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RESEARCH ARTICLE

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The Role of Risk Preferences in Transitioning to Organic Livestock Farming: Evidence from Kazakhstan

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ABSTRACT

Risk preferences play a crucial role in farmers' decision-making regarding organic transition. Particularly in organic livestock farming, risk-tolerant farmers are more likely to adopt environmentally sustainable production practices. Using original survey data from livestock farmers in Kazakhstan, this study empirically examines how risk preferences influence and interact with multidimensional contextual factors to affect the intention to transition to organic practices. The results indicate that risk preferences significantly enhance farmers' intention to transition to organic farming. Further analysis reveals that multidimensional contextual factors—including intrinsic attitudes, resource capacity, external opportunities, and social legitimacy—moderate this relationship. These factors strengthen the positive effect of risk preferences on transition intention. Heterogeneity analysis shows that the impact of risk preferences is more pronounced among larger-scale and specialized producers.

In contrast, it is weaker among small-scale farmers facing resource constraints and those engaged in mixed livestock systems with greater operational complexity. The findings underscore the importance of the interplay between farmers' psychological traits and external contexts in driving the transition to organic agriculture. Policymakers can target support toward farmers with high-risk preferences and optimise their operational environment across attitudinal, capacitative, opportunistic, and legitimacy dimensions to precisely stimulate transition motivation, thereby effectively promoting the sustainable development of organic livestock farming.

Keywords: Risk preferences, Transition intention, Organic livestock farming, Moderating effects, Kazakhstan.

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INTRODUCTION

The transition to organic production has become a central component of systemic change in food systems amid increased global concerns about food safety, animal welfare, and environmental degradation (Eyhorn et al., 2019; Möhring et al., 2024; Makinde, 2024). With the ever-increasing consumer demand for ethically produced, environmentally friendly, and health-conscious products, organic livestock farming is positioned at the intersection of sustainability and profitability. It provides high-value commodities aligned with high environmental and ethical standards, while also supporting biodiversity conservation and rural resilience. However, even with the increased global trend, there is unequal diffusion of organic livestock practices, especially in the developing and transitional economies where the structural, institutional, and psychological restrictions limit the adoption choices of farmers (Tuomisto et al., 2012; Liebert et al., 2022; Stephenson et al., 2022).

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Kazakhstan is one of the vastest pastoral economies in Eurasia and a fascinating paradox in this setting. With 188 million hectares of natural pasture and a deep history of nomadic livestock farming, the nation has enormous potential for sustainable organic livestock development (Pashkov et al., 2024). Since the adoption of the Law on the Production and Turnover of Organic Products in 2015, Kazakhstan has demonstrated a firm policy commitment to developing the organic sector, reflected in simplified certification procedures and a group certification system. However, growth in the sector has been unevenly distributed towards crop production. Although organic grain exports exceeded USD 35 million in 2022, organic livestock production remains stagnant (UNDP, 2023). Of the 38 certified organic farms in the country, only a few, or none, are specialized in livestock. This source of imbalance demonstrates a structural misalignment between enabling policy structures and farmers' behavioral responses at the micro level (Borsato et al., 2020; Bertolozzi-Caredio et al., 2025).

A large body of literature proves that organic agriculture has numerous economic, environmental, and social advantages (Qiao et al., 2016; Haggar et al., 2017; Shennan et al., 2017; Zhang et al., 2024; Singh & Kumar, 2023). However, the transition to organic farming is risky in itself, as it entails a significant initial investment, yield uncertainty, and unpredictable market changes (Berentsen & Van Asseldonk, 2016; Łuczka and Kalinowski, 2020). Such uncertainties make the adoption of organic practices a high-stakes investment decision, and behavioral implications are influenced not only by economic factors but also by farmers' intrinsic psychological traits. However, most previous studies have focused on structural or socio-economic factors, such as price premiums, subsidies, or peer influence, while paying little attention to risk preferences as a fundamental determinant of farmers' decision-making heterogeneity. Why do some farmers adopt organic conversion when others are reluctant, given some similar economic and institutional circumstances? To answer this question, it is necessary to address it within a behavioral-economic framework that incorporates risk psychology and contextual limitations (Bravo-Monroy et al., 2016; Serra et al., 2008; Tran-Nam & Tiet, 2022; Van et al., 2023; Bayer & Kühl, 2024).

In this study, risk preference is proposed as a key explanatory variable to explain the desire to switch to organic livestock farming. Based on the multidimensional conceptualization of Bottazzi et al. (2023), we further suggest that the impact of risk preference is context-dependent and contingent on four contextual domains: attitude, capability, opportunity, and legitimacy. These dimensions summarize the inherent ethical orientations of farmers, resource endowments, institutional contexts, and social network effects, respectively. Building on these points of view, the study proceeds to two main research questions: first, how much risk preference influences farmers' intention to adopt organic livestock farming? Second, what are the moderating effects of multidimensional contextual factors in the relationship between risk preference and transition intention?

