Risk preferences of agricultural students and their willingness to become a farmer

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Abstract

This study investigates the link between risk preferences of agricultural students and their willingness to become a farmer. I measure willingness to become a farmer and risk preferences in an online survey and incentivized experiment conducted with 577 students at Bogor Agricultural University, Indonesia. Discriminating between alternative theories of decision-making under risk, I find that students' risk preferences behave in accordance with Cumulative Prospect Theory (CPT), whereas there is no connection between risk preferences and students' willingness to become a farmer. Framing the risky gamble tasks in either an agricultural or a general entrepreneurship context does not help in improving the predictive power of the tasks. Based on a large sample with high statistical power, these results contribute to the debates on risk preferences in agriculture as well as methodological studies on the external validity of behavioral field experiments. I also discuss the impact of socio-economic background variables as they relate to generation renewal and the so-called "young farmer problem" in agriculture.

Keywords: Risk Preferences, Cumulative Prospect Theory, Agricultural Students, Experiment, Generation Renewal, Indonesia

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Abbreviations

CPT	Cumulative Prospect Theory
EUT	Expected Utility Theory
TPB	Theory of Planned Behavior
RAA	Reasoned Action Approach
AIC	Akaike Information Criteria
BIC	Bayesian Information Criteria
GPA	Grade Point Average

1. Introduction

The primary objective of this thesis is to estimate the impact of agricultural students' risk preferences on their willingness to become a farmer. The number of farmers in Indonesia is decreasing. At the same time, approximately five percent of the population—or 13 million people—experience food insecurity. Indonesia is increasingly dependent on food imports, which in recent years have increased at an annual rate of 5.98% (Statistics Indonesia, 2021), as farmers and agricultural workers move out of the sector. Although the conversion of farmland and efficiency gains in farming often go hand in hand with economic development, this view is not uncontested (Moeis et al., 2020; Prayitno et al., 2021). Recent global crises have also shifted policy debates towards a greater recognition of achieving higher levels of self-sufficiency and supply chain resilience which often goes along with a greater emphasis on local food production (e.g., Meuwissen et al., 2021).

Recent studies of farmer generational renewal have considered perceptions, motivations, and attitudes as drivers of people's decisions to become a farmer (Coopmans et al., 2021; Ephrem et al., 2021; May et al., 2019; Morais et al., 2018; Zaremohzzabieh et al., 2021; Żmija et al., 2020), and there is an increasing recognition that attitudes towards risks play an important role in the choice to become a farmer (Coopmans et al., 2021). However, there is a paucity of research that investigates these questions on the basis of economic models of risk preferences which can be viewed as a relatively stable trait of a person (Schildberg-Hörisch, 2018; Sitkin & Pablo, 1992). There also is ongoing debate in agricultural economics regarding the theoretical models to be used in explaining risk preferences, as well as different models' ability to predict real-world behavior (e.g., Bocquého et al., 2014; Rommel et al., 2022). While early research with farmers (e.g., Binswanger, 1980) was solely based on Expected Utility Theory (EUT, von Neumann & Morgenstern, 1947), inspired by (Allais, 1953) and Kahneman & Tversky (1979), there is also a more recent interest (e.g., Bocquého et al., 2014) in behavioral economic models such as Cumulative Prospect Theory (Tversky & Kahneman, 1992).

This thesis uses both models to answer the following research questions:

1. Is there a link between students' risk preferences and their willingness to become a farmer?
2. Can Cumulative Prospect Theory (CPT) better explain students' risk preferences than Expected Utility Theory (EUT)?

3. Can framing the experimental task in a context familiar to respondents better explain students' willingness to become a farmer?

This study contributes to the literature on generation renewal in farming. I focus on examining the group of agriculture students which were rarely discussed in past studies (Filloux et al., 2019; Zaremohzzabieh et al., 2021). Methodologically, the study also contributes to the growing literature on how to adapt risk elicitation tasks to specific study contexts (Menapace et al., 2016; Meraner et al., 2018; Rommel et al., 2019).

Experimental methods for eliciting risk preferences must be chosen for a specific study context (Charness et al., 2013). I decided to use a task from Tanaka et al. (2010) which is suitable for the topic and the framework that I use. Alekseev et al. (2017) argued that using a contextual framing of a task can be useful to enhance comprehension. It can also increase data quality for more sophisticated tasks. I adopt a task developed by Tanaka et al. (2010) to elicit risk preferences, since it follows Cumulative Prospect Theory (CPT). I use two experimental treatments to frame the task in agricultural and non-agricultural contexts, which allows me to test whether one of the framings can better explain the willingness to become a farmer.

The rest of the thesis is structured as follows. Chapter 2 presents a literature review on farmer generation renewal and farmers' risk preferences with a focus on experimental methods. Chapter 3 outlines the theoretical and methodological framework; chapter 4 presents the experimental design and procedures. Results are presented and discussed in chapter 5 and chapter 6, respectively.

2. Literature Review

2.1 Farmers Generation Renewal

Youths would often view a career in farming as the last option (Baker et al., 2013; Miller et al., 2011; Ridha et al., 2017), which can cause problems, as older farmers are sometimes less productive and efficient (Hamilton et al., 2015; Rigg et al., 2016; Zagata & Sutherland, 2015). Older farmers can also be less motivated and innovative, as well as less willing to adopt new technologies. This may also explain why most farmers in Asia, including Indonesia, are still smallholders which have very small fields (see Rigg et al., 2016, 2020). In addition, young farmers tend to be more likely to adopt sustainable farming practices (Pérez Urdiales et al., 2016).

There are several studies that have investigated young people's intention to become farmers. Most of these studies address generational renewal and succession within family farm households in Western countries (Leonard et al., 2017; May et al., 2019). Using the framework of reasoned action approach (RAA), Morais et al. (2017), for instance, identified successors' beliefs behind their intention to hand over the farm. They found that youths who are about to take over the farm are emotionally attached from farming activities, perceive themselves as capable of running the business, and receive support from their parents. Morais et al. (2018) used the same framework for potential successors which found a high intention to take up farming which was affected by attitude, perceived behavior control, and perceived norms. However, the results cannot explain and be implemented on youth who lack interest in agriculture. The selection problem of dealing with respondents who already have a high willingness to become a farmer, as found in the study of Arora & Slavchevska (2021), concludes that the high aspiration of youths' aspiration to become farmers may be an artefact of study design.

Other studies have also used the Theory Planned Behavior (TPB). Ephrem et al. (2021), for example, found a relatively low level of youths' intention to farm in the Eastern Democratic Republic of Congo. Local youth feel a lack of social support to become a farmer which is linked to "psychological capital," such as the confidence to make good decisions under risk and uncertainty. Even in light of support funds, mentioned psychological factors can dominate the decision to join farming. Zaremohzzabieh et al. (2021) found similar results in a group of agricultural

students in that their attitude toward farming and perceived behavior control affected their intentions to become farmers. These studies highlight the role of psychological and behavioral aspects in the decision to become a farmer.

Most studies agree that risk is an important factor affecting someone's interest in becoming a farmer. Coopmans et al. (2021) found that farming often implies greater personal risks than other occupations. Ephrem et al. (2021) and Zaremohzzabieh et al. (2021) noticed that youths who perceived that they are risk-takers have a higher intention to become a farmer. Filloux et al. (2019) argued that high risks associated with farming can become a major constraint. Furthermore, Arora and Slavchevska (2021) discerned that youths who were "risk-takers" and "opportunity-seekers" aspired to become entrepreneurs in sectors unrelated to agriculture. Hence, while there are high risks associated with farming, there are also some indications that the sector might attract risk-averse people. In conclusion, the studies agreed that attitudes towards risk are one of the most important factors in the decision to become a farmer.

2.2 Risk Preferences and Theories of Decision-making under Risk

To my best knowledge, previous generation renewal studies observed risk perception and risk propensity as factors behind youths' intention to become a farmer. Risk preferences differ from risk propensity and risk perception. Based on Sitkin and Pablo (1992), risk preferences are a stable character trait, indicating the degree to which one likes to take or avoid risks which is not necessarily influenced by other factors such as environment (also see Iyer et al., 2020). On the contrary, risk propensity is a perception of how willing individuals are to take risks affected by inertia, history, and risk preferences. On the other hand, risk perception is how a person *assesses* the risk of an event or a choice, that is, it is highly subjective.

