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Risk preference and willingness to participate in the futures market: Evidence from cotton and jujube enterprises of China

An Cheng[1], Xinru Han[2]* and Mahmood Ahmad[3]

[1]Wu Jinglian School of Economics, Changzhou University, Changzhou, China, [2]Institute of Agricultural Economics and Development, Chinese Academy of Agricultural Sciences, Beijing, China, [3]Business School, Shandong University of Technology, Zibo, China

Since the instability and uncertainty are mounting on the international landscape, it is urgent and necessary to explore the risk awareness and risk management capabilities of leading agricultural enterprises in China. Based on a survey of 219 enterprises, we build a logit model and estimate the impact of risk preference and price risk perception of leading cotton and jujube enterprises on their willingness to participate in the futures market. We further explore the moderating effect of the price risk perception on the relationship between risk preference and willingness to participate in the futures market. Results show that the risk preference and price risk perception of leading enterprises have a significant positive impact on their willingness to participate in the futures market, and the proportion of the mediating effect in the total effect is calculated to be 35.1%. Therefore, risk management instruments suitable for various types of leading enterprises and segmentation of training courses are suggested to optimize the effectiveness of China's cotton and jujube futures market.

Introduction

With the promotion of rural revitalization and modernization of agriculture and rural areas in China, Chinese agricultural enterprises have continually improved their asset scale and operating capacity (Chen, 2020; Duan et al., 2020; Han, 2020; Zhang et al., 2022a; Zhang et al., 2022b). Chinese agricultural enterprises have become the driving force for agricultural industrialization: they have bridged the gap between small farmers and large markets, raised farmers' incomes, and promoted innovation in agricultural management and practices (Liu and He, 2018).

However, due to the rapid rise in local living standards and food consumption of residents and the sharp decline in tariffs on agricultural products following China's accession to the World Trade Organization, its agricultural products have become increasingly dependent on foreign trade (Huang et al., 2004; Carter et al., 2009; Han

X. et al., 2019; Xue et al., 2021). Furthermore, agricultural products in the Chinese market are more sensitive to fluctuations in international market prices, resulting in increased operational risks for leading agricultural enterprises (Martin, 2001; Veeck et al., 2020). In this paper, leading agricultural enterprises are defined as those with a relatively large scale and a strong industrial driving force.

As a result, the loss probability of such enterprises has increased sharply because of their limited ability to cope with risks (Brandt et al., 2017; Peng et al., 2020b; Peng et al., 2021a; Zhao et al., 2021). Furthermore, a severe reduction has been observed in their capacity to achieve long-term, stable, and efficient development, to protect their own interests, and to expand production scales (Peng et al., 2020a; Liu et al., 2022; Zhao et al., 2022). Recently, the production and operation of several Chinese agricultural enterprises have been severely affected due to new developments, such as the Sino-US trade friction and the COVID-19 pandemic (Han J. et al., 2019; Li et al., 2020a; Zhang et al., 2020). Therefore, it is urgent and necessary to explore the risk awareness and risk management capabilities of leading agricultural enterprises in China.

In recent years, risk management instruments have become popular among agricultural enterprises (Just and Pope, 2002; Hao, 2010). Among these, futures are the only instruments that use standardized contracts as trading objects and employ open bidding to form a highly organized and professional market operation system, thereby keeping information centralized and accessible (Antoniou and Holmes, 1995). Therefore, the price discovery function of the agricultural product futures market can be effectively brought into play. Moreover, because the futures market has risk management functions, agricultural business entities often choose to use futures to manage their risks when the price of agricultural products fluctuates significantly.

China's futures market has also developed continuously due to marketization (Peng et al., 2021b), and futures prices are increasingly being used for agricultural risk management. Agricultural commodity futures prices have emerged as the basis for the pricing of risk-averse agricultural commodity futures in China, as well as the creation of risk-compensated futures products. Agricultural commodity futures prices have provided new means for agricultural business entities to effectively manage risk (An, 2018).

Over the last few years, researchers have been increasingly interested in the field of risky decision-making behaviour (Elahi et al., 2021b; Han et al., 2021; Elahi et al., 2022a). Previous studies have been conducted from a variety of perspectives and have produced meaningful results. For instance, Menapace et al. (2015) tested the analysis methods for the effectiveness of risk decision behaviour and confirmed that the results obtained by designing a reasonable investigation mechanism to assess the effect of risk decision-making on farmers are stable and credible. Some studies also analysed the specific influencing factors of the risk decision-making behaviour of agricultural producers and

concluded that risk preference, risk perception, weather changes, natural disasters, age, and education level can exert significant impacts (Leiserowitz, 2005; Harrison et al., 2007; Abid et al., 2018; Akhtar et al., 2018; Rizwan et al., 2020). Hellerstein et al. (2013) found that risk-averse agricultural producers were less willing to choose diversified operations and unwilling to use risk management instruments. van Winsen et al. (2016) found that the risk attitude of Belgian agricultural producers had a significant impact on their risk-hedging decision-making, but the impact of risk perception was not significant.