This study is an empirical study that uses original survey data of 420 livestock farmers living in seven key pastoral areas in Kazakhstan to examine the psychological and contextual processes that support the decision to transition to organic farming. The study makes three significant contributions to the literature. First, it broadens analytical attention beyond the area of organic crop production, where most research on adoption is focused (Lampach et al., 2020; Bravo-Monroy et al., 2016; Mahedi et al., 2025), to organic livestock farming, which is of strategic interest. Second, it links micro-level behavioral economics to macro-level sustainability transitions by foregrounding risk preference as a significant psychological motivator and situating it within a multidimensional context. Third, the study, which situates the analysis in Kazakhstan, enhances empirical knowledge of the untapped Central Asian environment and offers policy implications for policymakers keen on ensuring the development of sustainable livestock systems in resource-limited environments.

MATERIALS & METHODS

Study Area and Data

This study focused on cattle and sheep farmers in Kazakhstan to investigate the influence of risk preference on their intention to transition to organic farming. Kazakhstan presents an ideal context for the development of organic livestock production, particularly organic beef, due to the presence of vast natural pastures (around 188 million hectares, which is about 70% of the territory of the country) and the geographical and climatic characteristics of the area and the abundance of land (Shennan et al., 2017).

The number of respondents selected was calculated using a standard formula for finite populations, in accordance with the methodological approach accepted by Łuczka and Kalinowski (2020). Based on statistics from the Bureau of National Statistics of the Agency of Strategic Planning and Reforms of the Republic of Kazakhstan, the number of farmers involved in agricultural production (N) as of 1 January 2023 was 248,602. The formula is given as:

$$n = \frac{P(1-P)}{\frac{e^2}{Z_a^2} + \frac{P(1-P)}{N}} \quad (1)$$

Where n denotes the required sample size, N the total population size, e the margin of error, Z the Z-value corresponding to the desired confidence level, and p the estimated proportion. For this calculation, we used the most conservative estimate of p (0.5) to maximize variance, with a 95% confidence level ($Z \approx 1.96$) and a margin of error of 6% ($e = 0.06$).

The minimum sample size of 266 was determined using these parameters. Stratified random sampling was then used to ensure representativeness across the target populations various geographical regions and production types.

Data were collected from April to October 2024

through a face-to-face questionnaire survey in seven central livestock-producing regions of West Kazakhstan: Aksay, Chapaev, Jambeyty, Karatobe, Taskala, Daryinskoye, Peremyotnoye, and Zhangala (Fig. 1). The study used stratified sampling, yielding 423 valid and complete interviews, exceeding the required number for rigorous statistical inference.

The questionnaire addressed a range of topics pertinent to the transition to organic agriculture. Primary constructs, including transition intention, risk preference, and other salient psychological variables, were operationalized on 7-point Likert scales of 1 (strongly disagree) to 7 (strongly agree). Two exclusionary criteria were used in quality control: (1) lack of data on important variables, such as risk preference and transition intention; and (2) identification of disordered response patterns, in particular straight-line responding. After eliminating three invalid questionnaires, the final analytic sample comprised 420 high-quality cases, yielding a response rate of 99.3%. Verbal informed consent was obtained from all participants prior to the interviews.

Variables

Farmers' intention to switch to organic practices was used as a dependent variable and assessed using the newly created behavioural-intention construct. It was assessed by the respondent's level of agreement with the statement: "I wish to apply for organic certification within one year." This item was rated on a seven-point Likert scale (1 = strongly disagree, 7 = strongly agree). This object reflects the immediate intention or the intention to take a definite transition act by the individual, and it is one of the primary antecedents of factual behavior (Ajzen, 1991).

The primary independent variable is the risk preference. Adapted from the approach of Ito et al. (2012), it was measured by the level of agreement with the statement: "I am not a risk-averse person." This item, also on a seven-point Likert scale, captures the respondent's stable risk-taking propensity. Increased scores indicate a greater risk preference, i.e., less risk aversion.

Based on the multidimensional framework of Bottazzi et al. (2023), we included four independent constructs: attitude, capability, opportunity, and legitimacy. Each was measured with a single Likert-scale item tailored to the organic farming context: (a) Attitude, which refers to a favorable judgment of the intrinsic moral worth of organic agriculture, was measured by agreeing with: "I believe that organic farming provides better animal welfare standards compared to conventional livestock production." (b) Capability, which indicated the perceived availability of the necessary resources to make the transition, was measured by: "If a contract farming buyer could lend me the necessary organic equipment, I would consider transitioning to organic production." (c) Opportunity, which included perceptions of institutional obstacles in the external environment, was measured using: "I find the regulatory hurdles and paperwork for organic certification not to be a problem at all." (d) Legitimacy, which is social approval, which came as a result of norms and peer pressure, was assessed by: "There are successful organic farmers in my social network who encourage me to adopt organic practices." This item effectively captures the normative pressure and demonstration effects of having peers who have converted to organic farming. All moderating variables were measured using seven-point Likert scales with referent scaling equal to those of the core variables.