2.2.1 Non-Expected Utility Theory

In the economic literature, risk preferences for a long time relied on Expected Utility Theory (EUT), albeit violations of EUT were mounting shortly after its introduction. The most prominent study from Allais (1953)—which has become known as the Allais paradox—experimentally and empirically demonstrated that people violate the Bernoulli principle, i.e., decision-making under risk cannot easily be explained by a concave utility function. Some of his points to highlight are the variance of the distribution of psychological values and the distortion of objective probabilities. Since then, the scholars tried to formalize various non-EUT models, as well as strengthened their criticism of EUT (see Starmer, 2000). Some behaviors that pointed towards the contravention of EUT are the link between wealth and risk

preferences (Lybbert & Just, 2007), status-quo effects on decision making (Samuelson & Zeckhauser, 1988), reference dependence (Farber, 2008; Fehr & Goette, 2007), and distorted considerations of (very small and very large) probabilities (Bruhin et al., 2010).

The observed behaviors lead to the conclusion that people are reference-dependent, loss-averse, and distorted in assessing probability which are the main features of Prospect Theory (PT, Kahneman & Tversky, 1979). PT allows people to have different utility in a gain and loss domain, rather than having the curvature of the utility function as a single parameter of risk aversion. In addition, PT features a non-linear value function which maps objective probabilities of risky gambles to distorted subjective probabilities. The latter feature is further developed also in Cumulative Prospect Theory (CPT, Kahneman & Tversky, 1992), combining ideas of rank-dependent EU (RDU) from Quiggin (1982) and PT. Among the non-EUT theories, CPT has quickly become the most popular theory for decision making under risk (Bocquého et al., 2014).

Debates on which framework to use in applied work is still going on. Harrison et al. (2007) and Harrison & Rutström (2008), for example, argued that there could be preference heterogeneity, in the sense that some people act more in accordance with EUT, whereas others behave in accordance with CPT. Along similar lines, List (2003) has argued that as people become more familiar with a decision environment, they shift from CPT to EUT when facing risky decisions. Furthermore, Harrison et al. (2010) found an inverse S-shape probability weighting function, but no difference of risk preferences under EUT and CPT theories. The first study used experiment without considering probability distortion and the latter did not consider the loss frame in the design. Bocquého et al. (2014) adapted an experiment that considers all three features of CPT and concluded that its framework can fit empirical data better than EUT based on the structural estimation of utility functions as in Harrison et al. (2010). Moreover, Sagemüller & Mußhoff (2020) who used the same design and method, showed that CPT is more suited than EUT and RDU.

2.2.2 Experimental Methods for Eliciting Risk Preferences under Non-EU Theories

A widely employed experimental design to elicit risk preferences which can account for CPT, is the task developed by Tanaka et al. (2010) (henceforth Tanaka task). The Tanaka task uses multiple price lists in which experimental subjects are asked repeatedly to choose between safer and riskier lottery gambles. The task also implements losses (participants receive an initial endowment that is large enough to cover potential losses). By varying probabilities, one can also estimate a probability weighting function. Unlike in Holt & Laury's (2002) task, Tanaka task do not allow for multiple switching points to ensure transitivity and strict

monotonicity by asking respondents in which row they would prefer to switch (see methods section for more details).

Regarding the framing of the lottery task, the researcher has a motive to present an easier task linked to the context of the decision environment under investigation. As argued by Alekseev et al. (2017), framing an experimental task in a known context can be useful to enhance data quality. Another argument would be that context enhance ecological validity, i.e., the predictive power of the behavior in the experiments for real-world behavior (e.g., Hill & Viceisza, 2012; Vollmer et al., 2017). However, Rommel et al. (2019) did not find an impact of framing on real-world behavior (albeit there were still some differences in behavior). In short, risk preferences are often unstable and context-dependent (Reynaud & Couture, 2012).

Table 1 presents an over of the study of Tanaka et al. (2010) and other studies that made significant contributions to the method while adopting the task for applying it to farmers or in the context of agriculture and rural areas. I adopt the following features from these studies: (1) CPT parameters are estimated to explain farmers' behavior (e.g., Liu, 2013); (2) I estimate structural models of EUT and CPT utility functions, following Harrison and Rutström (2008); and (3) I take some inspiration in framing the task from Villacis et al. (2021).

Table 1. Summary of experimental studies using the Tanaka task

Study	Objective	Sample	Method	Main findings
Tanaka et al. (2010)	Developed experimental method that can estimate three parameters in CPT. Linked the risk preferences to some economic indicators of household and village.	181 Vietnamese villagers	Presented three series (total 33 rows) of two lottery choices-Option A (safer) and Option B (riskier) with probabilities and outcomes using urns filled with balls. Respondents were asked from which urn they would like to take the ball. Estimated three parameters of CPT using mid-point analysis.	Village income is related to risk preferences, but household income is not. People living in poor villages are loss-averse while people living in prosperous villages are more likely to be risk-seeking.
Liu (2013)	Investigated the role of risk preferences in explaining decisions of Chinese farmers on adopting a new form of agricultural biotechnology in China.	320 cotton farmers in four Chinese provinces	Lottery task and parameters analysis were similar to Tanaka task. Regressed the three parameters of CPT on adoption of new biotechnology.	Farmers who are less risk-averse, less loss-averse, and overweight small probabilities adopted the technology earlier.
Bocquého et al. (2014)	Examined risk preferences of French farmers under EUT and compared it with CPT.	107 farmers represented 64 rural towns in Bourgogne	Lottery task was similar to Tanaka task. Developed structural analysis for EUT and CPT with which all parameters are jointly estimated.	CPT can better explain farmers' risk preferences. Farmers are twice as sensitive to losses as to gains of the same magnitude. Probability weighting function of the farmers form an S-shape.

Sagemüller & Mußhoff (2020)	Assessed risk preferences of smallholders in Cambodia and Lao PDR and found which one is a better fit distinguishing EUT, RDU, and CPT. Linked loss aversion with the shocks that households experienced in the past.	93 smallholders in Cambodia and 91 smallholders in Lao PDR	Lottery task was similar to Tanaka task. Added parameter to indicate the value function curvature for the loss domain. Estimated the parameters using maximum likelihood analysis. The parameters were also estimated under RDU.	CPT specification is the best to describe the data compared to EUT and RDU. Loss aversion increased after household experienced shocks.
Villacis et al. (2021)	Linked risk preferences of farmers in Ecuador to risk perception of climate change.	202 farmers from four villages in Chimborazo province, Ecuador	Framed the lottery task in agricultural setting. Mid-point method similar to Tanaka study.	Farmers that behave in line with CPT perceive a greater risk of climate change.
Rommel et al. (2022)	Replicated the study of Bocquého et al. (2014) in a larger sample (eleven European farming systems).	1,430 farmers from eleven countries in the European Union	Lottery task and parameters analysis were similar with Bocquého.	Farmers' risk preferences in all countries follow CPT, but with heterogeneity in magnitude of parameters. Farmers in this new dataset are less reference-dependent and more vulnerable to probability distortion.

3. Combined Theoretical and Methodological Framework

3.1 Utility Functions

I estimate risk preferences in two ways, by using (1) the so-called mid-point technique and (2) structural estimation of utility functions by maximum likelihood estimation. In what follows, I briefly describe the theoretical framework of the utility functions. Since I follow Bocquého et al. (2014) to compare EUT and CPT in the structural estimation, I also shortly introduce EUT.

3.1.1 EUT

I follow Bocquého et al. (2014) and Rommel et al. (2022) for the specification of EUT, where utility from a risky prospect is a EUT power function with a reflected utility function at zero (the status quo used throughout this thesis project) with parameter r:

$$u(y) = \begin{cases} y^r & if\ y \geq 0 \\ -(-y)^r & if\ y < 0 \end{cases}, \tag{1}$$

where y is outcome of a lottery and $1 - r$ is the Constant Relative Risk Aversion (CRRA) parameter. An $r < 1$ implies concavity and risk aversion in the gain domain ($y \geq 0$) and implies convexity and risk seeking in the loss domain ($y < 0$) as gains are reflected for losses.

