Does Risk Aversion Affect Individuals'
Actions and Interests in Angel Investing?
Empirical evidence from Japan

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Does risk aversion affect individuals' actions and interests in angel investing? Empirical evidence from Japan[*]

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Abstract

This study explores individuals' actions and interests in angel investing, using a sample of more than 7,000 Japanese individuals obtained from original survey data. We examine whether risk aversion and discount rate are associated with angel investing. To provide a clear picture of potential and actual angel investors, we classify individuals' attitudes toward angel investing into "no interest," "interest only," and "action." The results reveal that individuals' risk aversion is negatively associated with their actions and interests in angel investing. We also find that wealthy individuals are more likely to engage in and have an interest in angel investing. Moreover, we find that among individuals with entrepreneurial experience, the discount rate is positively associated with angel investing, suggesting that entrepreneurs with a higher expected rate of return are more likely to engage in and have an interest in angel investing.

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1. Introduction

Early-stage investors provide financial capital to start-up firms, enabling their birth and development and thus contributing to innovation and growth in societies and economies (Bernstein et al., 2017; Solow, 1957). Conversely, a lack of early-stage investors willing to invest in start-up firms may cause inactive entrepreneurship because entrepreneurs often face difficulties in start-up financing. With respect to early-stage investors, numerous scholars have emphasized the role of private equity capital in the development of start-up firms (Berger and Udell, 1998; Bernstein et al., 2019). Among them, individual investors—especially those who invest in new businesses, often called "angel investors"—play a pivotal role in providing the initial capital (Cumming and Zhang, 2019; Harrison et al., 2016; Mason et al., 2021).[1] In this respect, the literature highlights the importance of interactions between entrepreneurs and angel investors (Mason and Botelho, 2016; Maxwell et al., 2011). It is possible that the entrepreneur-angel investor relationship influences new firm performance (Bammens and Collewaert, 2014; Fairchild, 2011; Honjo and Nakamura, 2020). Consequently, a growing number of national and local initiatives at the industry, government, and academia levels have been undertaken to promote new firm creation through angel investment (Harrison, Block et al., 2020; OECD, 2011).

Existing literature has argued that individuals' attitudes toward risks are associated with entrepreneurship and that risk-averse individuals are less likely to become entrepreneurs (Caliendo et al., 2009; Cramer et al., 2002; Van Praag and Cramer, 2001). Individuals' degree of risk aversion not only hinders entrepreneurial action, but also depresses entrepreneurial interest.[2] While, as mentioned above, the impact of risk aversion on the likelihood of becoming an entrepreneur has been examined in the literature, surprisingly, there is scant research on whether risk aversion is associated with angel investing. Moreover, it is unclear whether individuals' risk aversion affects either their actions or interests in angel investing. A better understanding of the impact of risk aversion on actions and interests related to angel investment is useful for strengthening policies toward risk reduction, including tax incentives, which could encourage angel investing. Further investigation of individuals' actions and interests in angel investing would help promote entrepreneurship in societies and economies.

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[1] Angel investors indicate a wide range of individual investors who invest their money and usually do not really know the founder (Wasserman, 2012). In our survey, however, we did not identify whether individual investors know the founder; thus, angel investors in our analysis virtually indicate individuals who invest their money in new businesses, regardless of relationships with the founder. In our survey, therefore, we can refer to angel investors as informal investors following Honjo and Nakamura (2020).

[2] However, Elston and Audretsch (2011) argued that risk attitudes do not play a significant role in entry decisions.

This study aims to provide a clear picture of potential and actual angel investors. Using a sample of more than 7,000 individuals obtained from original survey data of 10,001 Japanese individuals, we find out the types of individuals that engage in and have an interest in angel investing. In particular, we focus on the impact of risk aversion and discount rates on angel investment. We capture individuals' risk aversion following the measurement of absolute and relative risk aversion proposed by Cramer et al. (2002), and examine whether risk aversion is associated with angel investing. We also capture individuals' discount rates following the measurement of the subjective discount rate proposed by Harrison et al. (2002) and Ikeda et al. (2010). Moreover, we estimate the determinants of angel investing by classifying individuals' attitudes toward angel investing into "no interest," "interest only," and "action."

Using several types of empirical models, such as ordered and generalized ordered probit models, we identify the factors that affect individuals' actions and interests in angel investing. The results reveal that individuals' risk aversion is negatively associated with their actions and interests in angel investing, indicating that individuals with a lower degree of risk aversion are more likely to engage in and have an interest in angel investing. We also find that wealthy individuals are more likely to engage in and have an interest in angel investing. Moreover, we find that among individuals with entrepreneurial experience, the discount rate is positively associated with angel investing, suggesting that entrepreneurs with a higher expected rate of return are more likely to engage in and have an interest in angel investing.

The contributions of this study are threefold. First, we provide new evidence on the impact of risk aversion on angel investment. While the literature has examined its impact on entrepreneurship (Caliendo et al., 2009; Cramer et al., 2002; Van Praag and Cramer, 2001), there is a paucity of research on the relationship between risk aversion and angel investing.[3] Our findings suggest that risk aversion is negatively associated with an investment in new businesses. Second, we elucidate how risk aversion is associated with angel investing by identifying individuals' actions and interests in angel investing. We provide evidence of the differences in angel investing between individuals' actions and interests, considering the different effects between them. Third, we clarify the impact of entrepreneurial experience on angel investment. To date, numerous scholars have found a positive effect of entrepreneurial experience on start-up financing (Zaleski, 2011). While the entrepreneur-angel investment relationship has been highlighted in the literature (Honjo and Nakamura, 2020; Mason and Botelho, 2016; Maxwell et al., 2011; OECD, 2011), we clarify the relationship between entrepreneurial experience and angel

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[3] Using the fear of failure obtained from Global Entrepreneurship Monitor (GEM) data, Maula et al. (2005) examined the impact of the fear of failure on informal investment, but they did not find a significant impact on it.

investing. Indeed, the results reveal that entrepreneurial experience affects the impact of the discount rate on angel investment. Further, while the effects of both relative risk aversion and subjective discount rate on consumption have been examined in the literature (Booij and Van Praag, 2009), we provide new insights into those on angel investment action and interest.

The remainder of this paper is organized as follows. The subsequent section provides a review of the literature. Section 3 describes the data used in this study. Section 4 presents the models used in this study. Section 5 presents our estimation results. Finally, the concluding remarks are presented.