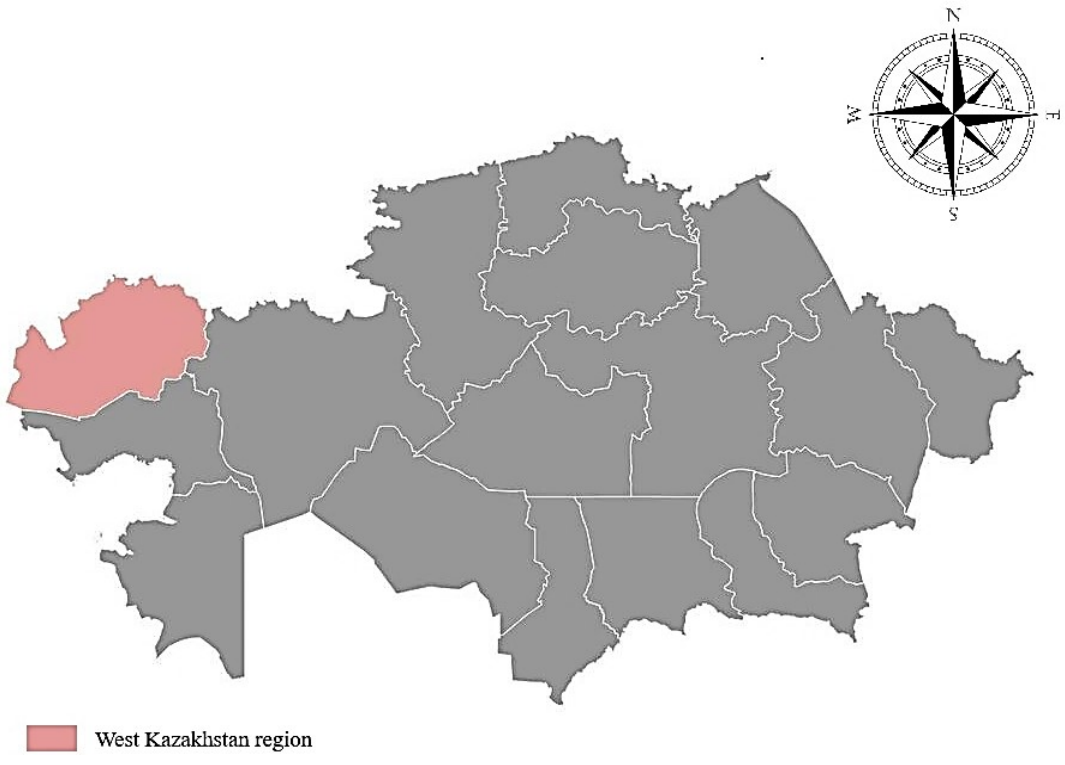

Fig. 1: Map of the research area.

To control for other potential confounding factors, a set of control variables was included. These primarily cover individual and operational characteristics, such as age, farming experience, household labor size, and information sources. We also included variables reflecting internal cognitive and psychological factors, such as the farmers' self-reported confidence in handling organic certification paperwork, their self-assessed knowledge of organic farming techniques, their perceived social pressure to adopt sustainable methods, and any religious motivation influencing their farming practices. Finally, regional fixed effects were incorporated into the model to account for unobserved heterogeneity across regions. Detailed definitions and descriptive statistics for all variables are presented in Table 1.

Model

Farmers' intention to transition to organic practices is measured as an ordered discrete variable. Applying methods such as OLS or multinomial logit/probit directly to such ordinal data would ignore the inherent ranking of the response categories. Therefore, we employed an ordered probit (Oprobit) model, which is well-suited for analyzing an ordinal dependent variable. This approach followed established practices in the literature for similar data (Wang et al., 2021; Xu et al., 2024). The empirical model is specified as follows:

Let H_i^* denote the latent variable representing the unobserved continuous propensity of a farmer i to transition to organic practices. The observed ordinal response H_i is determined based on the value H_i^* relative to a set of threshold parameters:

$$H_i = F(\alpha + \beta D_i + X_i\gamma) \quad (1)$$

$$F\left(H_i^*\right) = \begin{cases} 1, H_i^* \le r_1 \\ 2, r_1 < H_i^* \le r_2 \\ 3, r_2 < H_i^* \le r_3 \\ 4, r_3 < H_i^* \le r_4 \\ 5, r_4 < H_i^* \le r_5 \\ 6, r_5 < H_i^* \le r_6 \\ 7, r_6 \le H_i^* \end{cases} \quad (2)$$

Where $r_1 < r_2 < r_3 < r_4 < r_5 < r_6$ are the cut points to be estimated? For instance, when $H_i^* \le r_1$ the farmer is categorized as "strongly disagreeing" with the intention to transition. Conversely, when $H_i^* \ge r_6$ the farmer is considered to "strongly agree."

The latent variable H_i^* is modeled as:

$$H_i^* = \alpha + \beta D_i + X_i\gamma \quad (3)$$

Where H_i^* is the latent intention to transition for the farmer i; D_i denotes the risk preference of the farmer i; X_i is a vector of control variables that may influence transition intention; α , β , and γ are parameters to be estimated.