For the structural estimation, I use maximum likelihood estimation with the following log-likelihood function:

$$\ln L^{EU}(\delta, X; r) = \sum_k \left[\ln \Phi\left(\Delta_k^{\mathrm{EU}}\right) \times I\ (\delta_k\ =\ A) +\ ln[1 - \Phi\left(\Delta_k^{\mathrm{EU}}\right)] \times I(\delta_k =\ B)\right], \tag{2}$$

where k indicates the choices pooled over all subjects and lottery tasks, I is the indicator function, and δ_k indexes the choice of lottery option A[B].[1] Therefore, the maximum likelihood estimation for risk parameter *r* is:

$$\hat{r} = \arg\max \ln L^{\mathrm{EU}}(\delta, X; r). \tag{3}$$

To allow for varying degrees of absolute and relative risk aversion, I also use expo-power of Saha (1993):

$$u(y) = \begin{cases} [1 - \exp(-\beta y^{\alpha})]/\beta & if\ y \geq 0 \\ [1 - \exp(-\beta(-y)^{\alpha})]/\beta & if\ < 0 \end{cases}, \tag{4}$$

where α and β indicate risk aversion for gains ($y \geq 0$) and the maximum likelihood of those parameters is defined as:

$$(\hat{\alpha}, \hat{\beta}) = \arg\max \ln L^{EP}(\delta, X; \alpha, \beta). \tag{5}$$

3.1.2 CPT

For CPT[2], I follow the specification used by Tanaka et al. (2010), Liu (2013), Bocquého et al. (2014), Rommel et al. (2022), and Villacis et al. (2021):

$$\begin{aligned} &PT(y, p; z, 1-p) \\ &= \begin{cases} v(z) + w(p)[v(y) - v(z)]; y > z > 0\ or\ y < z < 0 \\ w(p)v(y) + w(1-p)v(z); y < 0 < z \end{cases}, \end{aligned} \tag{6}$$

where $PT(\cdot)$ indexes the expected value over binary prospects $(y; z)$ with related probabilities $(p; 1-p)$.

The value function $(v(y))$ is defined as a piecewise power function that assigns distinct values in gain domain $(y > 0)$ and in loss domain $(y < 0)$, as follows:

$$v(y) = \begin{cases} y^{\sigma} & if\ y > 0 \\ 0 & if\ y = 0 \\ -\lambda(-y)^{\sigma} & if\ y < 0 \end{cases}. \tag{7}$$

σ simultaneously defines the utility function curvatures of the value function for the gain and loss domains. Although in the original specification used different parameters (Kahneman and Tversky, 1992), most empirical studies, for simplification, assume that parameter σ is equivalent in gains and losses (Wakker, 2010). It is anti-index of concavity for gains (σ > 0) where σ < 1 indicates risk

[1] See Bocquého et al. (2014) for the full derivation.

[2] For consistency, I adapt the value function following the specification in Bocquého et al. (2014).

aversion. λ displays the level of loss aversion. People are more sensitive to losses than to gains for $\lambda > 1$. Values smaller than one imply loss-seeking behavior.

For the probability weighting function, I follow Prelec (1998):

$$\omega(p) = \exp[-(-\ln p)^{\gamma}]. \tag{8}$$

Parameter γ determines the strength of the s-shape of the function. Values smaller than one imply distorted probabilities perceptions with an overweighting of small and an underweighting of large probabilities. For $\gamma = 1$, $\omega(p) = p$, i.e., probability perceptions are objectively correct. CPT implies that $\gamma<1$. Following the previous studies mentioned above, I assume that γ is a single parameter for controlling the curvature in both the gain and loss domains.

Then, the log-likelihood function for structural estimation of CPT utility functions becomes:

$$\begin{aligned} \ln L^{CPT}(\delta, X; \sigma, \lambda, \gamma) \\ = \sum_{k} [\ln \Phi(\Delta_k^{CPT}) \times I(\delta_k = A) \\ + \ln[1 - \Phi(\Delta_k^{CPT})] \times I(\delta_k = B)]. \end{aligned} \tag{9}$$

The estimation for three parameters becomes:

$$(\hat{\sigma}, \hat{\lambda}, \hat{\gamma}) = \arg\max \ln L^{CPT}(\delta, X; \sigma, \lambda, \gamma). \tag{10}$$

As in Rommel et al. (2022), I assume the only reference point to be the status quo, although there are debates to use other reference points (Barberis, 2013; Koszegi & Rabin, 2007) or multiple reference points (Koop & Johnson, 2012).

3.2 Linking Risk Preferences to the Willingness to Become a Farmer

Most studies in generational renewal in agriculture which are relevant for this study (Zaremohzzabieh et al., 2001; Morais et al., 2018; Ephrem et al., 2021) are based on the Reasoned Action Approach (RAA) or the Theory of Planned Behavior (TPB). However, few studies propose a direct link between risk preferences and the willingness to become a farmer. Hence, I combine ideas of RAA and TPB with Sitkin and Pablo's (1992) model, as adopted by Villacis et al. (2021) to link risk preferences and risk perception.

Figure 1 summarizes this framework which is based on the assumption that risk preferences are one major component in students' willingness to become a farmer.

I also include attitudes towards farming and available social support as well as other socioeconomic factors (e.g., growing up on a farm) in this framework.

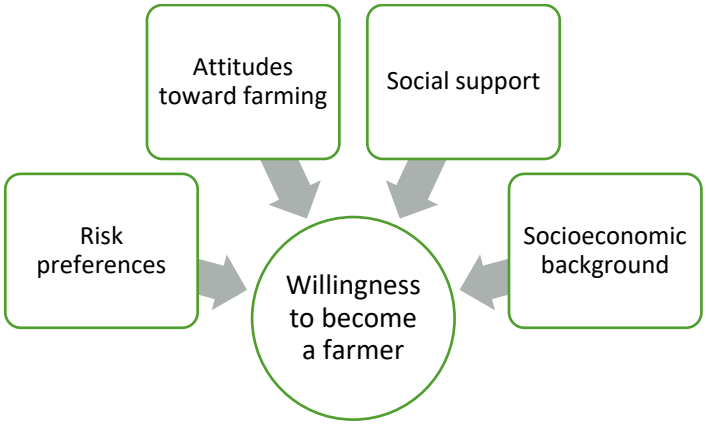

Figure 1. Framework of linking risk preferences with willingness to become a farmer

4. Experimental Design and Empirical Analysis

4.1 Experimental Design and Procedure

I adapted the multiple price list experiment from the Tanaka task on the basis of Bocquého et al. (2014). Two treatments modify the context of the task. This is to test whether different contexts of the tasks affect the respondents' choices. The first task is an agricultural scenario in which respondents are asked to perform a decision as if they were a farmer. In the second scenario, respondents are asked to respond as if they are entrepreneurs in a delivery-service business. Respondents performed both tasks in random order (crossover experimental design). In both scenarios, respondents are presented with payoffs and probabilities to choose between Technology A and Technology B, i.e., I frame the safer lottery (Lottery A) as Technology A and the riskier lottery (Lottery B) as Technology B.

Table 2 displays the lottery choices that I modify to account for agricultural and non-agricultural contexts. There are three series with 33 rows in total. To ensure monotonic switching, respondents are asked in which row they want to move to Technology B (change from Technology A to Technology B). Payoffs of the lottery choices are multiplied by 1,000 rupiahs. If participants choose Technology A in row 4 and series 1, they expect to get 40,000 rupiahs with a probability of 30% or 10,000 rupiahs with a probability of 70%. For series 3, if respondents choose Technology B in row 1, they can gain 30,000 rupiahs with a probability of 50% or lose 21,000 rupiahs with a probability of 50%. As illustrated in the column of the expected payoff difference, the values are negative and decrease as one moves down in the table, as the expected payoff of Technology B increases.

Respondents received incentives for their choices. All respondents received a show-up fee of 30,000 IDR (approximately two US dollars). This is a salient payment for participating in an online survey. It could cover two meals and is more than the typical opportunity cost of a student as proxied by an hourly wage. In addition to this show-up fee, twenty randomly selected respondents had a chance to be randomly selected for a payment based on their lottery choices.

