.637*	−10.347**	−5.207	−10.352***	−6.862
	(4.955)	(4.192)	(4.372)	(4.778)	(4.101)	(4.782)	(3.894)	(5.208)
Price and knowledge	−6.777	−6.949	−5.433	−8.164	−6.941*	−8.040	−6.996*	−8.136
	(4.883)	(4.645)	(4.454)	(5.362)	(4.141)	(5.513)	(3.902)	(6.046)
Control variable	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	12.369	30.451***	11.162	35.580***	22.067**	19.702*	21.514**	25.862**
	(13.682)	(9.012)	(11.942)	(9.923)	(9.044)	(11.545)	(8.649)	(11.962)
No. of observations	179	186	225	140	258	107	277	88
R ²	0.15	0.21	0.12	0.22	0.12	0.34	0.11	0.43

Notes: This table illustrates the impact of the intrinsic anchoring effect on different scales of planting households. Initially using 50 mu as the dividing line, Columns (1) and (2) respectively show cases where the planting area is greater than and less than 50 mu. Subsequently, 50 mu are incrementally added as new dividing lines. Columns (3) and (4) have a dividing line of 100 mu; Columns (5) and (6) have a dividing line of 150 mu; Columns (7) and (8) have a dividing line of 200 mu. The numbers in parentheses are standard errors. *** $p < 0.01$. ** $p < 0.05$. * $p < 0.1$.

TABLE 8 Heterogeneity in the disaster situation on farmers' insurance WTP.

Variables	Insurance WTP						
	No disasters	Year of disaster			Number of disasters		
		2022	2021	2020	Once	Twice	Three times
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Price	−9.799*	0.601	0.208	−10.091	−11.558	−8.192	−10.091
	(5.116)	(5.725)	(6.875)	(6.193)	(8.081)	(10.191)	(6.193)
Knowledge	−11.294**	−6.205	−2.994	−9.329	−10.671	−4.161	−9.329
	(4.794)	(5.275)	(6.731)	(6.155)	(6.560)	(11.810)	(6.155)
Price and knowledge	−11.513**	1.850	−2.961	−6.325	5.960	−6.176	−6.325
	(4.966)	(5.082)	(5.441)	(5.088)	(7.774)	(12.572)	(5.088)
Control variable	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	31.002***	4.687	20.092	43.252***	1.355	10.981	43.252***
	(10.193)	(11.981)	(13.323)	(14.075)	(16.732)	(20.921)	(14.075)
No. of observations	176	106	63	48	90	51	48
R ²	0.13	0.42	0.51	0.67	0.37	0.51	0.67

Notes: Column (1) is for households that have never experienced disasters, columns (2), (3), and (4) are for households that experienced disasters in 2022, 2021, and 2020, respectively. Columns (5), (6), and (7) are for households that experienced disasters for one year, two years, and three years, respectively. The numbers in parentheses are standard errors. *** $p < 0.01$. ** $p < 0.05$. * $p < 0.1$.

is difficult to highlight. Due to their lack of experience, they may underestimate the likelihood and severity of potential disasters, and thus are less likely to invest in quality insurance that provides more coverage. In addition, these farmers may be more susceptible to information interventions that may affect their WTP for new crop insurance.

Table 8 shows the regression results, where Column (1) exhibits a significant intrinsic anchoring effect using farmers who have not suffered a disaster in the past three years as the study population. This result suggests that misjudgment of the probability and severity of disasters significantly enhances the anchoring effect and thus reduces their WTP. Subsequent Columns (2) to (4), which categorize farmers according to their disasters in the past one, two and three years, respectively, indicate no anchoring effect. Similarly, Columns (5) through (7) correspond to farmers who experienced one, two, or three disasters in the past three years, respectively, and also show no anchoring effect. These results suggest that disaster-affected farmers have a higher awareness of the protective role of crop insurance, and their focus is on increasing

TABLE 9 Heterogeneity in the income structure on farmers' insurance WTP.