Table 1: Measurement and Descriptive Statistics of Main Variables (N=420)

Variable	Description	Measurement	Mean	SD
Dependent Variable				
Intention to Organic Practice Transition	Intention to apply for organic certification within one year.	Ordinal, 7-point Likert scale (1 = Strongly Disagree, 7 = Strongly Agree)	1.812	1.077
Independent Variables				
Risk Preferences	Self-assessed level of risk tolerance. A higher score indicates a higher preference for risk.	Ordinal, 7-point Likert scale (1 = Strongly Disagree, 7 = Strongly Agree)	2.755	1.486
Moderating Variables				
Attitude	Belief that organic practices provide better animal welfare.	Ordinal, 7-point Likert scale (1 = Strongly Disagree, 7 = Strongly Agree)	4.543	1.306
Capability	Willingness to transition if provided with the necessary equipment by a contract buyer.	Ordinal, 7-point Likert scale (1 = Strongly Disagree, 7 = Strongly Agree)	4.219	1.348
Opportunity	Perception that regulatory hurdles for certification are not problematic.	Ordinal, 7-point Likert scale (1 = Strongly Disagree, 7 = Strongly Agree)	2.410	1.015
Legitimacy	The presence of successful organic farmers in one's social circle serves as a role model.	Ordinal, 7-point Likert scale (1 = Strongly Disagree, 7 = Strongly Agree)	1.898	0.853
Control Variables				
Age	Age group of the respondent.	Categorical (1 = Under 20, 2 = 20-29, 3 = 30-39, 4 = 40-49, 5 = 50-59, 6 = 60-69)	3.900	1.137
Farming Experience	Number of years of experience in husbandry.	Categorical (1 = <5, 2 = 5-9, 3 = 10-14, 4 = 15-19, 5 = 20-24, 6 = 25-30)	3.960	1.606
Household Labor Size	Number of family laborer members.	Categorical (1 = 0, 2 = 1-2, 3 = 3-4, 4 = 5-6, 5 = 7-8, 6 = 9-10, 7 = >10)	3.576	1.445
Information Sources	information sources used	Categorical (1= Newspaper, 2=Magazine, 3=TV, 4= Radio, 5= Internet News, 6= Facebook, 7= Facebook)	3.633	1.762
Confidence in Handling Paperwork	Confidence in handling organic certification paperwork.	Ordinal, 7-point Likert scale (1 = Strongly Disagree, 7 = Strongly Agree)	2.845	1.237
Perceived Social Pressure	Perceived social pressure to adopt sustainable methods	Ordinal, 7-point Likert scale (1 = Strongly Disagree, 7 = Strongly Agree)	2.336	1.068
Religious Motivation	Motivation from religious beliefs to transition to organic.	Ordinal, 7-point Likert scale (1 = Strongly Disagree, 7 = Strongly Agree)	3.586	1.402
Self-Efficacy in Knowledge	Belief in possessing sufficient knowledge for organic management.	Ordinal, 7-point Likert scale (1 = Strongly Disagree, 7 = Strongly Agree)	2.226	1.105

RESULTS

The results of the baseline regression analysis of the effect of risk preference on farmers' intention to switch to organic practices are shown in Table 2. To test the impact of the focal variable critically, a step-wise model-specification approach was used. Column 1 represents only one explanatory variable, i.e., the risk preference; column 2 adds to the specification the effects of the region to explain the time-invariant heterogeneity of the region; and finally, in column 3, the entire set of control variables, including individual, operational, and cognitive characteristics, was added to the specification to produce the most comprehensive specification.

Table 2: Baseline results

	Dependent Variable: Intention to Organic Practice Transition		
	(1)	(2)	(3)
Risk Preferences	0.135***	0.128***	0.101***
	(0.021)	(0.023)	(0.023)
Age			-0.234***
			(0.089)
Farming Experience			-0.083***
			(0.021)
Household Labor Size			-0.138***
			(0.045)
Information Sources			0.060*
			(0.032)
Confidence in Handling Paperwork			0.019
			(0.051)
Perceived Social Pressure			-0.032
			(0.068)
Religious Motivation			0.035
			(0.036)
Self-Efficacy in Knowledge			0.098***
			(0.034)
Region FE	NO	YES	YES
Pseudo R2	0.013	0.037	0.099
Observations	420	420	420

* Note: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. Robust standard errors are shown in parentheses.

As shown in Table 2, the coefficient of risk preference was positive and statistically significant at the 1% level across all specifications. This finding indicated that farmers' risk preference exerts a significant positive influence on their intention to transition to organic practices. This result confirms our theoretical expectation that farmers with a greater adventurous spirit exhibit a stronger willingness to transition when confronted with the inherent uncertainties of organic agriculture.

The estimates for the control variables also revealed several interesting patterns. First, the coefficients for age, farming experience, and household labor size have significantly negative coefficients, which means that older and more experienced farmers, as well as individuals who depend on larger inputs of household labor, are less willing to switch to organic production. The trend can be reasonably explained by greater path dependence and the increased risk aversion that is integrated into established systems of conventional production. Second, access to information sources and self-assessed knowledge of organic management show significantly positive coefficients. In other words, farmers with better access to information channels and greater confidence in their knowledge of organic farming are more likely to express an intention to transition. This underscores the central importance of information availability and capacity-building in shaping the adoption of new agricultural technologies, such as organic farming.

Overall, the baseline regression model provides strong evidence that risk preference is a psychological stimulus for farmers' intention to switch to organic farming. This effect cannot be annulled despite an array of regional and individual covariates.