Table 2. Framed lottery task, adapted from Tanaka et al. (2010)

Series 1				
Technology A		Technology B		Expected payoff difference (A-B)
30%	70%	10%	90%	
40	10	68	5	7.7
40	10	75	5	7.0
40	10	83	5	6.0
40	10	93	5	5.2
40	10	106	5	3.9
40	10	125	5	2.0
40	10	150	5	-0.5
40	10	185	5	-4.0
40	10	220	5	-7.5
40	10	300	5	-15.5
40	10	400	5	-25.5
40	10	600	5	-45.5
Series 2				
90%	10%	70%	30%	
40	30	54	5	-0.3
40	30	56	5	-1.7
40	30	58	5	-3.1
40	30	60	5	-4.5
40	30	62	5	-5.9
40	30	65	5	-8.0
40	30	68	5	-10.1
40	30	72	5	-12.9
40	30	77	5	-16.4
40	30	83	5	-20.6
40	30	90	5	-25.5
40	30	100	5	-32.5
40	30	110	5	-39.5
40	30	130	5	-53.5
Series 3				
50%	50%	50%	50%	
25	-4	30	-21	6.0
4	-4	30	-21	-4.5
1	-4	30	-21	-6.0
1	-4	30	-16	-8.5
1	-8	30	-16	-10.5
1	-8	30	-14	-11.5
1	-8	30	-11	-13.0

The randomization was performed in Excel. A row was randomly selected with equal probability. Based on the observed choices and probabilities, the final payment was calculated. Because of the show-up fee, negative total earnings cannot occur (the highest possible loss is fully covered by the show-up fee).

The survey was carried out in February 2022 with students at Bogor Agricultural University (IPB) in Bogor, Indonesia. I collected 577 responses from various bachelor and master programs at all faculties, except the Faculty of Veterinary Medicine, which I deemed unsuitable to cover participants that have a background and interest in farming. I distributed the survey online, using a Qualtrics-programmed web survey available under this link: https://bit.ly/previewquest. Respondents were given instructions and examples. Based on comprehension questions, most of them showed a good understanding of the experiment. The survey was distributed with the help of student representative contacts at faculty and department levels who were asked to share links in WhatsApp groups and emails. In order to limit responses from outsiders or the possibility of the survey to be captured by bots, students had to use their university email for processing the payments. The sample must still be considered a convenience sample though. Informed consent was obtained from all participants, no deception was used, a debriefing was offered, and the study's analysis followed a simple pre-registered protocol (https://aspredicted.org/L2N_TBT).

The CPT parameters of are estimated firstly using the mid-point technique which has the advantage that a parameter for each respondent can be obtained. These parameters can then be used to explain risk preferences. The parameters are estimated based on the mid-points of the intervals in accordance with the theory and switching points. Tanaka et al. (2010) provided the values for parameters of σ and γ (note that the original paper used slightly different symbols). The switching points in my case are the rows *after* the ones respondents indicated, as the question was: "Until which row you want to choose Technology A?".

However, Tanaka et al. (2010) did not show the mid-point values for the loss aversion parameter λ. I estimated the parameter based on switching points in series 3 and parameters for σ and γ. I give the example of the calculation of λ if σ = 0.8, γ = 0.05, and participant switching at row 4 in series 3 using equation (6). Following the calculation of λ_A based on row before the point:

$$v(1, 0.5; -4, 0.5) = v(30, 0.5; -21, 0.5)$$
$$\exp[-(-\ln 0.5)^{0.05}] \times 1^{0.2} + \exp[-(-\ln 0.5)^{0.05}] \times -\lambda(4)^{0.2} = \exp[-(-\ln 0.5)^{0.05}] \times 30^{0.2} + \exp[-(-\ln 0.5)^{0.05}] \times -\lambda(21)^{0.2}, \quad (11)$$

by solving the equation, I obtain λ_A = 1.877. Then, following the calculation of λ_B based on row of switching point:

$$v(1, 0.5; -4, 0.5) = v(30, 0.5; -16, 0.5)$$
$$\exp[-(-\ln 0.5)^{0.05}] \times 1^{0.2} + \exp[-(-\ln 0.5)^{0.05}] \times -\lambda(4)^{0.2} =$$
$$\exp[-(-\ln 0.5)^{0.05}] \times 30^{0.2} + \exp[-(-\ln 0.5)^{0.05}] \times -\lambda(16)^{0.2}, \quad (12)$$

by solving the equation, I obtain λ_B = 2.31. Then, the parameter of λ equals to 2.094 from calculating the mid-point between λ_A and λ_B as an approximation. To test whether CPT or EUT explain students' risk preferences, I take the average of each parameter and test whether the confidence interval of the parameters of λ and γ overlap with the null hypothesis of λ = γ = 1. If one does not fall within the confidence interval, I reject the null hypothesis of students' behavior in accordance with EUT. To test for treatment effects between the two differently framed tasks for the mid-point approximations, I use the Wilcoxon signed-rank test.

For the structural estimation, I follow the procedures described in Chapter 3. Following Rommel et al. (2022), I compared the AIC and BIC between the EUT and CPT models. As the CPT model is nested within EUT and estimates more parameters, judging the model also based on statistical fit is important. I modified the code from Bocquého et al. (2014) to estimate the structural models in Stata.

4.2 Empirical Analysis

To investigate the link of students' risk preferences and their willingness to become a farmer (WLF), I use a simple linear regression model. I assess the variable of WLF by asking the students how much they would be willing to work as a farmer in the future using an 11-point Likert scale. The econometric model is:

$$WLF_i = \alpha_i + \beta_{x,i} CPT_i + \gamma_{x,i} \mathrm{X}_i + \varepsilon_i, \quad (13)$$

where i indicates the respondent, x is a parameters vector to be estimated, CPT_i are the three parameters from the mid-point approximation of respondent i, i.e., σ, λ, and γ. X_i is a matric of covariates (see Table 3). I use Ordinary Least Squares (OLS) for estimation. Note that the data are ordinal, but the OLS estimator is easier to interpret. I add covariates stepwise to examine the robustness of the results. The same procedure is done for the agricultural and the non-agricultural task separately.

Table 3. List of Covariates

Groups of covariates	**Name of variable**	**Description**	**Expected coefficient sign**
Familiarity of farming	*Familiarity*	Familiarity with farming using 11-point scale.	+

	Parents	Dummy = 1 if at least one of the parents is a farmer.	+
	Origin	Dummy = 1, if origin from village.	+
Attitude towards farming (5-point scale) based on statements	*Attitude 1*	Being a farmer is for people with low education.	-
	Attitude 2	Being a farmer is a disgraceful job.	-
	Attitude 3	Being a farmer is very risky.	-
	Attitude 4	Being a farmer means having a hard life.	-
Social support (5-point scale) based on statements	*Support 1*	I do not get support from parents to become a farmer.	-
	Support 2	I do not get support from peers to become a farmer.	-
	Support 3	I get encouraged from teachers to become a farmer	+
	Support 4	I will not support my children to become a farmer.	-
Other demographic factors	*Gender*	Dummy =1, if Male.	NA
	Father educ	Categorical, 0= no schooling; 1= primary education; 2: lower secondary education; 3: higher secondary education; 4: post-secondary/higher education.	NA
	Expenditure	Categorical, 0: 0-500k; 1: 500k-1000k; 2: 1000k-2000k; 3: 2000k-4000k; 4: >4000k.	NA
	GPA	Categorical, 0: <3; 1: 3-3.33; 2: 3.33-3.5; 3: 3.5-3.77; 4:>3.77.	NA

5. Results

5.1 Summary of Statistics

The demographic of the respondents is the following: 55.63% are female, 42.63% come from a village, 22.01% have parents who are farmers, 40.47% spend 500,000 – 1,000,000 IDR per month on average, and 50.63% have a father with post-secondary or higher education. Summary statistics for some variables of interest are presented in Table 4. The willingness to become a farmer, the willingness to become an entrepreneur, and familiarity with farming are using 11-point scales. Meanwhile, the attitude and social support variables are using agree-disagree scales with five answer points.

Table 4. Summary of Variables of Interest

Variable	Description	Mean	St. Dev	Min	Max
WLF	Willingness to become a farmer	5.65	2.59	0.00	10.00
WLE	Willingness to become an entrepreneur	8.29	2.11	0.00	10.00
Familiarity	Familiarity with farming	5.83	2.60	0.00	10.00
Attitude 1	Farming is for low educated	1.39	0.66	1.00	5.00
Attitude 2	Farming is disgraceful	1.25	0.55	1.00	5.00
Attitude 3	Farming is risky	3.18	1.00	1.00	5.00
Attitude 4	Faming means having hard life (poor)	1.64	0.79	1.00	5.00
Social 1	Getting support from parents	2.44	1.01	1.00	5.00
Social 2	Getting support from peers	2.31	0.94	1.00	5.00
Social 3	Getting support from teachers	3.03	0.90	1.00	5.00
Social 4	Will not support their children	2.55	0.91	1.00	5.00
	N	577			

The average of students' willingness to become a farmer is 5.65, which is moderately low. It is substantially lower than the average of willingness to become an entrepreneur in other sectors (8.29). The average familiarity with farming is 5.83. On average, students disagreed with a negative statement toward being a farmer. Only Attitude 3 that indicates statement of farming is a risky job have higher average that means students are moderately agree with the statement. For social support, students mostly do not receive support to become a farmer especially from parents and peers. Students moderately agreed that they are encouraged by teachers

to become a farmer. However, most students disagreed with statement that they would not support their children in the future to become a farmer.