2. Research background

2.1. Angel investing for entrepreneurship

The development of active entrepreneurship is essential for sustainable growth in societies and economies because entrepreneurship is a driver of economic growth and industrial revitalization (Audretsch, 2007). However, entrepreneurs often face difficulties in start-up financing because their prospects are highly uncertain, lack tangible assets that can be used as collateral, and face severe information problems (Hall and Lerner, 2010). While many start-up firms depend on bank borrowing, some firms, especially high-tech start-ups, often require the risk capital provided by private equity investors (Colombo and Grilli, 2007; Honjo, 2021). It is plausible that private equity investors play a critical role in the initial funding of start-up firms with high growth potential and risk, such as high-tech start-ups, mainly because traditional financing sources, including banks, have limited willingness to provide funds to uncertain businesses. Financing from external suppliers of capital is heterogeneous among start-up firms, according to their risk levels.

Several studies have examined the relationship between entrepreneurs and venture capitalists (VCs) (Elitzur and Gavious, 2003a; Jain, 2001; Kaplan and Strömberg, 2003).[4] Angel investors are more likely to provide seed financing to entrepreneurs and their firms, unlike VCs, who tend to invest in them at later stages (Chemmanur and Chen, 2014; Cumming and Zhang, 2019). Both types of investors are essentially regarded as value-adding investors (Dutta and Folta, 2016; Vanacker et al., 2013). While VCs are employed in an organization, angel investors, who are often wealthy, make investment decisions themselves. Usually, angel and venture capital (VC) funding are viewed as complementary and synergistic investment processes (Harrison and Mason, 2000). Angel investors may also play a role in bridging financing between start-up firms and VC

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[4] Elitzur and Gavious (2003b) argued that entrepreneurs and angel investors interact with VCs when start-up firms need further investment, using a game theoretic model of entrepreneurs and VCs.

investments; therefore, the importance of angel investors increases in the early stages of a business. Angel investment is often a prerequisite for obtaining investments from VCs (Madill et al., 2005).[5]

The entrepreneur-angel investor relationship is inevitable for seed financing. It is necessary to vitalize the entrepreneur-angel investor relationship (Mason and Botelho, 2016). Indeed, angel investors are more likely to have entrepreneurial experience (Ho and Wong, 2007). The number of start-up firms that receive funding increases when entrepreneurs and investors engage in investment interactions (Maxwell et al., 2011). Moreover, angel investors play a critical role in entrepreneurial ecosystems, in which actors and factors, including entrepreneurs and angel investors, are linked each other in a region or country, by funding the start of the entrepreneurial pipeline (Mason et al., 2021). A better understanding of the factors used to trim the set of business opportunities seeking investment can increase an entrepreneur's likelihood of achieving funding (Maxwell et al., 2011).[6]

2.2. Individuals' action and interest in angel investing

Entrepreneurial intention is the most important and central determinant of entrepreneurial behavior (Abraham et al., 1998; Bygrave, 1989; Krueger, 1993). Existing literature has addressed the concept of entrepreneurial intention, based on the view that forming the intention to start a business is an important step in the process of entrepreneurial activity (Liñán et al., 2011; Schlaegel and Koenig, 2014; Van Gelderen et al., 2015; Zapkau et al., 2015). The differences in entrepreneurial intention and action are supported by theoretical arguments, specifically, the theory of planned behavior (Ajzen, 1991), the entrepreneurial event model (Shapero and Sokol, 1982), and/or the Rubicon model of action phases (Gollwitzer, 1999; Heckhausen and Gollwitzer, 1987).

However, while entrepreneurial actions and intentions have been investigated, individuals' actions and interests (or intentions) in angel investing have been ignored in the literature. Undoubtedly, angel investing comes with a higher risk than general investing. Because of the risk level, individuals' decisions on angel investing differ from their decisions on general investing, especially in large established firms. In general, investors require more information about their

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[5] However, Hellmann and Thiele (2015) provided "friends or foes" theory that explicitly models the interdependences between angel investors and VCs.

[6] Maxwell et al. (2011) investigated the decision-making process of potential angel investors using interactions between entrepreneurs and potential angel investors in a reality TV show. They observed the decision process, identified specific factors, and broke down a complex process into stages.

investment decisions. However, start-up firms' characteristics, such as young age, small capital, and simplified accountant requirements, make it difficult for outside investors to verify their net worth (Tirelli, 2021). In other words, information asymmetries tend to arise between entrepreneurs and investors. In this respect, angel investors are required to take a high risk; that is, they must be prepared to tolerate high risk. Moreover, individuals' psychological traits may be related to angel investment. Such psychological traits enable individuals to have a greater interest in angel investing. In addition, the presence of entrepreneurs and angel investors serving as role models in the immediate community may encourage individuals' actions and interests in angel investing.

It is often argued that the level of risk aversion matters for angel investing (Maula et al., 2005). On the one hand, individuals with a lower degree of risk aversion are more likely to invest in new businesses in the early stages. On the other hand, such individuals may have more interest in angel investing. In other words, the risk-aversion level has a significant effect on both individuals' actions and interests in angel investing. Moreover, an increase in the level of experience reduces risk aversion to angel investment (Capizzi, 2015). It is also plausible that individuals' actions and interests in angel investing vary according to their experience in entrepreneurial activity.

Many countries, including local governments, are willing to promote angel investment in entrepreneurship (OECD, 2011). Indeed, angel tax credits to subsidize early-stage investors by providing personal income tax credits equal to a certain percentage of their investment, irrespective of investment outcomes, have been widely adopted in some economies (Harrison, Block et al., 2020). Such tax incentives are expected to promote angel investment by reducing payments. However, unless individuals are interested in angel investing, such tax incentives do not exert individual action toward angel investing. To promote angel investment more effectively, we should better understand whether individuals not only invest in new businesses but also have an interest in angel investing.

2.3. Risk aversion and discount rate

A substantial number of studies have argued that risk aversion discourages individuals from entrepreneurship (Blanchflower and Oswald, 1998; Kihlstrom and Laffont, 1979). Indeed, several studies have examined entrepreneurial decisions using a measure of risk aversion (Caliendo et al., 2009; Cramer et al., 2002; Elston and Audretsch, 2010, 2011). These studies have established the stylized fact that individuals with a lower degree of risk aversion tend to opt for entrepreneurship.