To verify the reliability of the baseline regression results, we conducted a series of robustness checks from two perspectives: (i) alternative estimation methods and (ii) alternative measures of the core variable.

Columns (1-3) of Table 3 present the estimates from the Ologit model. Consistent with the baseline approach, we progressively incorporated regional fixed effects and control variables. Consistent with the baseline ordered probit approach, we progressively incorporated regional fixed effects, followed by the complete set of control variables. The results indicate that the coefficient of risk preference remains positive and highly significant ($P<0.01$) across all Ologit specifications. Columns 4 to 6 report the OLS estimation results. Although OLS is not ideal for an ordinal outcome, it serves as a proper supplementary check. The results show that the coefficient of risk preference is again positive and significant in all OLS specifications.

Table 3: Robustness Tests: replace model

	Dependent Variable: Intention to Organic Practice Transition					
	Methodology: ologit			Methodology: OLS		
	(1)	(2)	(3)	(4)	(5)	(6)
Risk Preferences	0.202***	0.193***	0.162***	0.141***	0.130***	0.096***
	(0.037)	(0.035)	(0.037)	(0.019)	(0.019)	(0.018)
Control variable	NO	NO	YES	NO	NO	YES
Region FE	NO	YES	YES	NO	YES	YES
R2/Pseudo R2	0.010	0.036	0.089	0.038	0.079	0.215
Observations	420	420	420	420	420	420

* Note: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. Robust standard errors are shown in parentheses.

In summary, regardless of whether an Oprobit, Ologit, or OLS model is used, the positive effect of risk preference on the intention to transition to organic farming remains highly statistically significant. This confirms that our core finding is robust to different model specifications and is not an artifact of the chosen estimation method.

To further enhance the credibility of our conclusions, we performed additional robustness checks by altering the measurements of the core variable. The results are presented in Table 4.

First, we altered the measurement of the dependent variable. The original seven-point scale measure of "intention to transition to organic farming" was transformed into a binary indicator: farmers who responded with scores of 4 to 7 (indicating "somewhat agree" to "strongly agree") were classified as having "intention to transition" (coded as 1), while those with scores of 1 to 3 ("strongly disagree" to "somewhat disagree") were classified as having "no intention" (coded as 0). A probit model was used to re-estimate the relationship with this new binary variable. As shown in

Table 4: Robustness Tests: replace variable

	Dependent Variable: Binary Indicator			Dependent Variable: Already Applied		
	(1)	(2)	(3)	(4)	(5)	(6)
Risk Preferences	0.246***	0.235***	0.210***	0.040***	0.035***	0.014**
	(0.062)	(0.068)	(0.073)	(0.011)	(0.011)	(0.007)
Control variable	NO	NO	YES	NO	NO	YES
Region FE	NO	YES	YES	NO	YES	YES
R2/Pseudo R2	0.079	0.086	0.262	0.017	0.252	0.829
Observations	420	400	400	420	420	420

* Note: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. Robust standard errors are shown in parentheses.

columns 1 to 3 of Table 4, the coefficient of risk preference remains positive and significant, indicating that our core conclusion is not sensitive to alternative discretization thresholds of the dependent variable.

Second, we employed a proxy variable more closely aligned with actual behavior to measure transition intention. The regression results using this binary variable as the dependent variable are reported in columns (4) to (6) of Table 4. The coefficient of risk preference was again positive and significant across all model specifications. This result not only reaffirms the positive role of risk preference but also extends its influence from "intention" to "actual behavior," indicating that farmers with higher risk preference are more likely to have taken concrete steps toward quality and safety certification. This significantly strengthens the persuasiveness of our conclusions. In conclusion, both sets of robustness checks consistently demonstrate that the positive effect of risk preference on farmers' transition intention (and even on preparatory behavior) is highly robust.

We next examined how the multidimensional contextual factors (attitude, capability, opportunity, and legitimacy) moderate the relationship between risk preference and transition intention. For this moderation analysis, interaction terms between risk preference and each contextual factor were included in the model. The results are reported in Table 5. To illustrate the direction and magnitude of these moderating effects more intuitively, we also provide simple slope plots in Fig. 2.

Table 5: Moderation analyses

	Dependent Variable: Intention to Organic Practice Transition			
	(1)	(2)	(3)	(4)
Risk Preferences ×Attitude	0.054**			
	(0.024)			
Risk Preferences ×Capability		0.043*		
		(0.023)		
Risk Preferences ×Opportunity			0.057***	
			(0.020)	
Risk Preferences ×Legitimacy				0.047*
				(0.025)
Risk Preferences	-0.165	-0.095	-0.018	0.013
	(0.133)	(0.095)	(0.051)	(0.035)
Attitude	-0.135**			
	(0.068)			
Capability		-0.087		
		(0.068)		
Opportunity			-0.047	
			(0.098)	
Legitimacy				-0.112
				(0.093)
Control variable	YES	YES	YES	YES
Region FE	YES	YES	YES	YES
Pseudo R2	0.102	0.101	0.105	0.100
Observations	420	420	420	420

* Note: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. Robust standard errors are shown in parentheses.