5.2 CPT Parameters

This part presents the estimates of risk preferences parameters and compares the EUT and CPT frameworks.

Table 5. Estimates and confidence intervals of CPT Parameters from mid-point technique

	Mean	Std. Err.	Confidence Interval (95%)	
			Lower bound	Upper bound
Agricultural task				
σ	0.61	0.01	0.58	0.64
λ	2.99	0.12	2.74	3.23
γ	0.64	0.01	0.62	0.66
Non-agricultural task				
σ	0.65	0.01	0.62	0.68
λ	2.85	0.12	2.61	3.09
γ	0.66	0.01	0.64	0.68
Observations	577			

Table 5 displays the average of the CPT parameters obtained by the mid-point technique. Using two different framings of the task, the average indicates that respondents act in accordance with CPT. Looking at the confidence intervals, I can reject the null hypotheses of $\lambda = \gamma = 1$. In conclusion, students are risk averse ($\sigma < 1$), loss-averse ($\lambda > 1$), and perceive probabilities distorted ($\gamma < 1$). The standard error for parameters σ and γ is very small, but is higher for λ which is in line with Rommel et al. (2022) and might be caused by the smaller number of gambles in the loss domain (only one series covers losses; whereas two series cover gambles in the gain domain).

Table 6 displays results from the structural estimation for the EUT, EU Exponential Power (EP), and CPT utility functions. Variable r controls the utility curvature which in the agricultural task is 0.36 and in the non-agricultural task is 0.38. The coefficient of relative risk aversion 1 –r is estimated to be more than 0.5 which means the students are very risk-averse in the gain domain and very risk-taking in the loss domain. For the EP of the agricultural task, α is 0.37 (less than 1) and β is 0.02 (more than 0). This means that respondents have, on average, decreasing absolute risk aversion and increasing relative risk aversion. However, these values are in contrast with the non-agricultural task for which the value of α is 0.37 (less than 1) with a β of -0.02 (less than 0). From the specification of EU and EP, we see that respondents are risk takers in the non-agricultural task.

Table 6. Estimates and confidence intervals for parameters from structural estimation

	Mean	Std. Err.	Confidence Interval (95%)		AIC	BIC
			Lower bound	Upper bound		
Agricultural task						
Expected Utility					24,217.01	24,224.87
r	0.36	0.00	0.35	0.37		
EU Power					24,208.80	24,224.51
α	0.37	0.01	0.36	0.38		
β	0.02	0.01	0.01	0.04		
Cummulative Prospect Theory					21,180.57	21,204.13
σ	0.47	0.00	0.47	0.48		
λ	1.78	0.03	1.73	1.84		
γ	0.63	0.01	0.62	0.65		
Non-agricultural task						
Expected Utility					23,998.18	24,006.03
r	0.38	0.00	0.37	0.39		
EU Power					23,991.64	24,007.34
α	0.37	0.01	0.36	0.38		
β	-0.02	0.00	-0.04	-0.01		
Cummulative Prospect Theory					21,139.02	21,162.58
σ	0.48	0.00	0.48	0.49		
λ	1.71	0.03	1.66	1.76		
γ	0.66	0.01	0.65	0.67		

The three risk parameters of CPT are significantly different from the 1 at the 1% level which means the students have non-linear utility functions, are loss-averse, and perceive probabilities distortedly. The value of σ is estimated as 0.47 in the agricultural task and 0.48 in the non-agricultural task. Since it is less than 1, it implies a concave utility in the gain domain and a convex utility function in the loss domain. The students are 1.78 times more sensitive to losses than gains for the agricultural task, while this factor is 1.71 in the other task. The estimated value for γ shows the students distortedly perceive probabilities, following an inverse S-shaped weighting function. The CPT estimates provide the best fit, as indicated also by low scores for AIC and BIC. Comparing the agricultural task and the non-agricultural task, students are more risk-averse, more loss-averse, and more probability-distorted.

5.3 Risk preferences and willingness to become a farmer

Table 7 presents regression results with main variables of interest from the CPT mid-point as the independent variables. The CPT parameters have no statistically significant relationship with students' willingness to become a farmer. Although λ is statistically significant in Model 5 and the parameter is positive, which means that loss-averse students are more willing to become farmer, one should not have a very strong interpretation of these parameters in light of the many tested hypotheses.

Table 7. OLS regressions on willingness to become a farmer

	Model 1	Model 2	Model 3	Model 4	Model 5
σ	0.265	0.262	-0.0977	-0.229	-0.229
	(0.340)	(0.351)	(0.322)	(0.332)	(0.305)
λ	0.0244	0.0401	0.0108	0.0399	0.0682**
	(0.0383)	(0.0402)	(0.0365)	(0.0361)	(0.0327)
γ	-0.107	0.0637	0.0786	-0.0156	0.177
	(0.396)	(0.400)	(0.338)	(0.343)	(0.319)
Gender		0.0714	-0.0643	0.0713	0.0666
		(0.226)	(0.196)	(0.198)	(0.180)
Expenditure		-0.113	-0.0587	-0.0473	-0.0754
		(0.119)	(0.107)	(0.109)	(0.0918)
Father education		-0.479***	-0.242*	-0.222*	-0.220*
		(0.128)	(0.126)	(0.129)	(0.117)
GPA		-0.159*	-0.0944	-0.115	-0.0831
		(0.0948)	(0.0810)	(0.0827)	(0.0766)
Familiarity			0.516***	0.482***	0.354***
			(0.0433)	(0.0464)	(0.0438)
Origin			-0.0635	-0.0373	0.0995
			(0.236)	(0.237)	(0.211)
Parents			-0.384	-0.356	-0.171
			(0.300)	(0.300)	(0.277)
Attitude_1				-0.657**	-0.551**
				(0.258)	(0.260)
Attitude_2				0.0181	0.218
				(0.365)	(0.365)
Attitude_3				-0.0196	-0.00518
				(0.112)	(0.0993)
Attitude_4				-0.209	0.0396

				(0.174)	(0.169)
Social_1					-0.392***
					(0.129)
Social_2					-0.157
					(0.131)
Social_3					0.660***
					(0.119)
Social_4					-0.495***
					(0.113)
Cons	5.480***	8.264***	4.331***	5.715***	5.869***
	(0.322)	(0.717)	(0.743)	(0.918)	(0.970)
N	577	520	520	496	492
R^2	0.002	0.041	0.274	0.297	0.426
adj. R^2	-0.003	0.028	0.260	0.277	0.405
AIC	2740.1	2447.6	2308.7	2194.3	2081.6
BIC	2757.5	2481.6	2355.5	2257.4	2161.3

Robust standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

I emphasize some other variables that interesting in this study as follows. Students' familiarity with farming increases their intention to become a farmer, but no statistically significant relationship is found for the variables *Origin* (from village or not) and *Parents* (whether any of their parents are farmer or not). Another demographic variable of interest is the father's education: students whose fathers have a higher level of education, have a lower intention to become a farmer. Other demographic and socioeconomic factors like gender, expenditure, and GPA do not show large or statistically significant links with the willingness to become a farmer.

For *Attitude* variables, it is just *Attitude 1* (farming is for low educated), that has a statistically significant effect on the willingness to become a farmer. Students who agree more with the statement have a lower willingness to become a farmer which is reasonable since they are pursuing a higher education at university level. For *Social* variables, support from parents and teachers seem to have an impact on students' career aspirations. Students who are getting lower support from parents have a smaller willingness to become a farmer, but those who have higher encouragement from teachers have a greater willingness to become a farmer. Then, students who would not want their children to become farmers also are not willing to become farmers. Support from peers does not have a statistically significant effect on students' willingness to become a farmer.