Similarly, risk aversion may discourage individuals from angel investing. Conversely, a low degree of risk aversion encourages individuals' actions and interests in angel investing. Thus, we

hypothesize that individuals with a low degree of risk aversion are more likely to become angel investors and have an interest in angel investing. However, while individuals generally have difficulties in controlling the risk of income arising from the choice of becoming entrepreneurs, they can control the risk of investment through a diversified investment portfolio. Even if an investor has a propensity to avoid high risk, the investor may possibly control the risk of angel investment using portfolio investment. Therefore, it is plausible that the impact of risk aversion on the likelihood of becoming an angel investor differs from that on the likelihood of becoming an entrepreneur. Nevertheless, there is scant research on whether risk aversion affects angel investment. Because of the importance of the entrepreneur-angel investor relationship, research on the impact of risk aversion on angel investment is needed in the literature.

Moreover, other traits may affect individuals' decisions regarding angel investing. In the literature, the subjective discount rate, in addition to the relative risk-aversion level, plays a role in the estimation of the Euler equation of aggregate consumption (Booij and Van Praag, 2009). Essentially, individuals pay attention to the net present value of an investment, which is calculated, based on the expected return and discount rate. Given that the expected return is fixed, the discount rate may represent an individual's expected rate of return on the investment. Indeed, some scholars have emphasized the expected rate of return as VCs' preference (Appelhoff et al., 2016; Petty and Gruber, 2011). Accordingly, individuals' investment actions and interests may depend on their expected rates of return. Thus, we examine whether individuals' subjective discount rates influence their actions and interests in angel investing. If a higher subjective discount rate indicates a higher expected rate of return, we hypothesize that the subjective discount rate is associated with an individual's action and interest in angel investing.

Furthermore, it is conceivable that the impact of risk aversion on angel investment depends on individuals' wealth. While individuals with a low degree of risk aversion are interested in angel investing, they may face difficulties in angel investment action without sufficient wealth. Such individuals require more free cash to engage in angel investment. Additionally, individuals' personal attributes have an impact on their actions and interests in angel investing. Incentives for angel investing, such as tax incentives, may also be effective in promoting actions and interests in angel investing. We identify the factors that affect individuals' actions and interests in angel investing, while considering the differences in wealth and personal attributes between individuals.

2.4. The Japanese context

Entrepreneurial activity and individual entrepreneurship are stagnant in some developed economies, including Japan. According to the Global Entrepreneurship Monitor (GEM) Report,

in practice, Japan, compared to other developed economies, is always lowly ranked in terms of entrepreneurial activity and individual entrepreneurship (Honjo, 2015; Honjo and Nakamura, 2020). According to the White Paper on Small and Medium Enterprises, the proportion of people not interested in business start-ups in Japan was 77.3% in 2012, which is much higher than that in France, Germany, the UK, and the US (Small and Medium Enterprise Agency, 2017). Many individuals in Japan have no interest in entrepreneurship, and such a low level of entrepreneurial interest discourages entrepreneurial activity.

It is well known that Japan has a bank-centered financial system, and debt financing from financial institutions, including banks, plays a central role in financing (Honjo, 2021; Pinkowitz and Williamson, 2001). Due to the supporting infrastructure, Japanese firms have better access to financial resources, such as bank loans and government support (Suzuki et al., 2002). Meanwhile, VC and angel financing are advocated as important sources of financing for young and innovative firms (Block et al., 2018). Equity financing has advantages over debt financing for high-tech investment (Carpenter and Petersen 2002; Colombo and Grilli, 2007; Hall, 2002). Indeed, some entrepreneurs, especially entrepreneurial inventors, tend to seek equity financing (Honjo, 2021). However, the role of angel investing is limited in some countries, such as Japan, mainly because of fewer entrepreneurs and angel investors in these countries (Honjo and Nakamura, 2020). Therefore, nascent entrepreneurs often face difficulties in initial equity funding because of a lack of private equity capital, such as angel investors.

As discussed, Japan has a higher rate than North American and European nations of individuals disinterested in starting a business (Small and Medium Enterprise Agency, 2017, 2018). For this reason, the government promoted projects to popularize and raise awareness of business start-ups to increase individuals' understanding of and interest in business start-ups under the Bill for Partially Revising the Act on Strengthening Industrial Competitiveness adopted by Cabinet decision on February 9, 2018—specifically, start-up support business plans and start-up momentum cultivation projects, including training entrepreneurs and holding business plan contests for young generations (Small and Medium Enterprise Agency, 2018). Moreover, the Angel Tax System, introduced in 1997 to promote investment in young and small firms in Japan, provides tax incentives to individual investors. The Angel Tax System allows individuals who have invested in start-up firms to receive tax benefits both when they invest in and sell their stocks (Small and Medium Enterprise Agency, 2017). [7] However, although national and local

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[7] There are two types of tax benefits. Type A, which can be applied for investment into firms less than three years old (five years old after the tax reform in April 2020), is a reduction from gross income (deduction calculated by the amount of investment into target firms) for the year. Type B, which can be applied for investment into firms less than 10 years

governments have encouraged individuals to have an interest in business start-ups, it is not yet certain whether such support and initiatives contribute to increasing individuals' actions and interests in angel investing, as well as entrepreneurship. Further research on individuals' investment actions and interests is required.

3. Methods

3.1. Generalized ordered probit model

While some scholars have examined the determinants of angel investing, they have only identified whether an individual has experience in angel investing (Honjo, 2015; Honjo and Nakamura, 2020). In this study, we examine whether risk aversion is associated with angel investing by considering the differences in angel investing between individuals' actions and interests. While individuals' actions determine angel investment, their interests may involve future angel investing. In this respect, individuals' investment actions and interests can be regarded as ordinal variables; hence, we apply an ordered probit model to estimate the determinants of individuals' actions and interests in angel investing. Moreover, the impact of the determinants of individuals' interests in angel investing may differ from that of their actions. For this reason, we employ a generalized ordered probit model in this study.[8]

Let y_i^* $(i = 1, ..., n)$ denote a latent variable that represents individual i's response to angel investment. This latent variable is assumed to have a linear relationship with a vector of covariates X_i, which describes individual i's characteristics, such as risk aversion, wealth, and personal attributes, for angel investing:

$$y_i^* = X_i^T \beta + \varepsilon_i \qquad (1)$$

where β is a vector of coefficients, and ε_i is an error term.