First, regarding the moderating role of attitude, as shown in column 1 of Table 5, the interaction term between risk preference and attitude was positive and statistically significant. This indicates that the more positive a farmer's ethical attitude toward organic agriculture, the more likely they are to adopt organic agriculture. As illustrated in Fig. 2a, a simple slope analysis revealed that, among farmers with high ethical attitudes, risk preference exerts a strong and significant positive influence on transition intention. In contrast, for those with low ethical attitudes, the effect of risk preference is considerably weaker. This confirms that a strong intrinsic ethical motivation provides risk-preferring individuals with a sense of purpose and moral justification for making risky decisions, thereby activating their intention to transition.

Next, for the moderating effect of capability, column 2 of Table 5 shows that the interaction effect between risk preference and capability is significantly positive. Such a result suggests that the greater the farmers' perceived capacity to access important resources (e.g., necessary equipment or inputs), the more fully they will translate their risk preferences into increased transition intentions. Fig. 2b shows that risk preference has a substantial positive impact on transition intention among farmers with high perceived capability. However, this effect is significantly diluted among those with low perceived capability. These findings indicate that adequate access to resources moderates the impact of resource constraints on execution anxiety during the transition process and thus enables risk-preferring farmers to convert their adventurous spirit into tangible transition strategies.

Moving to the opportunity role, column 3 of Table 5 indicates a highly positive correlation between risk preference and opportunity. This finding shows that the perceived reduction in external administrative barriers strengthens the positive influence of risk preference on transition intention. Fig. 2c shows that the positive impact of risk preference on intention is most substantial in a scenario with a low administrative barrier (high opportunity) and less significant in a scenario with a high administrative barrier (low opportunity). This evidence highlights that institutional friction (i.e., excessive certification processes) is an obstacle to the expression of farmers' adventurous spirit, whereas a lean institutional landscape eases the organic transition.

Lastly, on the moderating effect of legitimacy, column (4) of Table 5 shows that the interaction term between risk preference and legitimacy is positive and statistically significant. This suggests that the social legitimacy derived from being embedded in a network of successful organic farmers significantly enhanced the effect of risk preference. Fig. 2d reveals that the slope of the relationship between