To better understand the impact of domain-specific risk preferences, I asked about the propensity to take risks, using the 11-points scale developed by Dohmen et al. (2011). I distinguished between general risk preferences, risk preferences as a farmer, as an entrepreneur, related to sports, and related to health behaviors. Table 8 shows the regression results. The variable risk propensity as a farmer is positively

and statistically significantly related to the willingness to become a farmer, which means that students who are willing to take a risk as farmers also have a higher willingness to become a farmer. In contrast, students who are willing to take risks as entrepreneurs in another sector have a lower willingness to become a farmer.[3] This is interesting, as since it shows that risk propensity depends on the context and whenever someone has a certain career aspiration, this also goes in hand with a willingness to take risks for that career.

Table 8. OLS regression on the willingness to become a farmer with variables of interest for domain-fspecific risk assessments

	Model 6	Model 7
Risk domain - general	0.0565	0.00544
	(0.0705)	(0.0720)
Risk domain - farmer	0.699***	0.372***
	(0.0481)	(0.0603)
Risk domain - entrepreneur	-0.166***	-0.167***
	(0.0602)	(0.0599)
Risk domain - sports	0.0109	0.0433
	(0.0396)	(0.0412)
Risk domain - health	-0.0353	-0.0451
	(0.0372)	(0.0363)
CPT Parameters	No	Yes
Covariates	No	Yes
_cons	2.669***	5.119***
	(0.438)	(1.018)
N	577	492
R^2	0.321	0.488
adj. R^2	0.315	0.463
AIC	2522.2	2035.7
BIC	2548.3	2136.4

Robust standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

5.4 Effect of framing the task

To see whether there is effect of framing task, at first, I look at whether there are differences on risk preferences as elicited by the tasks. Figure 2 displays the distribution of the parameters. There are small differences in the distribution, but overall, these seem negligible.

[3] I test if there is indication of multicollinearity using variance inflation factors which are below 2 in all instances, indicating very low multicollinearity.

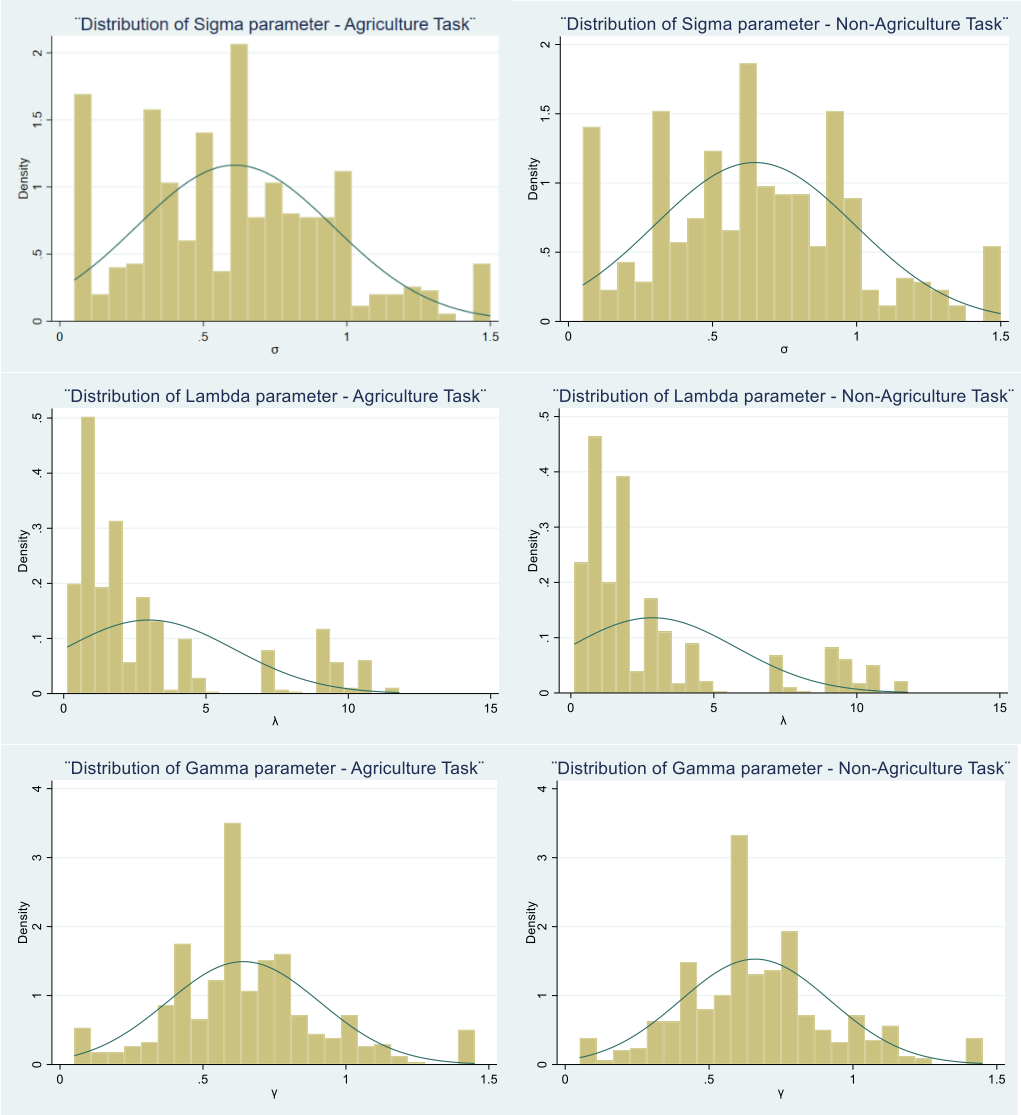

Figure 2. Distribution of CPT Parameters

I use the Wilcoxon signed-rank test for formal testing of differences in the distribution (due to the non-normal distribution as seen in the histogram).[4] Table 9 reports the test results. Two parameters have statistically significantly different distributions: σ at the 95% level and γ at the 90% level. The distribution of the parameter λ is not statistically significant different between the tasks. This may also happen because parameter of λ is noisier, as its standard error is higher compared to the other parameters (see Table 5). The distribution of σ in the agricultural task is less than σ in the non-agricultural task. It means that students are more risk-averse than in the non-agricultural task. In other words, students are willing to take greater

[4] I also ran some normality tests such as Shapiro-Wilk test, Shapiro-Francia test, and Skewness and Kurtosis test. All of them showed that the data are not normally distributed.

risks in an entrepreneurial setting (albeit the differences are small overall). Probability weighting is more pronounced in the task framed in the farming context.

Table 9. Wilcoxon signed rank test results on CPT parameters between agricultural and non-agricultural tasks

	obs	z_value	p_value
σ ag -- σ non-ag	577	-3.054	0.0022
λ ag -- λ non-ag	577	0.760	0.4474
γ ag -- γ non-ag	577	-1.821	0.0686

To explain respondents' willingness to become a farmer, I regress the CPT parameters from the non-agricultural task on the willingness to become a farmer (see Table 10). Focusing on the estimated coefficients for σ and γ, we can see that the results are fairly unstable for the CPT parameters across different model specifications. The coefficient of σ becomes insignificant after adding more variables, while γ become significant after doing it. In Model 8 and Model 9, the coefficient of σ is positive and significant which implies that students who are more risk-seeking have a higher willingness to become a farmer. Meanwhile, the coefficient of γ is positive and significant in Model 12 and 13 which means that students who are less probability-distorted have a higher willingness to become a farmer. However, since those are not stable, it is difficult to draw a clear conclusion.

Table 10. OLS regressions on the willingness to become a farmer for the non-agricultural task

	Model 8	Model 9	Model 10	Model 11	Model 12	Model 13
σ	0.677**	0.595*	0.271	0.246	0.222	0.124
	(0.330)	(0.347)	(0.321)	(0.324)	(0.291)	(0.297)
λ	0.00847	-0.00382	-0.0283	0.00665	0.0293	0.0211
	(0.0363)	(0.0383)	(0.0360)	(0.0362)	(0.0311)	(0.0300)
γ	0.460	0.433	0.286	0.350	0.684**	0.868***
	(0.404)	(0.411)	(0.344)	(0.363)	(0.340)	(0.303)
Demographics	No	Yes	Yes	Yes	Yes	Yes
Familiarity	No	No	Yes	Yes	Yes	Yes
Attitude	No	No	No	Yes	Yes	Yes
Social support	No	No	No	No	Yes	Yes
Risk domain	No	No	No	No	No	Yes
Constant	4.881***	7.874***	4.095***	5.266***	5.359***	4.679***
	(0.347)	(0.735)	(0.755)	(0.938)	(1.016)	(1.045)
N	577	520	520	496	492	492
R^2	0.012	0.047	0.277	0.297	0.427	0.492
adj. R^2	0.007	0.034	0.263	0.277	0.406	0.467
AIC	2734.1	2444.1	2306.4	2194.4	2080.8	2032.1
BIC	2751.6	2478.1	2353.2	2257.5	2160.6	2132.9

Robust standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

For comparison, I also investigate the willingness to do a business outside of the agricultural sector. Table 11 shows the regression results. Focusing on the CPT

parameters, there are no coefficient estimates that are statistically significant for any of the two tasks. Risk preferences have no link to students' willingness to become an entrepreneur. In contrast, variables of risk propensity are significantly affecting the willingness. Students who are more risk-seeking in general, in the farmer, and the entrepreneur domains have a higher willingness to open a business.