However, relatively few studies have examined the impact of risk decision-making on agricultural business entities in China. For instance, Fang et al. (2019) shed light on farmers' willingness to participate in the "insurance and futures" pilot program. Shang et al. (2020) investigated the relationship between farmers' perceptions of risk and their willingness to use risk management tools. Chen and Wei (2019) examined the impact of poor farmers' risk preferences on their risk management strategies. However, similar studies are typically conducted from the perspective of individual farmers. They did not provide analysis from the perspective of agricultural business entities. Many other studies have focused on industrial sector for estimating risk and environment nexus (Elahi et al., 2019a; Zhao et al., 2020; Zhong et al., 2020; Cheng et al., 2021; Zhong et al., 2021). Chinese leading agricultural enterprises constitute the main body of risk management in the futures market, which should be addressed in full.

The lack of research on leading agricultural enterprises has made it difficult to objectively understand the risk preference and risk management practices of leading agricultural enterprises. Therefore, it is difficult to determine the factors influencing the willingness of China's leading enterprises to participate in the futures market from the perspective of behavioural economics. It is evident that leading agricultural enterprises are highly efficient producers, but due to the complex circumstances of the market economy, it is not yet known whether these enterprises have adequate risk management capabilities. Therefore, it is necessary to enhance enterprise risk awareness and management so that they can contribute more actively to rural revitalization and agricultural modernization.

Northwest China is the main region for the production of cotton and jujube. In this region, the Chinese government has been conducting risk training activities in-depth for agricultural operators for many years. Further, cash crops, such as cotton and jujube, are effective instruments for poverty alleviation in China (Li et al., 2020b). Therefore, to compensate for the deficiencies in existing studies, leading domestic enterprises in the cotton and jujube industries were selected for the current investigation. This study makes two primary contributions to the literature. First, based on first-hand survey data, the current situation of leading Chinese enterprises' risk preference, price risk perception, and willingness to participate in the futures market is assessed. Second, we identify the impacts of risk preference, price risk

TABLE 1 Summary of research conclusions on the relationship between risk preference and willingness to take risks.

Literature	Main conclusions
Weber et al. (2013)	Risk preference is the main influencing factor of risk taking, however this relationship shows uncertainty over time
Kandasamy et al. (2014)	Risk preference is highly dynamic, and risk-taking decisions based on highly dynamic risk preference are uncertain
Cohn et al. (2015)	Fear leads to an increase in the subject's risk aversion, which in turn leads to a decrease in risky investment in the market.
König-Kersting and Trautmann (2018)	The effect of fear on risk aversion and market risky investment may only work for financial professionals
Guiso et al. (2018)	Faced with a negative shock, individuals are affected by risk aversion emotion that alters their willingness to take risk in financial markets
Aragó et al. (2022)	Less risk-averse subjects are more likely to participate in the asset market when the volatility is high

perception, and the interaction between the two on leading enterprises' willingness to participate in the futures market and the possible mediating effect of price risk perception.

The remainder of this article is organized as follows. First, a logit model is used to empirically test the impact of leading enterprises' risk preference and price risk perceptions on the willingness to participate in the futures market (Elahi et al., 2018b; Elahi et al., 2019c; Elahi et al., 2021a). Second, we discuss the interaction effect between risk preference and price risk perception on leading enterprises' willingness to participate in the futures market. Third, the possible mediating effect of leading enterprises' price risk perception on risk preference and willingness to participate in the futures market is empirically analysed. We find that the risk preference and price risk perceptions of leading enterprises have a significant positive impact on the willingness to participate in the futures market. Their price risk perception positively moderates the relationship between risk preference and willingness to participate in the futures market. Furthermore, their price risk perception has a mediating effect on the relationship between risk preference and willingness to participate in the futures market.

Materials and methods

Theoretical framework

Research on risk preference and risk decision-making behaviour originates from the investigation of individual behaviour. Prospect theory proposes that when people make risky decisions, they should not only rely on their analysis of assumptions based on the behaviour of rational people in traditional economics, but also consider people's cognitive biases. On this basis, risk decision theory grounded on risk preference and other uncertain conditions was introduced into economic research (Kahneman and Tversky, 1979), providing a new perspective for better analysis and interpretation of the relationship between enterprise risk preference and risk decision-making behaviour.

Existing research results indicate that the decision-making process of enterprises is usually affected by many factors, such as enterprise scale and strength, business philosophy, risk attitude, and information availability (Zhang et al., 2021). Several studies have explored the relationship between risk preference and risk taking, and have reached different conclusions, as shown in Table 1 (Weber et al., 2013; Kandasamy et al., 2014; Cohn et al., 2015; Guiso et al., 2018; König-Kersting and Trautmann, 2018; Aragó et al., 2022). The results of these studies on correlation between risk preference and risk taking, however, are inconsistent. Therefore, we propose hypothesis 1 as follows.