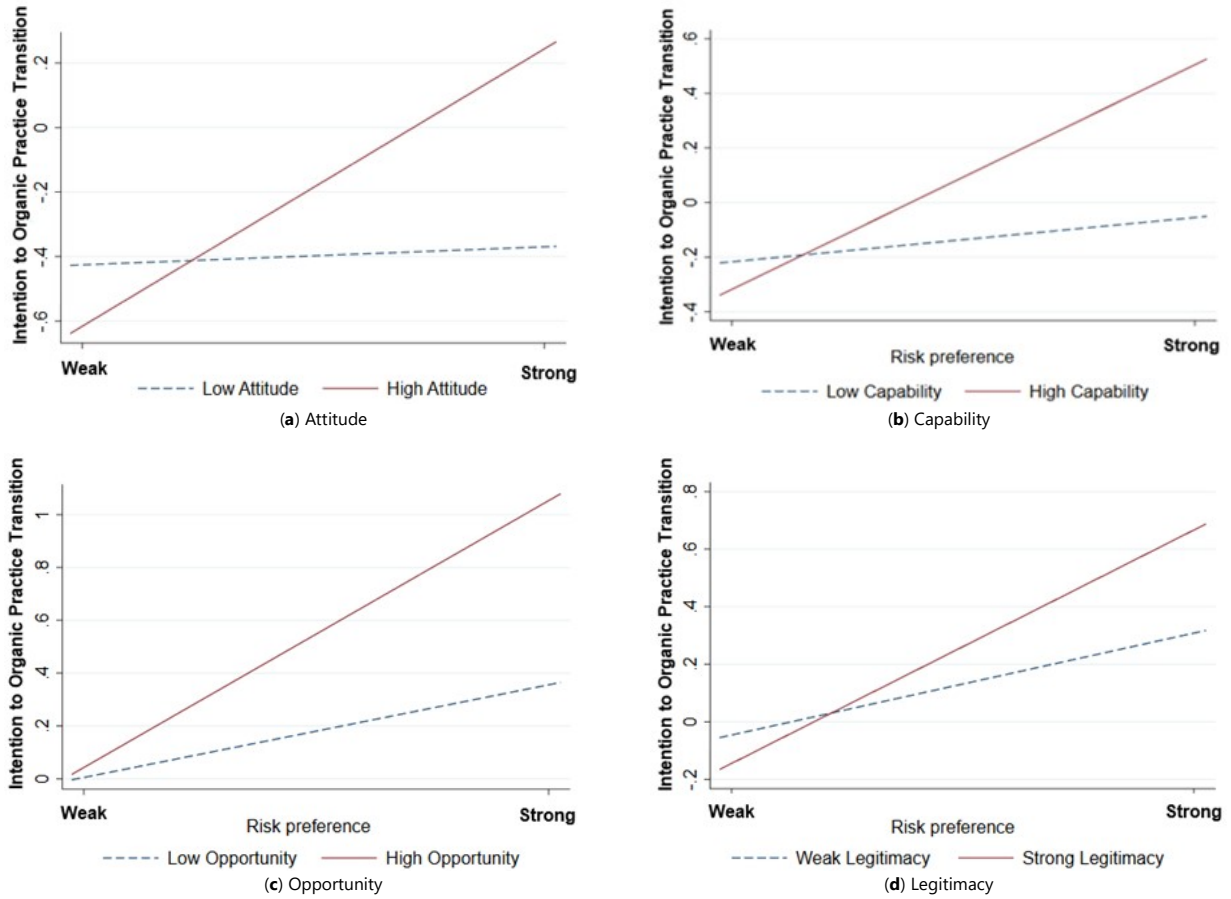

Fig. 2: Moderation analyses: (a) Attitude; (b) Capability; (c) Opportunity; (d) Legitimacy.

risk preference and transition intention is steeper for those farmers with strong peer effects. This suggests that effective peers will provide social evidence, minimize uncertainty, and create beneficial normative pressure, thereby providing strong social validation for risk-preferring farmers and strengthening their intention to transition.

In summary, the results of the moderation analysis fully support the theoretical framework of this study. The four contextual dimensions (attitude, capability, opportunity, and legitimacy) each interact with farmers' inherent risk preferences synergistically, collectively shaping their ultimate decision to transition to organic practices.

While the baseline regression reveals the average effect of risk preference on transition intention, these aggregate effects may mask systematic differences across different types of farmers. Identifying such heterogeneity is essential for understanding the underlying micro-mechanisms and designing targeted policies. Accordingly, we further examined the heterogeneous effects of risk preference along two critical dimensions: operational scale and production system.

Table 6 reports the results of the group-wise regressions. Columns 1 to 3 present estimates for small-, medium-, and large-scale farmers, respectively. The results indicate significant heterogeneity in the effect of risk preference across scales. For small-scale farmers, the coefficient of risk preference was statistically insignificant. In contrast, for both medium- and large-scale farmers, the coefficients were positive and statistically significant. This finding strongly suggests that resource constraints are a critical precondition for risk preference to exert its influence. Although small-scale farmers may be willing to take risks, limitations in capital, land, and risk resilience hinder their ability to translate this inclination into concrete transition plans. Their decisions are likely dominated by subsistence and security concerns. Conversely, medium- and large-scale farmers benefit from greater resource buffers and higher risk tolerance, enabling their risk preferences to be fully activated and thus significantly enhancing their transition intention.

Table 6: Heterogeneity Analysis: Operational Scale

	Dependent Variable: Intention to Organic Practice Transition		
	Small-scale farms	Medium-scale farms	Large-scale farms
	(1)	(2)	(3)
Risk Preferences	0.091	0.116**	0.117**
	(0.060)	(0.055)	(0.057)
Control variable	YES	YES	YES
Region FE	YES	YES	YES
Pseudo R2	0.133	0.171	0.147
Observations	140	140	140

* Note: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. Robust standard errors are shown in parentheses.

Table 7 presents the regression results by production system. Columns 1 to 3 correspond to specialized sheep, specialized cattle, and mixed-system farmers, respectively. The results indicate that for farmers engaged in mixed livestock systems, the coefficient of risk preference is not

statistically significant. However, for those involved in specialized production (whether sheep or cattle), the risk preference coefficient is positive and significant.

Table 7: Heterogeneity Analysis: Production System

	Dependent Variable: Intention to Organic Practice Transition		
	Specialized sheep farms	Specialized cattle farms	Mixed farms
	(1)	(2)	(3)
Risk Preferences	0.182*	0.104**	0.006
	(0.101)	(0.048)	(0.186)
Control variable	YES	YES	YES
Region FE	YES	YES	YES
Pseudo R2	0.152	0.056	0.255
Observations	119	219	82

* Note: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. Robust standard errors are shown in parentheses.

This result implied that the complexity of the production system can attenuate or even overshadow the effect of individual psychological traits. Mixed systems require simultaneous coordination of organic transition techniques, management protocols, and market demands for multiple livestock types, introducing inherent complexities and uncertainties that surpass those of specialized systems. Such high system-level risks may exceed the scope of individual risk preference, making decisions more dependent on other practical considerations. In contrast, specialized production offered a more straightforward pathway and more uniform management, providing a well-defined direction for risk-preferring farmers and allowing their personal traits to be more fully expressed.

In summary, the heterogeneity analysis demonstrates that the effectiveness of risk preference as a driver of transition intention is contingent on both the operational scale of the farm and the complexity of the production system. These findings offer a more nuanced perspective on farmers' behavioral intentions and provide valuable empirical evidence for the design of differentiated, well-targeted policy interventions.

DISCUSSION

This study developed an integrated analytical framework combining psychological traits and multidimensional contextual factors to systematically investigate the drivers of the transition to organic livestock farming among Kazakhstani herders. The primary results provide new theoretical insights and empirical evidence to understand farmers' decision-making behavior in adopting agricultural innovations.