The observed variable Y_i is associated with the latent variable. $Y_i = 1$ if individual i has no interest in angel investing (no interest), $Y_i = 2$ if individual i has an interest in angel investing but has no experience in it (interest only), and $Y_i = 3$ when individual i has experience in angel investing (action). Following the generalized ordered probit model, we specify the probabilities of an individual's no interest, interest only, and action:

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old, is a deduction from capital gains (deduction of the amount invested into target firms from other capital gains) for the year (Small and Medium Enterprise Agency, 2017).

[8] For more details of the generalized ordered probit model, see Pudney and Shields (2000).

$$\Pr(Y_i = 1 | X_i) = \Phi(\alpha_1 - \beta_1^T X_i),$$
$$\Pr(Y_i = 2 | X_i) = \Phi(\alpha_2 - \beta_2^T X_i) - \Phi(\alpha_1 - \beta_1^T X_i), \qquad (2)$$
$$\Pr(Y_i = 3 | X_i) = 1 - \Phi(\alpha_2 - \beta_2^T X_i),$$

where α_1, α_2, β_1, and β_2 are the parameters to be estimated, and $\Phi(\cdot)$ is the cumulative normal distribution. When the standard ordered probit model can be applied, the vector of coefficients β_1 equals that of coefficients β_2.

3.2. Risk aversion

Numerous scholars have attempted to estimate risk aversion (Bliss and Panigirtzoglou, 2004; Chetty, 2006; Harrison et al., 2007). There are several approaches to assessing the nature of an individual's risk aversion through laboratory experiments. The first is based on the certainty equivalent of a given lottery using open-ended valuation procedures, including the method proposed by Becker et al. (1964). The second is based on the choice of lotteries that vary prizes offered for given probabilities (Binswanger, 1981). Holt and Laury (2002) also proposed an experimental measure of risk aversion using a multiple price list design.

In a seminal work on entrepreneurship, Cramer et al. (2002) proposed a measure of risk aversion using a reservation price, in which the price respondents would pay for a ticket in a hypothetical lottery with 10 tickets and a single prize of certain cash (1000 guilders). They considered the Arrow–Pratt measure of absolute risk aversion (Pratt, 1964). Their method is useful for capturing the risk-aversion level using a single question. Following this method, we measure the absolute risk-aversion index (*A_RISK_AVERS*). We ask how much an individual would pay for a lottery ticket and obtain the risk-aversion index for an individual from the bids. The risk-aversion index is given by:

$$A\_RISK\_AVERS = \frac{-U''}{U'} = \frac{aZ - p}{(1/2)(aZ^2 - 2aZp + p^2)} \qquad (3)$$

where Z is the prize or loss, a is the probability of winning or suffering a loss, and p is the respondent's bid.

Using the answer to the lottery question, we capture an individual's risk-aversion level. While this index indicates the absolute risk-aversion level, the risk-aversion level depends on the individual's wealth. Cramer et al. (2002) also proposed the relative risk-aversion index (*R_RISK_AVERS*), defining the multiple of an individual's absolute risk-aversion index and wealth. Using the relative risk-aversion index, we examine whether an individual's risk aversion is associated with angel investing.

3.3. Discount rate

Although angel investors expect to earn higher financial returns than those investing in publicly traded firms, realized returns are often low, partially because entrepreneurs are overly optimistic about future performance (Cassar, 2010; Landier and Thesmar, 2009). The future is ambiguous and uncertain, while the present is concrete and certain, and individuals act reasonably when they consume benefits immediately but postpone costs to a later point in time (Haq and Weiss, 2018). Understanding the rate of discounting is essential for individuals' investment decisions.

Decisions that involve trade-offs between the present and the future are referred to as inter-temporal decisions (Haq and Weiss, 2018). This survey includes four questions on inter-temporal choices to measure the respondents' discount rate following the measurement of the subjective discount rate proposed by Harrison et al. (2002) and Ikeda et al. (2010). We asked respondents questions regarding four inter-temporal choices with different delay options (r_1, r_2, r_3, r_4).[9] Detailed explanations are presented in the Appendix. The discount rate ($DISC\_RATE$) is given by:

$$DISC\_RATE = \frac{1}{4}\sum_{j=1}^{4}\frac{r_j - \mathrm{E}(r_j)}{\sigma(r_j)} \tag{4}$$

where $\mathrm{E}(\cdot)$ and $\sigma(\cdot)$ represent the sample mean and standard deviation, respectively. Using the discount rate measure, in addition to the risk-aversion index, we examine the factors that affect individuals' actions and interests in angel investing.

4. Data

4.1. Data collection and sample

The data used in this study come from "Internet Survey on the Characteristics and Decision-Making of Potential Entrepreneurs and Angel Investors," conducted by our previous research project at the Research Institute of Economy, Trade, and Industry (RIETI), Japan. The RIETI subcontracted Rakuten Research, Inc. (currently, Rakuten Insight, Inc.) to distribute the survey and collect and tabulate the responses in May 2018. The survey targeted male and female

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[9] Harrison et al. (2002) considered four possible time horizons: 6 months, 12 months, 24 months, and 36months. Ikeda et al. (2010) used five questions on intertemporal choice under alternative conditions by controlling for (i) money amounts, (ii) time horizons, (iii) time delays, and (iv) receipt or payment.

individuals aged between 18 and 79 years in Japan. Surveys were distributed and collected in proportion to each prefecture's population by gender and age group. When the target proportion of responses for a group was not met, the number of responses was supplemented with unused responses for that gender/age group from the same regional area. Surveys were sent to 150,144 people, and 13,449 responses were received (response rate: 8.96%). After eliminating invalid survey responses, such as those with missing data, the original survey data contained 10,001 responses.[10]

The survey included several questions. We collected not only action and interest in investing and angel investing, but also entrepreneurial experience, interest in business start-ups, and the sociodemographic data of individuals. In this survey, an angel investor is defined as an individual with experience in funding a new business or project started by someone else during the past three years. It is important to note that angel investment in this study includes investment in a new business by an individual, regardless of whether the individual is a professional investor or an entrepreneur's family and friend. We also asked questions and collected data on risk/loss aversion and discount rates. For the analyses in this study, some responses were excluded from the sample because of a lack of data on personal income and savings. The final sample comprised 7,372 individuals.