Variables	Insurance WTP		Off-farm work (exclude investment, business activities)
	Pure farming (1)	Off-farm work (2)	
Price	−2.816 (4.809)	−13.049*** (4.673)	−13.033*** (4.853)
Knowledge	−5.000 (4.422)	−13.845*** (4.276)	−13.736*** (4.501)
Price and knowledge	0.343 (4.407)	−14.250*** (4.629)	−14.033*** (4.898)
Control variable	Yes	Yes	Yes
Constant	18.824** (9.124)	25.476** (10.234)	24.944** (10.768)
No. of observations	162	203	193
R ²	0.19	0.25	0.25

Notes: Column (1) represents pure farming households whose income solely comes from agricultural production activities. Column (2) represents mixed-income households engaged in agriculture, with income sources including agricultural production, off-farm employment, individual business operations, investments, etc. Column (3) represents households engaged in both farming and off-farm work, with income derived solely from agricultural production and off-farm employment. The numbers in parentheses are standard errors. *** $p < 0.01$. ** $p < 0.05$. * $p < 0.1$.

the level of coverage rather than just considering the cost of insurance. As a result, when crop insurance with higher levels of protection is available, farmers who have suffered disasters are willing to pay higher costs to improve their ability to combat disasters, even if the level of premiums increases.

5.3.3 | Income structure

The structure of farmers' incomes influences the importance they place on the stability of their farm incomes. Some farmers supplement their income with non-agricultural work, which serves as a buffer against fluctuations in farm income. In contrast, purely agricultural households that rely exclusively on agricultural production for their livelihoods are more vulnerable to natural disasters. This vulnerability highlights the fact that farmers who rely solely on agricultural income have a greater need for risk-spreading instruments to safeguard their farm income, and therefore have a higher demand for crop insurance and a higher WTP for insurance with higher levels of coverage.

This study classifies farmers based on their income composition in order to explore how income structure affects farmers' sensitivity to anchoring effects in purchasing insurance. Table 9 presents the results of the regressions describing the differences in the intrinsic anchoring effect between farmers with non-farm income and pure farmers. Columns (1) and (2) show comparative results highlighting the different effects on these two groups. In addition, Column (3) provides an in-depth analysis that excludes income from investment or business activities to more accurately determine the impact of differences in sources of income on anchoring effects. The data suggest that the decision of pure farmers to purchase crop insurance is not influenced by their past insurance experience. However, farmers with off-farm income were highly influenced by past experience and external information and exhibited a significant anchoring effect that had a significant negative impact on their WTP to purchase crop insurance.

This part of the analysis emphasizes the impact of differences in the income structure of farm households on the distorting effects of the anchoring effect. When farmers have relatively abundant sources of income, even if agricultural production is affected by natural disasters and production is reduced, farmers can ensure their daily expenses through other sources of income. Therefore, compared with this type of households, purely agricultural households have a single income structure, which makes them more in need of crop insurance to ensure the stability of their income from agricultural production, and therefore less likely to be affected by the anchoring effect.

TABLE 10 The impact of extrinsic anchoring effects on farmers' WTP for rice insurance.

Variables	Insurance WTP				Extrinsic anchoring effect	
	B1+B2		B1+B3			
	(1)	(2)	(3)	(4)	(5)	(6)
High anchor point	−2.453 (4.421)	−3.506 (4.808)			−2.453 (3.925)	−3.044 (4.072)
Low anchor point			−10.844*** (3.579)	−10.016*** (3.711)	−10.844*** (3.652)	−11.070*** (3.758)
Control variable		Yes		Yes		Yes
Constant	36.323*** (3.077)	14.547 (14.667)	36.323*** (2.676)	21.618** (10.195)	36.323*** (2.731)	20.710** (9.277)
No. of observations	159	159	186	186	263	263
R ²	0.00	0.11	0.05	0.17	0.04	0.12

Notes: This table presents the regression results of the extrinsic anchoring effect. Columns (1) and (2) separately show the regression results for the high anchor point group, with Column (1) without including control variables and Column (2) including control variables. Columns (3) and (4) separately present the regression results for the low anchor point group, with Column (3) without including control variables and Column (4) including control variables. Columns (5) and (6) display the overall regression results for the extrinsic anchoring effect, with Column (5) without including control variables and Column (6) including control variables. The numbers in parentheses are standard errors. *** $p < 0.01$. ** $p < 0.05$. * $p < 0.1$.

5.4 | Extrinsic anchoring effect

This part aims to shed light on the long-lasting effects of the long-term experience of purchasing cheap crop insurance on farmers' perceptions. Regression analyses of experimental data on extrinsic anchoring effect are used to verify the extent to which different intervening information affects farmers' WTP for insurance.