Hypothesis 1: The risk preference of leading enterprises has a significant impact on their willingness to participate in the futures market, but the direction of the impact is uncertain.

Under market economy conditions, to maximize profits, managers usually make production and operation decisions based on changes in market price signals (Ahmad et al., 2021a). In reality, enterprises are affected by various factors, such as their own perceptions, business objectives, and the external environment; thus, different enterprises often pay different levels of attention to price risk (Ahmad et al., 2021b). In this study, leading enterprises are divided into two groups: those that consider price risk as the most important risk factor and those that do not.

Hypothesis 2: Leading enterprises that regard price risk as the most important risk factor are more willing to participate in the futures market.

The recognition of possible risks by the risk subject is called risk perception (Bauer, 1960). Studies have shown that the relationship between risk preference and individual behavioural decision-making is affected by risk perception (Lv, 2014). In other words, individual behavioural decision-making is affected not only by risk preference and risk perception, but also by the interaction between the two. Based on this, risk-loving enterprises maybe also be considered more willing to participate in the futures market when leading enterprises are more sensitive to price risk.

Hypothesis 3: Price risk perception can positively moderate the impact of leading enterprises' risk preference on their willingness to participate in the futures market.

Palich and Bagby (1995) argued that risk preference could influence the final decision through the mediation of risk perception. He et al. (2018) empirically studied farmers' willingness to adopt water-saving irrigation technology and confirmed that risk preference could influence farmers' decision-making through the mediation of risk perception. From the perspective of leading enterprises, since price fluctuations bring risks and opportunities, risk-loving enterprises are more concerned about price changes. When the ideal price is reached, such enterprises can choose to enter the risk management market at the right time.

Hypothesis 4: The risk preference of leading enterprises can influence their willingness to participate in the futures market through the mediation of price risk perception.

Methodology

Analysis of the influencing factors of leading enterprises' willingness to participate in the futures market

First, a logit model is used to analyze the factors influencing leading cotton and jujube enterprises' willingness to participate in the futures market. The logit model is one of the most widely used discrete choice models (Kuo et al., 2021), and its basic form can be written as:

$$P(Y = 1 | X) = \frac{1}{1 + e^{\beta_0 + \beta_1 X + \mu}} \tag{1}$$

where Y is a binary dependent variable that takes a value of 0 if the enterprise is unwilling to participate in the futures market and 1 otherwise; P is a probability of observing a particular outcome Y given X; X is the independent variable of Y; β_0 and β_1 are both model parameters; and μ is the residual term which is assumed to be normally distributed at zero mean value and constant variance (Elahi et al., 2018a; Elahi et al., 2019b; Elahi et al., 2020; Elahi et al., 2022b).

Test of the moderating effect

If the relationship of two variables is influenced by a third variable, then the third variable is called the moderator variable (James and Brett, 1984).To test whether price risk perception can moderate the impact of the risk preference of leading cotton and jujube enterprises on their willingness to participate in the futures market, a regression analysis of the interaction effect between the price risk perception and the risk preference of enterprises is conducted, in accordance with Wen et al. (2005) conclusion. It is for the moderating effect analysis of explicit

variables, when the independent variable and the moderating variable are both categorical variables.

$$Q = \alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 + \alpha_3 X_1 X_2 + \alpha_4 U + \varepsilon_1 \tag{2}$$

where Q is a logit function of Y; X_1 is the enterprise's price risk perception and X_2 its risk preference; $X_1 X_2$ is the moderating effect of the enterprise's price risk perception on risk preference and willingness to participate in the futures market; U is a control variable; ε_1 is the residual term; and α_0, α_1, α_2, α_3, and α_4 are the coefficients need to be estimated.

Test of the mediating effect

A mediating effect model is used to explore whether the risk preference of leading cotton and jujube enterprises can influence the willingness to participate in the futures market through the mediation of price risk perception. In general, when the independent variable X influences the dependent variable Y, X also influences Y by influencing variable M, which is the mediating variable. This study investigates the mediating effect of binary dependent variables. To avoid the possibility that the coefficients of the regression variables cannot be compared because of different scales being used, the regression coefficients need to be standardized to obtain relatively accurate estimates. In this study, stepwise regression is used to calculate possible mediating effects.

First, the logit regression equation is:

$$Y' = cX + e_1 \tag{3}$$
$$M' = aX + e_2 \tag{4}$$
$$Y'' = c'X + bM + e_3 \tag{5}$$

where X indicates risk preference; Y indicates the willingness to participate in the futures market; M represents the mediating variable of price risk perception; a, b, c, and c' are the coefficients to be estimated; and e_1, e_2, and e_3 are the residual terms.