4.2. Action and interest in investing and angel investing

In this survey, angel investment is measured by personal investment in a new business during the past three years. We also distinguish "action" from "interest" in investing, including angel investing. Table 1 presents a cross table of investing and angel investing.[11] This table shows that the percentage of individuals with investment experience is 42.2%, indicating that such individuals account for approximately 42% (action) in the sample. Individuals who have an interest in investing, despite having no investment experience, account for approximately 12% (interest only). This indicates that approximately 55% of individuals have experience or interest in investing, whereas approximately 45% of them have no interest in investing (no interest).

Meanwhile, as shown in Table 1, the percentage of individuals with angel investment actions

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[10] For more details on this survey, see also Honjo et al. (2022).

[11] Regarding interest in investing and angel investing, responses were rated on a 5-point scale (1: No; 2: Not very; 3: Neutral; 4: Somewhat; and 5: Yes) to questions "Are you interested in investment?" and "Are you interested in angel investing?" For the analysis, responses 1, 2, and 3 are treated as "no interest" and responses 4 and 5 are treated as "interest."

is 5.4%, indicating that such individuals account for approximately 5% (action).[12] Moreover, the percentage of individuals who have an interest in angel investing but no experience is approximately 12% (interest only). By contrast, approximately 83% of individuals have no interest in angel investing (no interest), which is much higher than the percentage of those who have no interest in investing.

4.3. Measure of risk aversion and discount rate

Following the measurement discussed in Sections 3.2 and 3.3, we calculate the risk-aversion level and discount rate of individuals. In the survey, we asked respondents questions and captured relative risk aversion (*R_RISK_AVERS*), in addition to absolute risk aversion (*A_RISK_AVERS*), following the measurement of risk aversion proposed by Cramer et al. (2002). Moreover, we capture individuals' subjective discount rate (*DISC*), following the measurement of the subjective discount rate proposed by Harrison et al. (2002) and Ikeda et al. (2010). We asked respondents questions about their risk-aversion level and discount rate, which will be explained in more detail in the Appendix.

Figure 1 displays the mean levels of individuals' absolute and relative risk aversion according to action and interest in angel investing: (i) no interest, (ii) interest only, and (iii) action (investment experience). Figure 2 displays the mean discount rate. These figures indicate that individuals with no interest in angel investing have a higher degree of risk aversion, regardless of their absolute or relative risk aversion. Among these three types of individuals, those with angel investment actions have a lower degree of risk aversion. Moreover, individuals with no interest in angel investing have a lower discount rate, while those with angel investment actions have a higher discount rate. These findings suggest that individuals with a lower degree of risk aversion or a higher discount rate are more likely to engage in angel investing.

4.4. Variables

We distinguished between individuals with and without entrepreneurial experience. Entrepreneurial experience (*ENTRE*) is defined as "experience in founding, owning, and running a corporation that paid salaries and wages to employees and owners, as well as all other expenses,

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[12] This percentage (5.4%) seems higher, compared to that in the study using GEM data (Honjo, 2015; Honjo and Nakamura, 2020). This is due partly to difference in the observation years between the studies. In addition, our survey data were collected via Internet, while GEM data were mainly collected via landline. Therefore, individuals with experience and skills on information technologies, which is the major target industry for angel investment, might tend to be included in our survey.

for three or more months."

It is plausible that individuals' wealth is associated with their actions and interests in angel investing. To capture individuals' wealth, we measure personal income and savings. We use two variables: personal income (*LNINC*) and savings (*LNSAVE*).[13] In addition, to capture individuals' personal attributes, we use the following variables: age (ln*AGE*), gender (*FEMALE*), and education status (*UGRAD* and *GRAD*).

Moreover, we include the variables measured by an individual's entrepreneurial attitude in the regression. We use three variables: perceived capabilities (*SUSKILL*), perceived opportunities (*OPPORT*), and entrepreneurial network (*KNOWENT*), following previous studies using GEM data (Köllinger and Minniti, 2006; Langowitz and Minniti, 2007).[14] Table A1 in the Appendix summarizes the definitions of the variables used in this study.

Table 2 summarizes the descriptive statistics of variables used in this study. The mean *ENTRE* is 0.080, indicating that approximately 8% of individuals have entrepreneurial experience in the sample. The mean *SUSKILL* is 0.096, indicating that approximately 10% of individuals presumably have the knowledge, skills, and experience required to start a new business. The mean *OPPORT* is 0.121, indicating that approximately 12% of individuals presume that there will be viable opportunities for starting a business in the area where they live. Moreover, the mean *KNOWENT* is 0.195, indicating that approximately 20% of individuals personally knew someone who started a business in the past two years. Table 3 presents the correlation matrix for the variables. Table 4 provides the mean of the variables used in this study, by dividing the sample into no interest, interest only, and action for angel investing.

5. Estimation results

5.1. Main results: ordered probit and generalized ordered probit models

Table 5 presents the estimation results for angel investment action and interest. Columns (i), (ii), and (iii) in Table 5 report the estimation results using the ordered probit model. Columns (i), (ii), and (iii) include the variables of absolute risk aversion (*A_RISK_AVERS*), relative risk aversion (*R_RISK_AVERS*), and both, respectively. Columns (iv) and (v) and columns (vi), and

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[13] In the survey, personal income and savings were measured, based on seven categories. To measure the variables of personal income and savings, we practically calculated the logarithm of the median of each category. For more details on the definitions of the variables, see Table A1 in the Appendix.

[14] The fear of failure (*FEARFAIL*) is also used to measure entrepreneurial attitude, in addition to the above three variables, in the GEM. However, the fear of failure is directly associated with risk aversion; thus, we do not include the fear of failure.

(vii) report the estimation results using the generalized ordered probit model. While columns (iv) and (vi) report the estimation results for "no interest," columns (v) and (vii) report them for "interest only" (reference category is "action"). Columns (iv) and (v) include *A_RISK_AVERS*, and columns (vi) and (vii) include *R_RISK_AVERS*. As shown in Table 5, the results using *R_RISK_AVERS*, which are reported in columns (ii), (iv) and (v), are almost similar to those using *A_RISK_AVERS*, which are reported in columns (i), (vi), and (vii), whereas we find no significant effect when using both *A_RISK_AVERSE* and *R_RISK_AVERSE*. Moreover, the log-likelihood ratio test in columns (iv) and (v) and columns (vi) and (vii), which tests the null hypotheses that all the coefficients in "interest only" equal those in "no interest," is rejected at the 1% level, indicating that the estimated coefficients differ between "interest only" and "no interest" equations. The results using the generalized ordered probit model show that the coefficients of risk aversion for "interest only" tend to be lower than those for "no interest," suggesting that the impact of risk aversion on angel investment interest differs from its impact on angel investment action.