Table 10 presents the regression results associated with the extrinsic anchoring effect using the OLS regression model. In Columns (1) and (2), the high anchoring point experimental group is included in the model separately and compared to the control group. The inclusion of the relevant control variables in Column (2) suggests that farmers are not significantly affected by high anchor points, as evidenced by the non-significant regression coefficients. Columns (3) and (4) present the regression results for the experimental group with low anchoring points. The results show that low anchoring points have a significant negative effect on farmers' WTP at the 1% level of statistical significance. Columns (5) and (6) contain both the high and low anchoring point groups and the results are consistent with the results of the individual regression models. Farmers in the low-anchor point experimental group experienced a decrease in average WTP of about RMB 11.07/mu compared to the control group. The direction of the effect of the control variables is consistent with the expected results.

Our findings reveal a subtle relationship between the two anchoring effects, an area that has not been fully explored in the existing literature. Through a randomized intervention experiment, this study finds that not all extrinsic anchors affect farmers' insurance purchasing behavior, which differs from previous findings. The ineffective distortion of decision-making by high anchor points can be attributed to farmers' long-term exposure to low-cost crop insurance options. This exposure leads to a misjudgment of the value of crop insurance, associating it with lower prices, thus making farmers insensitive to higher anchor points. At the same time, it amplifies the distortions caused by lower anchor points, thus exacerbating the anchoring effect's dampening effect on farmers' WTP for crop insurance.

6 | CONCLUSION

Premium subsidy policies play a pivotal role in alleviating farmers' economic burdens of crop insurance. However, the long-term provision of low-cost insurance resulting from high subsidy ratios may distort farmers' valuation of insurance, reduce their WTP, and constrain the future development of crop insurance. Drawing on the theory of anchoring effects, this study innovatively explains the potential relationship between premium subsidies and farmers' insurance demand, and clarifies the fundamental reason why the continuous increase in the scale and proportion of premium subsidies in China has failed to stimulate sustained growth in farmers' insurance demand, and the sustained downturn in the demand for farmers' insurance.

Our results reveal that farmers' experience of purchasing low-cost insurance over time significantly distorts their perception of crop insurance value and inhibits their WTP for new crop insurance products. This finding is fundamentally linked to the anchoring effect, which restricts the enhancement of farmers' WTP, leading to misjudgments about the true value of new insurance and hindering informed decision-making. The distorting effect of anchoring arises not only from numerical anchors such as historical premiums but also from non-numerical anchors such as cognitive frameworks about crop insurance. In addition, the intrinsic anchoring effect from high premium subsidies is distinctly group-specific, with groups in which insurance is more important being less susceptible to the intrinsic anchoring effect. The study also identifies that farmers with smaller planting scales, limited disaster experience, and adequate household income demonstrate more pronounced internal anchoring effects. Furthermore, internal anchoring effects stemming from limited insurance experience produce spillover effects that alter the magnitude of external anchoring effects on farmers. Specifically, farmers become unresponsive to high-anchor information designed to enhance perceived insurance value while remaining highly sensitive to low-anchor information that undermines perceived value, resulting in a significant declines in WTP.

Due to space constraints, this study has several limitations that warrant further exploration in future research. First, restricted by data availability, all data used in this study were collected from Jiangsu Province, China, without validation in other regions, which may limit the generalizability of the findings. Second, the research does not delve into strategies for mitigating or eliminating anchoring effects. However, based on the results, it is proposed that governments could improve farmers' insurance literacy and emphasize the substantial fiscal subsidies behind low-cost insurance to correct misperceptions of insurance value. Lastly, the study does not fully investigate whether appropriately lowering high anchor points in external anchoring effects could re-stimulate positive impacts on farmers' WTP. Future research may consider designing optimal high anchor points to leverage external anchoring effects and promote growth in farmers' WTP through policy interventions.

CONFLICT OF INTEREST STATEMENT

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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How to cite this article: Hu, M., Yi, F., & Zhou, H. (2025). Stepping stone or stumbling block: Anchoring effect of crop insurance subsidies. *Canadian Journal of Agricultural Economics/Revue canadienne d'agroeconomie*, 1–21. <https://doi.org/10.1111/cjag.70008>