Table 11. OLS regressions on the willingness to become an entrepreneur

	Model 14 Agricultural task	Model 15 Non-agricultural task
σ	-0.208	-0.179
	(0.244)	(0.237)
λ	-0.0206	-0.0241
	(0.0276)	(0.0268)
γ	0.445	0.414
	(0.336)	(0.324)
Gender	-0.274*	-0.260
	(0.164)	(0.165)
Expenditure	0.0249	0.0100
	(0.0931)	(0.0922)
Father Education	-0.0920	-0.0966
	(0.0826)	(0.0820)
GPA	-0.133*	-0.126*
	(0.0715)	(0.0711)
Risk domain - general	0.352***	0.342***
	(0.0844)	(0.0833)
Risk domain - farmer	0.102*	0.106*
	(0.0551)	(0.0554)
Risk domain - entrepreneur	0.106	0.110*
	(0.0677)	(0.0657)
Risk domain - sports	-0.0366	-0.0358
	(0.0411)	(0.0409)
Risk domain - health	-0.0720**	-0.0682*
	(0.0356)	(0.0356)
Constant	6.153***	6.178***
	(0.670)	(0.653)
N	520	520
R^2	0.210	0.210
adj. R^2	0.191	0.191
AIC	2150.1	2150.3
BIC	2205.4	2205.6

Robust standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

6. Discussion

I discuss the elicited risk preferences based on the structural estimation and the midpoint technique. From both analyses, I conclude that risk preferences of agricultural students in Bogor, Indonesia are better modelled by CPT than by EUT. There are slight differences in which the values of σ and λ differ between the two methods, as also found by Bocquého et al. (2014). Using the mid-point technique results, students' risk aversion in this study is close to the average of most studies using the CPT framework, but more risk-seeking than Chinese farmers (Liu, 2013) and more risk-averse than French farmers (Bocquého et al., 2014). For loss-aversion, the students are less loss averse than subjects in most studies, but the parameter value is closer to Tanaka et al. (2010) with 2.63 and the estimation of Kahneman and Tversky (1992) which is 2.25. The students' parameter value for probability distortion is close to most studies, but rather far from the Ecuadorian farmers studied by Villacis et al. (2021) who found a value of 0.8.

I find no clear link between risk preferences and the willingness to become a farmer. This supports the argument of Rommel et al. (2019) that risk preferences elicited by lotteries are weakly correlated with real-world behaviors at individual level. Although some coefficients are statistically significant, the estimates are not consistent across multiple model specifications with covariates. I find a similar result when using the CPT parameters from the agricultural and non-agricultural tasks. However, again these should be treated with some care (see debates on p-hacking, publication bias, and in-transparency for instance in Brodeur et al., 2020; Lenz & Sahn, 2021).

Overall, my findings show that elicited risk preferences are relatively unstable and context-dependent which is based on my finding that risk preferences are different across tasks but have no different explanatory power for real-world behaviors. Although it may not be too surprising, slightly adapting lottery gambles and presenting them in a different setting, should not be seen as an easy way to study context-dependent risk preferences which is potentially better covered by psychometric scales developed for specific study populations and questions (Hansson & Lagerkvist, 2012). This result confirms what has been found by Rommel et al. (2019) for German farmers. Reynaud and Couture (2012) also showed the instability of risk preferences which they argued are context dependent. Against the previous arguments however, Menapace et al. (2016) demonstrated that

sometimes risk preferences *are* stable and *can* explain real-world behavior, but they have to be adapted to the context very strongly. What has been a major value added of my study though is the much larger sample size which increased statistical power and makes a false negative finding much less likely.

Future research should consider not to link risk preferences directly to the real-world behavior, but rather to risk propensity as suggested by Villacis et al. (2021). I also found risk propensity for specific domains to explain the willingness to engage in certain careers. However, I did not find a correlation between CPT parameters and risk propensity. I suggest for developing the risk domain specific question from Dohmen et al. (2011) to follow the CPT framework. The original study only asks for the risk-taking domain, but I suggest to also ask the self-assessment for loss-aversion and probability weighting for a greater range of risk domains in future research. Simple survey items that can capture some variation in the willingness to take risks are needed in much of social science, even though only risky gambles allow researchers to estimate utility functions (which simple items cannot).

Despite the missing statistically significant link between risk preferences and the willingness to become a farmer, some other findings may inform the debate on generational renewal in farming. Students who asses themselves as risk-seeking in a farming context and who have a higher familiarity with farming were also more willing to become a farmer. In education, this may mean that universities could offer extracurricular activities to reconnect students with farming life. Based on most students' answers about what they lack to become a farmer, access to capital/assets, knowledge and skills, as well as relevant social networks are other crucial resources for aspiring farmers. Whereas governmental bodies and universities could support students regarding these aspects, one should not forget the strong moral support students also deemed crucial for their willingness to become a farmer. Ultimately, the view of the farmer from society is not an easy thing to change. Changing the perception of farming as something that is for the poor and uneducated is needed in Indonesia.

7. Conclusion

The objectives of this study were to answer three questions: (1) *is there a link between students' risk preferences and their willingness to become a farmer?* (2) *can Cumulative Prospect Theory (CPT) better explain students' risk preferences?* and (3) *can framing of the experimental task in a context familiar to respondents better explain students' willingness to become a farmer?* I surveyed 577 students of Bogor Agricultural University (IPB) to elicit their risk preferences using the Tanaka task with two different framings (an agricultural and a non-agricultural task) in order to assess their willingness to become a farmer and to ask some other questions. The parameters of risk preferences were estimated using the mid-point technique and structural estimation which were then then regressed on the willingness to become a farmer.

I can conclude that there is no strong link between students' risk preferences and their willingness to become a farmer which strengthens the argument that risk preferences elicited through gambles cannot easily explain real-world behavior. Students' risk preferences are better explained by CPT than by EUT, and I have added some additional evidence to this long debate in decision-making under risk. Finally, framing the tasks cannot better explain any behaviors, but reinforces the argument of unstable and context-dependent risk preferences. Future research should consider not moving from risk preferences to risk propensities.

Appendix 1 – Questionnaire

The complete questionnaire is available under this link: https://bit.ly/previewquest.

Captures of important parts:

- **Introduction**

Thank you for your interest in this survey!

Introduction
I am Lukas Bonar Nainggolan, a Master student at the Swedish University of Agricultural Sciences (SLU). This survey is part of my thesis project which I want to understand how people make decision when facing risks.

Payment for participation
All of you, by participating, will get an initial payment of 30 000 IDR when completing the survey.

There will be 20 participants (approximately 10% of the total respondents) who are randomly selected to win additional incentives of up to IDR 600,000 or lose incentives of up to IDR 21,000. The terms will depend on the choice and the results of randomization which will be explained in the questionnaire.

Data, personal information, and confidentiality
We will use your data for scientific purposes in an anonymous form. The results of the survey will be scientifically analyzed, and all findings will be compiled in a publicly available report.

In order to administer payments, we will ask you for a student email address. We will only use this address to contact you regarding the payment. After the payment, the email address will be deleted from the data, and it will never be published.

Duration
It will take approximately 20 minutes to complete the survey. You can only participate once.

Risks
There are no known risks from participation.

Contact information
Send an email to *lrna0001@student.slu.se* if you have any questions.

Consent to participate
I herewith confirm that I have read and understood the above information. I am at least 18 years old and give my consent to participate in this research. I am aware that I am only eligible for payments if I provide a valid student email address at the end of the survey. I acknowledge that my email address will only be used to contact me for the payment.