To better understand the estimation results, in Table 6, we calculate the marginal effects of the variables used in columns (ii), (vi) and (vii) of Table 5. Columns (i), (ii), and (iii) in Table 6 report the estimated marginal effects for "no interest," "interest only," and "action" using the ordered probit model, corresponding to the results shown in columns (iii) and (iv) of Table 5. Columns (iv), (v), and (vi) report the results, corresponding those shown in columns (v) and (vi) of Table 5.

According to the estimated marginal effects shown in Table 6, relative risk aversion (*R_RISK_AVERS*) has a negative and significant effect on "action" in column (iii) when the ordered probit model is used. The results reveal that risk aversion is negatively associated with individuals' actions toward angel investing. While previous studies found the negative relationship between risk aversion and entrepreneurial activity (Cramer et al., 2002), we provide evidence of a negative relationship between risk aversion and angel investing. The results suggest that risk aversion hinders not only entrepreneurial action but also investment action. We also find that relative risk aversion is negatively associated with "interest only" in column (ii), although the marginal effect of relative risk aversion on "interest only" is lower than it is on "action." The results reveal that risk aversion depresses angel investment interest. By contrast, relative risk aversion is positively associated with "no interest" in column (i), indicating that individuals with a higher degree of risk aversion tend to have less interest in angel investing. Moreover, we find that relative risk aversion is negatively associated with angel investment action in column (vi) when using the generalized ordered probit model. Relative risk aversion is positively associated

with "no interest" in column (iv), although it is not significantly associated with "interest only" in column (v). These findings support the negative impact of risk aversion on angel investment action and interest. More importantly, using the generalized ordered probit model, we provide novel evidence that the impact of risk aversion on angel investment action is greater than its on angel investment interest.

While the marginal effect of the discount rate (*DISC_RATE*) on "no interest" is negative in column (i) of Table 6, its marginal effects on "interest only" and "action" are positive in columns (ii) and (iii), respectively. When using the generalized ordered model, we find that the discount rate is negatively associated with "no interest in column (iv). However, the positive effects of the discount rate on "interest only" and "action" are insignificant in columns (v) and (vi). The results indicate that individuals with a lower discount rate tend to have less interest in angel investing. The findings suggest that such individuals pay less attention to angel investing, presumably because they do not expect a higher rate of return on investment under current economic conditions, as in Japan.

Regarding the wealth level of individuals, personal income (*INCOME*) has a positive and significant effect on "action" in columns (iii) and (vi) of Table 6, indicating that individuals with higher personal income are more likely to engage in angel investing. Personal income also has a positive and significant effect on "interest only" in column (ii), whereas the marginal effect of personal income on "interest only" is larger than its marginal effect on "action" in columns (ii) and (iii). By contrast, personal income has a negative and significant effect on "no interest" in columns (i) and (iv). The results indicate that individuals with higher personal income are more likely to have an interest in angel investing. Moreover, personal savings (*SAVE*) have a positive and significant effect on "action" and "interest only" in columns (ii) and (iii), while they have a negative and significant effect on "no interest" in column (i). The results are consistent with those obtained using the generalized ordered probit model, as shown in columns (iv), (v), and (vi). The results reveal that individuals with higher personal savings are more likely to engage in and have an interest in angel investing. These results indicate that wealthy individuals tend to become angel investors and that wealth level is critical not only for individuals' decisions on angel investing but also for their interests in it.

With respect to personal attributes, age (ln*AGE*) has a negative and significant effect on "action" in column (iii) of Table 6. In addition, age has a negative and significant effect on "interest only" in column (ii), while it has a positive and significant effect on "no interest" in column (i). These results are consistent with those obtained using the generalized ordered probit model. These findings suggest that younger individuals tend to engage in and have an interest in

angel investing, which is not necessarily consistent with the findings using GEM data (Honjo, 2015; Honjo and Nakamura, 2020). By controlling wealth level associated with age, we can demonstrate that younger individuals tend to have more interest in angel investing.

As another personal attribute, female gender (*FEMALE)* has a negative and significant effect on "interest only" in column (ii) as well as "action" in column (iii) of Table 6. By contrast, the female gender has a positive and significant effect on "no interest" in column (i). We find similar results when using the generalized ordered probit model. It is often argued that female angel investing differs from male angel investing (Harrison, Botelho et al., 2020; Nelson, 2015). Our results indicate that women are less likely to engage in and have an interest in angel investing.

Regarding the education level of individuals, undergraduate education (*UGRAD*) has a positive and significant effect on "action" in column (iii), in addition to "interest" in column (ii) of Table 6. By contrast, undergraduate education has a negative effect on "no interest" in column (i). Moreover, the results of post-graduate education (*GRAD*) are almost similar to those of undergraduate education. When using the generalized ordered probit model, we find similar results, although the significance levels change. These results reveal that individuals' propensity for angel investing varies according to education level and that individuals with a higher level of education are more likely to engage in and have an interest in angel investing.

Moreover, we provide evidence of the impact of entrepreneurial attitude, which has been captured by GEM projects, on angel investment action and interest. Overall, we find that angel investment action and interest vary according to entrepreneurial attitude, based on the three measures (*SUSKILL*, *OPPORT*, and *KNOWENT*). The results indicate that individuals with entrepreneurial attitude captured by *SUSKILL*, *OPPORT*, and *KNOWENT* are more likely to engage in and have an interest in angel investing. These findings suggest that individuals with a higher level of entrepreneurial attitude are more likely to engage in and have an interest in angel investing, consistent with the results of previous studies using GEM data (Honjo, 2015; Honjo and Nakamura, 2020).

5.2. Further estimation results

As discussed, individuals' actions and interests in angel investing may depend on their entrepreneurial experience. Therefore, we examine whether individuals' characteristics, including risk aversion, affect angel investing, according to their entrepreneurial experience. Table 7 presents the estimation results for angel investment action and interest. Columns (i) and (ii) in Table 7 report the estimation results using the ordered probit model. While column (i) reports the estimation results for individuals without entrepreneurial experience, column (ii) reports the

results for individuals with entrepreneurial experience. Columns (iii) and (vi) report the estimation results for "no interest" and "interest only," respectively, using the generalized ordered probit model. Columns (iii) and (iv) report the estimation results for individuals without entrepreneurial experience, and columns (v) and (vi) report those for individuals with it.