To ensure comparability of the coefficients, a, b, c, and c' are standardized to obtain comparable coefficients of a^{std}, b^{std}, c^{std}, and c'^{std}. The specific forms are:

$$a^{std} = a \times \frac{SD(X)}{SD(M')} \tag{6}$$

$$b^{std} = b \times \frac{SD(M)}{SD(Y'')} \tag{7}$$

$$c^{std} = c \times \frac{SD(X)}{SD(Y')} \tag{8}$$

$$c'^{std} = c' \times \frac{SD(X)}{SD(Y'')} \tag{9}$$

$$VAR(Y') = SD(Y')^2 = c^2 \times VAR(X) + \frac{\pi^2}{3} \tag{10}$$

$$VAR(M') = SD(M')^2 = a^2 \times VAR(X) + \frac{\pi^2}{3} \tag{11}$$

$$\text{VAR}(Y'') = \text{SD}(Y'')^2$$
$$= c'^2 \times \text{VAR}(X) + b^2 \times \text{VAR}(M)$$
$$+ 2bc' \times \text{COV}(X, M) + \frac{\pi^2}{3} \qquad (12)$$

Second, by substituting Eqs 10–12 into Eqs 6–9, the estimated coefficients after standardization can be obtained, where $\pi^2/3$ is the variance in the standard logistic distribution. Then, the standard error of a^{std}, b^{std}, c^{std}, and c'^{std} is calculated:

$$\text{SE}(a^{std}) = \text{SE}(a) \times \frac{\text{SD}(X)}{\text{SD}(M')} \qquad (13)$$

$$\text{SE}(b^{std}) = \text{SE}(b) \times \frac{\text{SD}(M)}{\text{SD}(Y'')} \qquad (14)$$

$$\text{SE}(c^{std}) = \text{SE}(c) \times \frac{\text{SD}(X)}{\text{SD}(Y')} \qquad (15)$$

$$\text{SE}(c'^{std}) = \text{SE}(c') \times \frac{\text{SD}(X)}{\text{SD}(Y'')} \qquad (16)$$

Finally, the product of $a^{std} \times b^{std}$ is calculated for the size of the mediating effect. The expression for calculating the ratio of the mediating effect to the total effect is $a^{std} \times \frac{b^{std}}{c^{std}} \times 100\%$.

Source of data

The research object selected in this paper is the leading domestic cotton and jujube enterprises. The reason for not distinguishing between the two data obtained is that cotton and jujube are both representative agricultural products in western China, and the external risk environment faced by leading enterprises related to them and the various risk management trainings they have received are similar. Therefore, a comprehensive study of the two can better reflect the overall risk preference, risk perception and willingness to participate in futures of the leading enterprises related to them.

Data were collected through a field survey using a well-structured questionnaire. We distributed questionnaires from April 2019 to August 2020 through training conferences for the cotton and jujube industries held by the Zhengzhou Commodity Exchange and the China Cotton Textile Forum. The people who participated in the survey are the heads or staff of the risk management departments, and they generally have a certain degree of understanding of the futures market. Based on the different requirements of each conference, data are collected through electronic questionnaires distributed on www.wjx.cn and paper questionnaires distributed on site. A total of 238 questionnaires are distributed to leading agricultural enterprises, and 219 are collected for a questionnaire recovery rate of 92%. Representatives from middle and high-level positions are responsible for filling out the questionnaires.

Variable selection

Willingness to participate in the futures market

The willingness of leading enterprises to participate in the futures market is an important indicator that reflects the effect of financial services on agriculture, rural areas, and farmers. In recent years, China has continued to promote tasks such as "financial services for agriculture, rural areas, and farmers" and the "expansion of the 'insurance and futures' pilot program", and has considered financial services for the real economy to be the focus of agricultural and rural work. By investigating leading enterprises' willingness to participate in the futures market, an objective understanding of the current awareness of the futures market in agricultural enterprises can be obtained to test the actual effect of the above work and provide a reference for the next steps. Therefore, the willingness of leading cotton and jujube enterprises to participate in the futures market is chosen as the binary dependent variable, with 'enterprise willing to participate in the futures market' set to 1 and 'enterprise unwilling to participate in the futures market' set to 0.

Risk preference

The degree of leading enterprises' risk preference is also a key factor affecting their willingness to participate in the futures market. The enterprises participating in the study were asked to self-evaluate their risk preference based on this categorization: 1, Risk aversion (unwilling to take any risks); 2, Willingness to bear a small amount of risk (no more than 20% loss); 3, Willingness to bear a certain amount of risk (in the range of 20–50% loss); and 4, Willingness to bear a relatively large amount of risk (more than 50% loss).

Price risk perception

The risk of price fluctuations is an important factor affecting agricultural production and operational activities. The more attention leading enterprises pay to price risk, the stronger their demand for risk management and the higher their willingness to participate in the futures market. In this study, price risk perception is used as a key binary variable that affects willingness to participate in the futures market. It takes a value of 1 if the leading enterprise considers 'price risk as the most important risk factor' and 0 otherwise.