First, this research affirms that the intention to adopt organic practices is a fundamental psychological motivator driven by risk preference. The result is consistent with the current literature, which considers risk preference as an antecedent of high-risk decision-making (Duan et al., 2021). More crucially, it also fills a research gap in modern studies on organic agriculture, which have largely centered on external economic influences such as prices and subsidies (Bravo-Monroy et al., 2016; Sapbamrer & Thammachai, 2021) without exploring the underlying individual psychological characteristics. Our findings indicate that a risk-taking attitude can be an inherent incentive to address the status quo bias and the underlying production, market, and institutional risks of transitioning (Eti, 2025).

Second, one of the most important contributions of this research is that it shows risk preference is systematically moderated by four dimensions of context: attitude, capability, opportunity, and legitimacy. This aligns with the theoretical expectations of the multidimensional framework advanced by Bottazzi et al. (2023) and provides empirical validation of the livestock industry and the Central Asian setting. In particular, a) The modulating effect of the attitude is in line with the results of Li et al. (2024) and Anebagilu et al. (2021), who also indicated that moral and ethical values had a significant effect on pro-environmental behavioral intentions of farmers. Our findings also suggest that strong moral attitudes reinforce the risk-taking tendency of people with a propensity towards risk-taking, thereby strengthening the organic intention to transition. b) The moderating role of capability supports claims by Shennan et al. (2017) and Andow et al. (2017) regarding the significance of resource access on organic transition decisions made by farmers. Our research builds on this point of view by demonstrating that resource capability enables risk-preferring farmers to translate psychological potential into actionable confidence. c) The opportunity moderating factor supports the claim that the perceived external opportunity, i.e., low institutional barriers, plays a significant role in the process of organic transition (Cranfield et al., 2010; Cakirli Akyüz & Theuvsen, 2020). Farmers are also encouraged, through a conducive institutional environment, to release their spirit of adventure, thereby making the transition easier. d) The moderating role of legitimacy directly aligns with the results of Tran-Nam and Tiet (2022) and Van et al. (2023) regarding the significance of social networks and peer influence to facilitate transition. This research also provides a clearer explanation: social legitimacy is a factor that enhances the influence of risk preference.

Lastly, the heterogeneity analysis indicated significant boundary conditions of these mechanisms. The absence of a significant risk preference effect among resource-constrained small-scale farmers provides a possible explanation for Flaten et al. (2010)'s observation that economic factors are the main reason farmers cease organic production: those with limited resources may struggle even to take the first step toward organic farming, regardless of their personal risk tolerance. Equally, the absence of a noticeable effect among mixed-system livestock farmers suggests that system-level complexity and risk override the impact of individual characteristics (Läpple, 2010). It offers a more subtle view of why some farmers make sustainable choices and others do not, noting that context (resources and complexity) can mediate the influence of personality traits such as risk preference.

This research has a few limitations. Firstly, cross-sectional data are utilized to determine correlations between variables, but they do not allow strict causal inference. Future studies may use panel data or

experimental methods to provide further confirmation of the causal impact of risk preference. Second, this study was conducted among livestock farmers; future research can thus compare the decision-making dynamics of crop and livestock producers to assess the generalizability of our results. Lastly, non-quantifiable cultural and social norms could also be significant. Qualitative or mixed-methods techniques might provide further information on how these factors mediate risk preferences in influencing decisions together.

The findings of this research have unambiguous implications for the policymaking process to encourage organic livestock production in Kazakhstan and other areas, and make the transition between the one-size-fits-all policy and differentiated intervention strategies: a) for farmers with different psychological traits, combine "push" and "pull" strategies. Target risk-preferring farmers with enhanced market information, technical training, and resource access (e.g., equipment leasing services and land transfer platforms) to help them translate entrepreneurial spirit into successful practice. For risk-averse farmers, introduce risk mitigation instruments such as organic agriculture price insurance, transition subsidies, and guaranteed purchase contracts to reduce trial costs and bolster initial confidence. b) Tailor support to operational scale. For small- and medium-scale farmers, priority should be given to alleviating resource constraints through low-interest loans, simplified micro-certification credits, and the establishment of "organic cooperatives for smallholders" to enable resource sharing and risk pooling through economies of scale. For large-scale farmers, policies should facilitate access to high-end markets and guide international certification to encourage their role as industry leaders. c) For mixed livestock farmers, promote a step-wise transition rather than an all-or-nothing approach. Encourage farmers to begin organic certification with one type of livestock and gradually expand as technical and managerial expertise develops, thereby reducing initial complexity and uncertainty.

Conclusion

This study found that risk preference strongly influences farmers' intentions to transition to organic livestock farming in Kazakhstan. Risk-tolerant farmers are significantly more likely to plan or begin organic conversion, even after controlling for demographic and regional factors. The impact of risk preference is enhanced by four contextual factors—positive attitudes, resource capability, institutional opportunities, and social legitimacy. These conditions enable risk-preferring farmers to act on their intentions. However, the effect is weaker among small-scale and mixed-system farmers, who face greater resource and management constraints. Overall, the findings suggest that promoting organic livestock farming requires policies tailored to farmers' psychological traits and operational contexts, combining risk-reduction tools for cautious farmers with support for resources and training for risk-takers. This integrated approach can more effectively drive Kazakhstan's transition toward sustainable organic livestock systems.

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