As shown in columns (i) and (ii) of Table 7, relative risk aversion (*R_RISK_AVERS*) has a negative effect on "action" and "interest" in angel investing, regardless of entrepreneurial experience. However, in columns (iii)–(vi), we find that relative risk aversion has a negative effect on "interest only" for individuals without entrepreneurial experience, while it has a negative effect on "no interest" for those with it. The results indicate that angel investment action decreases with the risk-aversion level for individuals without entrepreneurial experience, whereas angel investment interest decreases with the risk-aversion level for those with it. This suggests that for individuals without entrepreneurial experience, the risk-aversion level hinders angel investment action, even though such individuals are interested in angel investing. By contrast, risk aversion may enable individuals with entrepreneurial experience to lose interest in angel investing.

Furthermore, we find differences in the impact of the discount rate (*DISC_RATE*), according to entrepreneurial experience. As shown in columns (i), (iii), and (iv) of Table 7, the discount rate does not affect angel investment. By contrast, in columns (ii), (v), and (vi), the discount rate has a positive effect on angel investment, indicating that the discount rate is associated with angel investing only for individuals with entrepreneurial experience. The results reveal that among such individuals, those with a higher discount rate are more likely to engage in and have an interest in angel investing, suggesting that individuals with a higher rate of return tend to pay more attention to angel investing because they expect such a higher return through entrepreneurial experience.

In Table 8, we calculate the marginal effects of the variables, following the estimation results with the generalized ordered probit model, shown in columns (iii) to (vi) of Table 7. Columns (i), (ii), and (iii) in Table 8 report the marginal effects for individuals without entrepreneurial experience, corresponding to the results shown in columns (iii) and (iv) of Table 7. Columns (iv), (v), and (vi) in Table 8 report the marginal effects for individuals with entrepreneurial experience, corresponding to the results shown in columns (v) and (vi) in Table 7. The estimated marginal effects indicate that relative risk aversion (*R_RISK_AVERSE*) has a negative and significant effect on angel investment action for individuals without entrepreneurial experience, as shown in column (iii) of Table 8. By contrast, relative risk aversion does not affect angel investment action for those with entrepreneurial experience, as shown in column (vi). These results indicate that risk aversion does not necessarily hinder angel investment action if an individual has entrepreneurial experience, suggesting that the impact of risk aversion on angel investment action varies

according to entrepreneurial experience. Moreover, the results reveal that relative risk aversion has a positive and significant effect on "no interest," as shown in columns (i) and (iv), suggesting that individuals with a higher degree of risk aversion tend to have no interest in angel investing, regardless of entrepreneurial experience.

For robustness, we provide additional estimation results for angel investing. Table 9 presents the estimation results for angel investment action and interest using a conditional logit and nested logit models. Columns (i) and (ii) report the estimation results using the conditional logit model, and columns (iii) and (iv) report those using the nested logit model. The results reveal that risk aversion is negatively associated with angel investment action, rather than angel investment interest. However, we find no significant evidence that the discount rate is associated with angel investment interest. Furthermore, we explore individuals' actions and interests in investing (i.e., general investing), using the models used in this study. The results are provided in the Appendix.

6. Conclusions

This study explored individuals' actions and interests in angel investing, using a sample of more than 7,000 individuals obtained from the original survey data of 10,001 Japanese individuals. We examined whether risk aversion and discount rate are associated with angel investing. To provide a clear picture of potential and actual angel investors, we classified individuals' attitudes toward angel investing into "no interest," "interest only," and "action." The results revealed that individuals' risk aversion is negatively associated with their actions and interests in angel investing. We also found that wealthy individuals are more likely to engage in and have an interest in angel investing. Moreover, we found that among individuals with entrepreneurial experience, the discount rate is positively associated with angel investing, suggesting that entrepreneurs with a higher expected rate of return are more likely to engage in and have an interest in angel investing.

Despite some limitations, this study provides a clear picture of potential and actual angel investors and the relationship between individuals' traits and angel investing. A substantial number of studies have focused on the relationship between risk aversion and entrepreneurship (Blanchflower and Oswald, 1998; Kihlstrom and Laffont, 1979). Several studies have also examined entrepreneurial decisions using a measure of risk aversion (Caliendo et al., 2009; Cramer et al., 2002; Elston and Audretsch, 2010, 2011). While these studies indicated the impact of risk aversion on entrepreneurial behavior, this study provides new evidence on its impact on angel investment, also suggesting the effectiveness of risk aversion measured via an Internet survey. Our analyses also shed light on individuals' interests as well as their actions in angel investing, in addition to the impact of entrepreneurial activity on angel investing. We demonstrate

that the proportion of individuals with experience in angel investing is smaller than that of individuals with experience in general investing. Conversely, our results reveal that certain individuals are interested in angel investing, who may become potential angel investors. Specifically, individuals with a lower degree of risk aversion tend to be interested in angel investment. Moreover, among individuals with entrepreneurial experience, those with a higher discount rate are more likely to engage in and have an interest in angel investing, presumably because they recognize a higher rate of return through entrepreneurial experience. The findings assist in vitalizing entrepreneurial ecosystems through the entrepreneur-investor relationship for policy implications.

Appendix

A1. Definitions of variables

In the survey, we collected data on individuals, such as personal attributes, experience (action), interest in investing and angel investing, and interest in business start-ups. Table A1 summarizes the definitions of variables in the survey.

A2. Questions in the survey

We asked respondents a question about the certainty equivalent for something with an uncertain payoff. The detailed question of risk attitudes in the survey was as follows:

"There is a lottery in which you have a 1 in 100 chance of winning. If you win, you can get 1 million JPY. However, if you lose, you get nothing. How much would you pay for a lottery ticket?"

While risk aversion is measured by the lottery (i.e., payoff), it can be measured by insurance (e.g., loss). We asked respondents a question about the certainty equivalent for something with an uncertain loss. The question in the survey was as follows:

"You have 1 million JPY that you need to keep for one year. Let us say that while you are keeping it, you know there is a 1 in 100 chance of the 1 million JPY being stolen. If you buy insurance, you will be able to recover the loss if there is a theft. How much would you pay for insurance?"

Overall, bids for insurance are higher than those for lottery tickets. Although the certainty equivalents for the lottery and insurance should, theoretically, be the same, the results suggest that the respondents have a greater risk tolerance for loss.