Type of enterprise

The type of enterprise reflects its basic characteristics and may have an impact on its willingness to participate in the futures market. If an enterprise is engaged in only one type of business, such as planting, processing, and trading, its sensitivity to price risk is obviously high. If an enterprise is more diversified, when a certain business is affected by price fluctuations and suffers losses, the profits of other businesses can compensate; thus, the price risk sensitivity of the enterprise could be accordingly lower. Therefore, this variable takes a value of 1 for enterprises

FIGURE 1
Summary of descriptive statistics.
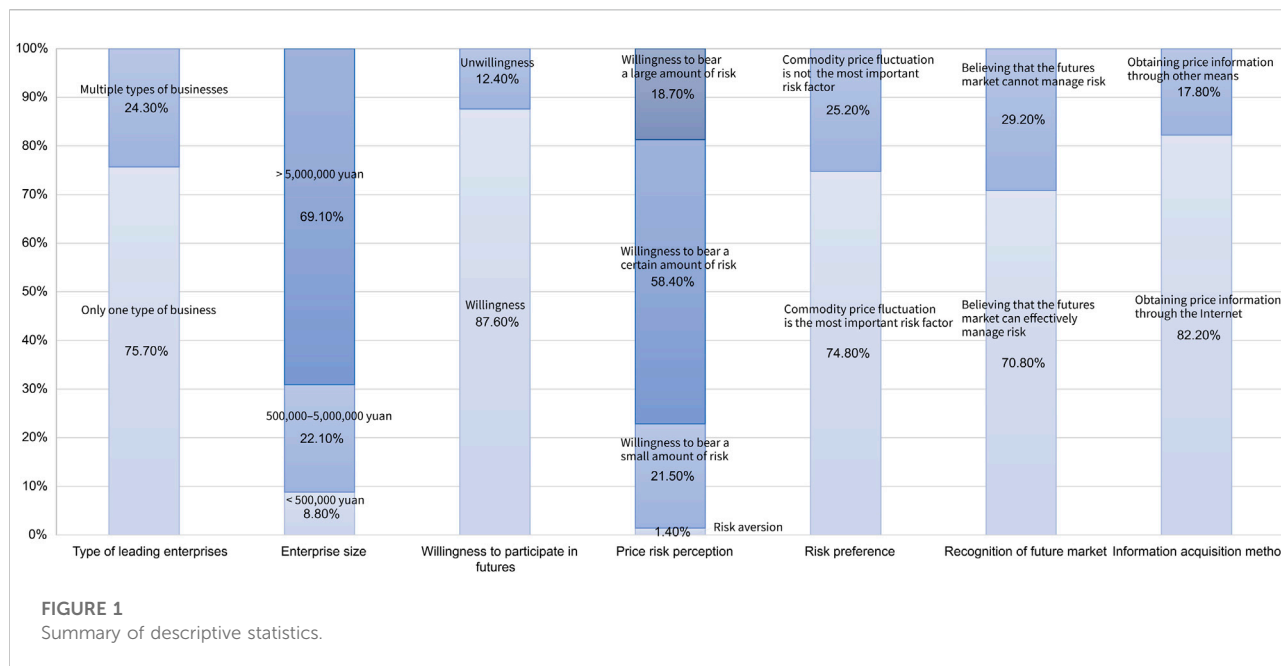
with only one type of business and 0 for enterprises with multiple types of businesses.

Enterprise size

The size of an enterprise can also affect its willingness to participate in the futures market. Large enterprises usually have sufficient funds and risk management staff; therefore, they often have a great demand for risk management and a strong willingness to participate in the futures market. In this article, leading cotton and jujube enterprises are divided into three categories based on annual revenue: enterprises with annual revenue of less than 0.5 million yuan are assigned a value of 1, and enterprises with annual revenue of 0.5 million–5 million yuan are assigned a value of 2, and enterprises with annual revenue of more than 5 million yuan are assigned a value of 3.

Recognition of futures market

Generally, the higher the enterprises' recognition of the futures market, the stronger their willingness to participate in it. Therefore, in this study, leading enterprises' recognition of the futures market was surveyed. If leading enterprises believe that the futures market can effectively manage the risk, the variable takes a value of 1 and 0 otherwise.

Price information acquisition method

Different ways of obtaining price information may lead to changes in the estimated willingness of leading enterprises to participate in the futures market. With the advent of the Internet, information can be obtained more efficiently and quickly. For

leading enterprises, it is efficient to obtain price information through online searches; the Internet is also conducive to quickly becoming familiar with online futures trading platforms, thereby increasing their willingness to participate in the futures market. Therefore, this variable takes a value of 1 for enterprises that obtain price information through the internet and 0 for those that do so through other means.