○ I have read and understood the information presented. I am at least 18 years old, and I agree to participate in the study. (1)

○ I do not agree, or I do not want to participate. (4)

- **Lottery task (agriculture)**

In this simulation, you are a soybean farmer. You face uncertainty stemming from climate change, price volatility, pests and diseases, and the use of the technology you choose. So, the profit or you receive becomes uncertain.

In the following, there is table of three scenarios where you decide which technology to use.

Note: You may be one of 20 people who are randomly selected to receive additional or reduced incentives based on decisions in this simulation.

Case 1

The use of Technology A can provide a profit of: 40k with 30% chance OR 10k with a 70% chance.

The use of Technology B can provide a profit of: *more than 40k* with 10% chance OR 5k with a 90% chance.

¨In which rows do you choose Technology A?¨

Notes:
- 1k = 1 000 IDR
- You have initial money as much as 30 000 IDR (30k)

	Technology A		Technology B	
Row	**30%**	**70%**	**10%**	**90%**
1	40k	10k	68k	5k
2	40k	10k	75k	5k
3	40k	10k	83k	5k
4	40k	10k	93k	5k
5	40k	10k	106k	5k
6	40k	10k	125k	5k
7	40k	10k	150k	5k
8	40k	10k	185k	5k
9	40k	10k	220k	5k
10	40k	10k	300k	5k
11	40k	10k	400k	5k
12	40k	10k	600k	5k

I intend to use Technology A from Row 1 to Row

▼1 (1) ... 0 I would never use option A (13)

Case 2

The use of Technology A can provide a profit of: 40k with 90% chance OR 30k with a 10% chance.

The use of Technology B can provide a profit of: *more than 40k* with 70% chance OR 5k with a 30% chance.

¨In which rows do you choose Technology A?¨

Notes:
- 1k = 1 000 IDR
- You have initial money as much as 30 000 IDR (30k)

	Technology A		Technology B	
Row	90%	10%	70%	30%
1	40k	30k	54k	5k
2	40k	30k	56k	5k
3	40k	30k	58k	5k
4	40k	30k	60k	5k
5	40k	30k	62k	5k
6	40k	30k	65k	5k
7	40k	30k	68k	5k
8	40k	30k	72k	5k
9	40k	30k	77k	5k
10	40k	30k	83k	5k
11	40k	30k	90k	5k
12	40k	30k	100k	5k
13	40k	30k	110k	5k
14	40k	30k	130k	5k

I intend to use Technology A from Row 1 to Row

▼ 1 (1) ... 0 I would never use technology A (13)

Case 3

In this case, you have some probabilities to have negative profit (loss).

¨In which rows do you choose Technology A?¨

Notes:
- 1k = 1 000 IDR
- You have initial money as much as 30 000 IDR (30k)

	Technology A		Technology B	
Row	50%	50%	50%	50%
1	25k	-4k	30k	-21k
2	4k	-4k	30k	-21k
3	1k	-4k	30k	-21k
4	1k	-4k	30k	-16k
5	1k	-8k	30k	-16k
6	1k	-8k	30k	-14k
7	1k	-8k	30k	-11k

- Other questions

You have now completed the main part of the survey. We have a few more questions.

Please indicate, how much you would be willing to work as a farmer in the future, where 0 means you are not willing to work as a farmer at all and 10 means that you are very much willing to work as a farmer.

	0 1 2 3 4 5 6 7 8 9 10
My willingness to work as a farmer ()	

Please indicate, how familiar or unfamiliar are you with farming activities, where 0 means you are extremely not familiar and 10 means you are very much familiar.

	0 1 2 3 4 5 6 7 8 9 10
My familiarity with farming activities ()	

Please indicate, how much you would be willing to start your own business in the future, where 0 means you are not willing to start your own business at all and 10 means that you are very much willing to start your own business.

	0 1 2 3 4 5 6 7 8 9 10
My willingness to start my own business ()	

Some people like taking risks, whilst others are more reluctant to do so. Please indicate, how much you are reluctant or willing with respect to a risky decision, where 0 means that you are extremely very reluctant and 10 means that you are

very willing to take a risky decision. Please differentiate your answers for different domains using the scales below.

	0 1 2 3 4 5 6 7 8 9 10
Willingness to take risk in general ()	
Willingness to take risk if you were a farmer ()	
Willingness to take risk if you were an entrepreneur ()	
Willingness to take risks in your free time (e.g., in sports) ()	
Willingness to take risks in health (e.g., related to healthy food or smoking) ()	

farmer_attitude How much do you agree or disagree with these statements?

	Strongly disagree (1)	Disagree (2)	Neither agree nor disagree (3)	Agree (4)	Strongly agree (5)
Being a farmer is for people with low education. (1)	○	○	○	○	○
Being a farmer is a disgraceful job. (2)	○	○	○	○	○
Being a farmer is very risky. (8)	○	○	○	○	○
Being a farmer means having a hard life. (3)	○	○	○	○	○
My parents will not support me if I work as a farmer. (4)	○	○	○	○	○
My peers will not support me if I work as a farmer. (7)	○	○	○	○	○
My teachers encourage me to pursue a career as a farmer. (6)	○	○	○	○	○
If I have children, I don't want them to be a farmer. (5)	○	○	○	○	○

Questions regarding yourself

What is your gender?

- ○ Male (1)
- ○ Female (2)

Does your family live in a rural area?

- ○ Yes (1)
- ○ No (2)

How many people, including you, live in your household?

- ○ Household Size (4) _____
- ○ No answer (5)

Is any of your parents a farmer?

- ○ Yes (5)
- ○ No (4)

What is your average expenditure in a month?

- ○ 0 - 500 000 IDR (1)
- ○ 500 000 - 1 000 000 IDR (5)
- ○ 1 000 000 - 2 000 000 IDR (11)
- ○ 2 000 000 - 4 000 000 IDR (6)
- ○ Above 4 000 000 IDR (12)
- ○ No answer (10)

What is your father's highest level of education?

- ○ No schooling (7)
- ○ Primary education (SD) (1)
- ○ Lower secondary education (SMP) (2)
- ○ Higher secondary education (SMA) (3)
- ○ Post-secondary/Higher education (Diploma/Universitas) (4)
- ○ Do not know (5)
- ○ No answer (6)

How much is your GPA in the last semester?

- ○ Below 3.0 (9)
- ○ 3.0 - 3.33 (10)
- ○ 3.33 - 3.5 (11)
- ○ 3.5 - 3.77 (12)
- ○ Above 3.77 (13)
- ○ No answer (14)

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Popular science summary

Risk preferences and willingness to become a farmer

This study investigates the link between risk preferences of agricultural students and their willingness to become a farmer. The background is decreasing number of farmers and youth farmer problem.

577 Agricultural Students
Bogor Agricultural University, Indonesia.

5.83 out of 10 with overall level of familiarity with farming

44.4% come from rural area

55.6% are female

22.1% have parents as a farmer

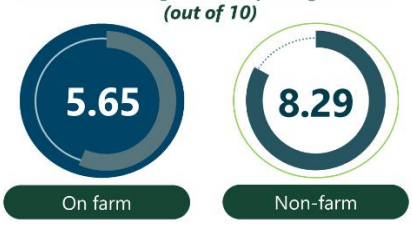
40.5% expend 500k-1000k IDR for each month

RESEARCH FRAMEWORK

WILLINGNESS TO BECOME A FARMER

01 RISK PREFERENCES
02 ATTITUDES TOWARD FARMING
03 SOCIAL SUPPORT
04 SOCIOECONOMIC BACKGROUND

Students' willingness on opening business *(out of 10)*

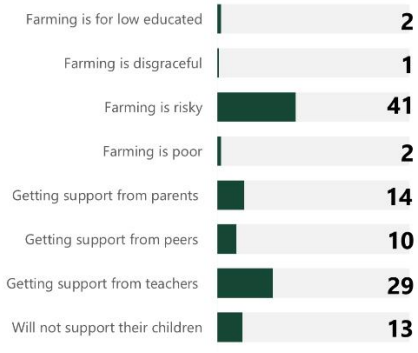


FINDINGS

01 Risk preferences can't explain students' willingness to become a farmer.

02 Familiarity with farming and social support become a main factor behind the students' willingness on farming.

Percentage of students who agree/strongly agree with these statements



Want to know your risk preferences?

SCAN HERE

Students' risk preferences follow Prospect Theory framework (Kahneman and Tversky, 1979): **risk-averse** for gain, **loss-averse**, and **probability distorted**.

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SCIENCE AND EDUCATION FOR SUSTAINABLE LIFE

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