Descriptive statistics

The questionnaire poses seven questions, and Figure 1 and Table 2 present the final survey results. First, regarding the type and size of leading cotton and jujube enterprises, most enterprises participating in this survey are engaged in only one type of business (i.e., planting, trading, or processing), accounting for more than 70%. Most are medium and large enterprises with annual revenue of more than 5 million yuan. Second, regarding the willingness of leading cotton and jujube enterprises to participate in the futures market, most enterprises are willing to participate. Because the corresponding futures products for both cotton and jujube are listed, the survey results indicate, to a certain extent, that the listed corresponding futures products can effectively promote the participation of relevant industrial enterprises in the futures market for risk management. Third, among the leading cotton and jujube enterprises that participated in this survey, only three are completely risk averse. These enterprises are completely unwilling to carry out risk management. Enterprises that can

TABLE 2 Summary of descriptive statistics.

Variables	Mean (SD)	Choices	Number	Proportion (%)
Type of leading enterprises	0.242 (0.429)	Only one type of business	166	75.70
		Multiple types of businesses	53	24.30
Enterprise size	2.598 (0.658)	<500,000 yuan	21	8.80
		500,000–5,000,000 yuan	46	22.10
		>5,000,000 yuan	152	69.10
Willingness to participate in futures	2.598 (0.658)	Willingness	192	87.60
		Unwillingness	27	12.40
Price risk perception	0.748 (0.434)	Risk aversion (unwilling to take any risks)	3	1.40
		Willingness to bear a small amount of risk (no more than 20% loss)	47	21.50
		Willingness to bear a certain amount of risk (in the range of 20–50% loss)	128	58.40
		Willingness to bear a large amount of risk (more than 50% loss)	41	18.70
Risk preference	2.958 (0.686)	Commodity price fluctuation is the most important risk factor	164	74.80
		Commodity price fluctuation is not the most important risk factor	55	25.20
Recognition of futures market	0.707 (0.455)	Believing that the futures market can effectively manage risk	155	70.80
		Believing that the futures market cannot manage risk	64	29.20
Information acquisition method	0.821 (0.383)	Obtaining price information through the Internet	180	82.20
		Obtaining price information through other means	39	17.80

TABLE 3 Influencing factors of enterprise willingness to participate in futures.

Variable	Regression model 1	Regression model 2
Risk preference	2.014*** (0.737)	4.361*** (1.507)
Price risk perception	3.475*** (0.996)	6.698*** (2.284)
Price risk perception × Risk preference	\	4.753** (2.208)
Type of enterprise	0.898 (0.905)	1.518 (1.009)
Enterprise size	0.125 (0.491)	−0.012 (0.519)
Recognition of futures market	4.653*** (1.316)	5.818*** (1.645)
Information acquisition method	2.605*** (0.934)	3.403*** (1.268)
Constant term	−8.645*** (2.627)	−16.716*** (5.552)
Chi-squared test	117.33	123.86
p value	0.000	0.000
Pseudo R^2	0.717	0.757

***, **, and * indicate that the estimation results are significant at the 1, 5, and 10% levels, respectively; and standard errors are in parentheses. To eliminate the potential multicollinearity caused by the interaction term, the final regression results are obtained after the centralized processing of the variables risk preference and price risk perception.

bear a certain amount of risk account for more than 50%, and those that can bear small and large amounts of risk account for 21.5 and 18.7%, respectively. Fourth, among the leading cotton and jujube enterprises, 74.8% are very concerned about price changes and believe that price risk is the most important risk factor in production and operation. The other enterprises believe that there are other risk factors that are more important. Fifth, among the leading cotton and jujube enterprises that participated in the survey, 70.8% believe that the futures market could effectively manage risks. That is, these enterprises have a high recognition of the futures market; the other enterprises have a relatively low recognition. Sixth, regarding ways to obtain price

information, 82% of the leading cotton and jujube enterprises obtain information through the Internet, while only 17.8% obtain price information through other channels.

Empirical results

Using STATA15.0, a logit model is used to perform a regression analysis of the factors that affect the willingness of leading enterprises to participate in the futures market. The regression results are shown in Table 3. Regression model 1 includes price risk perception, risk preference, and other

control variables; regression model 2 is formed by adding the binary interaction term of price risk perception and risk preference to regression model 1 and is used to test the existence of an interaction effect (moderating effect). The regression results for both are significant at the 1% level (Table 3). That is, the fit of the models is good. Therefore, we proceed to the next step of the analysis.

Factors influencing leading enterprises' willingness to participate in the futures market

Regression model 1 shows the effects of all the original variables on the willingness of leading cotton and jujube enterprises to participate in the futures market. Detailed analyses of the regression results for each variable follow.

First, risk preference has a significant positive impact on the willingness of leading cotton and jujube enterprises to participate in the futures market, indicating that the more the leading enterprises are willing to spend time and energy on risk management and invest in the risk management market, the stronger their willingness to participate in the futures market. Therefore, we prove that the risk preference of leading enterprises has a significant impact on their willingness to participate in the futures market, as stated in Hypothesis 1. Further, our empirical results show that the impact is positive.

Second, the price risk perception of the leading cotton and jujube enterprises has a significant positive impact on their willingness to participate in the futures market, indicating that the leading agricultural enterprises that regard price fluctuations as the main source of risk generally have a stronger awareness of risk management and a better understanding of the risk management role of the futures market and are more willing to use financial instruments, such as futures, for risk management. Therefore, Hypothesis 2 is valid.

Third, recognition of the futures market and the information acquisition method have a significant positive impact on the willingness to participate in the futures market. The more a leading enterprise recognizes the hedging function of futures, the stronger its willingness to participate in the futures market, which is consistent with the basic logic of enterprises participating in the futures market. The information acquisition method has a significant positive influence on leading enterprises' willingness to participate in the futures market. One possible explanation for this finding is that with the development of information technology, it is increasingly easy for enterprises to obtain commodity price information through the Internet, and futures orders also require the Internet for transmission; therefore, enterprises that often use the Internet to obtain commodity price information are more likely to participate in the futures market with the help of online instruments.

Fourth, the type and size of enterprises do not have a significant impact on the willingness of the sampled enterprises to participate in the futures market, indicating that for leading enterprises in China, the willingness to participate in the futures market is less correlated with their basic characteristics.

Moderating effect

Wen et al. (2005) showed that when both the moderating and independent variables are categorical variables and the two factors have an interaction effect (as indicated by the analysis of variance or ANOVA), the interaction effect is the moderating one. The data in Table 2 show that both the price risk perception and risk preference are categorical variables. Therefore, in regression model 2, the interaction term of price risk perception and risk preference is added to test whether the price risk perception plays a moderating role in risk preference and willingness to participate in the futures market.

The results for regression model 2 (Table 3) indicate that the regression coefficient of the interaction term between the price risk perception and risk preference is positive and significant at the 5% level; that is, the interaction between the price risk perception and risk preference has a positive effect on the willingness of leading cotton and jujube enterprises to participate in the futures market. This finding indicates that the price risk perception has a positive moderating effect on the relationship between risk preference and the willingness of leading cotton and jujube enterprises to participate in the futures market. That is, when enterprises are more sensitive to price fluctuations, the willingness of risk-loving enterprises to participate in the futures market is stronger, while that of risk-averse enterprises is further weakened. This result confirms Hypothesis 3.

To further test the robustness of the interaction effect, ANOVA is used to investigate the interaction between price risk perception and risk preference. The ANOVA results for the original variables and the interaction term of price risk perception and risk preference (Table 4) suggest that when the control variables are considered, the interaction term is significant at the 5% level, indicating that the regression results of the interaction term in model 2 are robust. Additionally, the robustness of Hypothesis 3 is verified.

Mediating effect

To investigate whether the risk preference of leading cotton and jujube enterprises can affect their willingness to participate in the

TABLE 4 ANOVA results for the moderating effect of price risk perception on risk preference and willingness to participate in futures.

Variable	Type III sum of squares	Degree of freedom	Mean sum of squares	F Value	p Value
Price risk perception	0.298	1	0.298	5.82	0.016
Risk preference	1.505	3	0.501	9.79	0.000
Price risk perception × risk preference	0.409	3	0.136	2.66	0.049
Type of enterprise	0.011	1	0.011	0.21	0.651
Enterprise size	0.011	2	0.005	0.11	0.900
Recognition of futures market	1.977	1	1.977	38.58	0.000
Information acquisition method	0.653	1	0.653	12.75	0.000
Model	13.110	12	1.092	21.31	0.000
Residual	10.560	206	0.051	\	\
Total	23.671	218	0.108	\	\

TABLE 5 The mediating effect of the willingness of leading enterprises to participate in futures.

	Price risk perception		Willingness to participate in futures		Willingness to participate in futures	
	Original coefficient	Standardized coefficient	Original coefficient	Standardized coefficient	Original coefficient	Standardized coefficient
Price risk perception	\	\	\	\	3.098*** (0.615)	0.505*** (0.100)
Risk preference	2.100*** (0.404)	0.325*** (0.038)	0.966*** (0.249)	0.226*** (0.095)	1.857*** (0.458)	0.192*** (0.047)
Chi-squared test	37.65		16.61		72.73	
p value	0.000		0.000		0.000	
Pseudo R^2	0.230		0.067		0.444	

***, **, and * indicate that the estimation results are significant at the 1, 5, and 10% levels, respectively. Standard errors are in parentheses.

futures market through the mediating role of price risk perception, stepwise regression is used; the results are shown in Table 5.

Table 5 shows that in the regression analysis of risk preference and price risk perception, and willingness to participate in the futures market, both regression coefficients for risk preference are significant at the 1% level. When risk preference and price risk perception are added to the same model for regression analysis, the regression coefficients are also significant at the 1% level, but the coefficient of risk preference after standardization decreases, indicating that price risk perception does have a mediating effect on risk preference and the willingness of leading enterprises to participate in the futures market. Therefore, Hypothesis 4 is valid. The proportion of the mediating effect in the total effect is calculated to be 35.1%, indicating that the higher the risk preference, the stronger the willingness of leading enterprises to directly participate in the futures market; accordingly, some risk-loving leading enterprises further enhance their willingness

to participate in the futures market by improving their price risk perception. Thus, Hypothesis 4 is further verified.

Conclusion and policy implication

Conclusion

Based on a logit model, we analyze the impact of risk preference and price risk perception of leading cotton and jujube enterprises on their willingness to participate in the futures market and further explore the moderating effect of the price risk perception on the relationship between risk preference and willingness to participate in the futures market. Below are our main conclusions.

First, the risk preference and price risk perception of leading enterprises have a significant positive impact on their willingness to participate in the futures market. This willingness of leading

enterprises increases with an increase in risk preference and price risk perception. That is, risk-averse enterprises have a relatively low willingness to participate in the futures market, while risk-loving enterprises are more willing. Additionally, enterprises that pay more attention to price risk are more willing to participate in the futures market, and those that do not pay sufficient attention to price risk are less willing.

Second, there is an interactive effect between the risk preference and price risk perception of leading enterprises; together, these factors have an impact on the willingness to participate in the futures market. The price risk perception of leading enterprises positively moderates the relationship between risk preference and willingness to participate in the futures market. Among leading enterprises that pay closer attention to price risk, risk-loving enterprises are more willing to participate in the futures market to hedge risks, while risk-averse enterprises are less inclined to do so.

Third, the price risk perception of leading enterprises has a mediating effect on their risk preference and willingness to participate in the futures market. In other words, in addition to directly affecting their willingness to participate in the futures market, the risk preference of leading enterprises can also indirectly affect this willingness through the price risk perception. In terms of degree, the proportion of the direct influence of risk preference on the willingness to participate in the futures market is approximately twice that of the indirect influence, indicating that risk-loving leading enterprises can further enhance their willingness to participate in the futures market by improving their price risk perception.

This study empirically confirms that risk preference and risk perception are critical factors in agricultural business decision-making, which is consistent with Menapace et al. (2015), Akhtar et al. (2018), and Hellerstein et al. (2013). However, there are several limitations to our study. First, this study focuses on leading agricultural enterprises. Still, the new agricultural entities include not only the leading agricultural enterprises but also different types of agricultural cooperatives and family farms in China. Second, the scope of this study is limited to two agricultural commodities, cotton and jujube, but does not consider other varieties offered in the agricultural futures marketplace. To further strengthen the robustness of the conclusions provided by this study, a broader category of future varieties should be detailed in future research. Future studies are also recommended to investigate whether other agricultural business entities, such as agricultural cooperatives and family farms, have similar risk perceptions, risk preferences, and risk decision-making relationships.

Policy implication

First, the risk preference and risk perception of leading enterprises are heterogeneous, and policy should target and select

risk management instruments for training and promotion. The results of this study indicate that the willingness of different leading enterprises to participate in the futures market is significantly different based on risk preference and price risk perception. Therefore, risk management instruments suitable for various types of leading enterprises should be selected for training. For example, for risk-averse enterprises, the focus should be on promoting and providing training related to agricultural insurance-related knowledge; for risk-loving enterprises, training should focus on futures- and derivative-related knowledge. Such an approach will help effectively improve the overall risk management awareness and capabilities of leading enterprises through the development of differentiated training strategies and targeted promotions and training.

Second, to enhance the price risk perception of leading enterprises, the futures association needs to further refine the training courses and optimize the publicity and training effect of the futures market. With the continuous development and progress of China's modern agricultural economy and policy reform in recent years (Han et al., 2022), many leading agricultural enterprises continue to emerge, which greatly expands the types of agricultural business entities in China and creates many new sources of demand for price risk management. Futures market-related publicity and training cannot be adapted to the new situation. In the future, training courses should be accurately customized in addition to following the existing norms. For example, training should be conducted at different levels based on themes such as hedging, basis trading, warehouse receipt registration, warehousing financing, and internal control system design to optimize the overall training effectiveness and further enhance the price risk perception of leading enterprises.

Data availability statement

The raw data supporting the conclusion of this article will be made available by the authors, without undue reservation.

Author contributions

AC contributed analysis and figures and wrote, edited and revised the text, created and edited tables. XH edited and revised the text, edited tables. MA edited and revised the manuscript. All authors contributed to the tables, wrote portions of the text, and edited the manuscript.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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