As mentioned in Section 3.3, four versions of questions with different delay options (r_1-r_4) were used. We asked respondents questions on certainty equivalent for something with a delay; for instance, one of the four questions in the survey (r_1) is as follows:

"Today, you are supposed to receive 1 million JPY. What is the minimum amount you would accept to agree to a delay of one week (seven days)?"

This question means to make respondents choose between "A" receiving today 1 million JPY and "B" receiving in 7 days 1 million JPY plus a certain amount of JPY, say JPY 1,000,384. Here, choosing the delayed receipt "B" instead of "A" implies receiving a 2% annual interest rate. In each question, we posed 21 such queries with alternative values from small to large and hence with an alternative imputed interest rate (discount rate) from low to high (−2% to 300%). Table A2 represents the different options by controlling for time horizons for "A" (today or 90 days); and time delays for "B" (7 days or 90 days). The options and results (r_1-r_4) are presented in Table A2. The results show that the mean value of discount rate is the highest under the condition that the time horizons for "A" are 90 days and time delays for "B" are also 90 days.

A3. Estimation results for general investing

We provide evidence of individuals' actions and interests in investing (i.e., general investing), compared to angel investing. Using the models used in this study, we examine whether risk aversion is associated with angel investing. Table A3 presents the estimation results using the ordered probit and generalized ordered probit models. In addition, in Table A4, we calculate the marginal effects of the variables used in columns (ii) and (iv) of Table A3. Table A5 presents the estimation results for investing (i.e., general investing) using a conditional logit and nested logit models.

A4. Estimation results for angel investment of general investors

To increase angel investing more effectively, policymakers should target both wealthy individuals and investors with potential concerns about angel investing. In this respect, individuals with general investment experience (action) may become future members of angel investors. In Tables A6, A7, A8, A9, and A10, we present the estimation results for 3,112 individuals with general investment experience in our sample, corresponding to those shown in Tables 5, 6, 7, 8, and 9. The results using the sub-sample of general investors demonstrate that the impact of risk aversion on angel investment tends to be lower, although this may stem from a

decrease in sample size. The results reveal that risk aversion, especially for those without entrepreneurial experience, has a negative impact on angel investment action, rather than angel investment interest.

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Table 1

Cross table of investing and angel investing.

| | | Angel investing | | | | |
		No interest	Interest only	Action	Total	%
	No interest	3,247	98	0	3,345	45.4%
	Interest only	603	312	0	915	12.4%
Investing	Action	2,250	467	395	3,112	42.2%
	Total	6,100	877	395	7,372	100.0%
	%	82.7%	11.9%	5.4%	100.0%	

Notes: The number of observations is 7,372.

Table 2

Descriptive statistics of variables.

Variable	Mean	SD	Min	Max
A_RISK_AVERSE	0.002	0.001	-0.010	0.002
R_RISK_AVERSE	0.008	0.007	-0.085	0.017
DISC_RATE	-0.020	0.812	-0.890	2.141
AGE	48.470	16.271	18.000	79.000
FEMALE	0.470	0.499	0.000	1.000
UGRAD	0.400	0.490	0.000	1.000
GRAD	0.048	0.214	0.000	1.000
INCOME	5.418	1.040	3.912	8.517
SAVE	5.643	1.492	3.912	8.517
SUSKILL	0.096	0.294	0.000	1.000
OPPORT	0.121	0.327	0.000	1.000
KNOWENT	0.195	0.396	0.000	1.000
ENTRE	0.080	0.271	0.000	1.000

Note: The number of observations is 7,372. SD indicates standard deviation.

Table 3

Correlation matrix

	Variable	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]
[1]	A_RISK_AVERSE	1.000												
[2]	R_RISK_AVERSE	0.953	1.000											
[3]	DISC_RATE	0.009	0.001	1.000										
[4]	AGE	-0.001	0.003	-0.072	1.000									
[5]	FEMALE	0.103	-0.014	-0.005	0.023	1.000								
[6]	UGRAD	-0.049	0.006	-0.001	-0.015	-0.210	1.000							
[7]	GRAD	-0.015	0.027	-0.007	-0.049	-0.127	-0.184	1.000						
[8]	INCOME	-0.112	0.128	-0.026	0.016	-0.477	0.247	0.173	1.000					
[9]	SAVE	-0.095	-0.024	-0.042	0.386	-0.064	0.169	0.106	0.294	1.000				
[10]	SUSKILL	-0.070	-0.041	0.011	0.013	-0.121	0.051	0.024	0.136	0.066	1.000			
[11]	OPPORT	-0.095	-0.078	0.004	-0.097	-0.109	0.051	0.037	0.107	0.006	0.448	1.000		
[12]	KNOWENT	-0.081	-0.057	0.000	-0.153	-0.060	0.046	0.052	0.119	-0.012	0.305	0.347	1.000	
[13]	ENTRE	-0.061	-0.038	0.004	0.079	-0.108	0.017	0.004	0.114	0.068	0.437	0.268	0.190	1.000

Note: The number of observations is 7,372.

Table 4

Mean covariates for angel investment action and interest.

	No interest	Interest only	Action
A_RISK_AVERSE	0.0016	0.0014	0.0011
R_RISK_AVERSE	0.0084	0.0080	0.0064
DISC_RATE	-0.033	0.037	0.044
AGE	49.670	41.179	46.129
FEMALE	0.504	0.290	0.349
UGRAD	0.384	0.450	0.537
GRAD	0.041	0.084	0.078
INCOME	5.356	5.634	5.887
SAVE	5.611	5.543	6.358
SUSKILL	0.076	0.158	0.263
OPPORT	0.085	0.274	0.339
KNOWENT	0.157	0.349	0.441
ENTRE	0.062	0.117	0.271

Note: The number of observations is 7,372.

Table 5

Estimation results for angel investment action and interest: ordered probit and generalized ordered probit models

	Ordered probit			Generalized ordered probit			
	(i)	(ii)	(ii)	(iv)	(v)	(vi)	(vii)
				No interest	Interest only	No interest	Interest only
A_RISK_AVERSE	-44.11***		-110	-40.76***	-58.03***		
	[13.73]		[71.28]	[14.33]	[17.67]		
R_RISK_AVERSE		-6.837***	11.26			-5.991**	-9.516***
		[2.313]	[11.98]			[2.431]	[2.905]
DISC_RATE	0.0436**	0.0433**	0.0440**	0.0457**	0.0405	0.0454**	0.0397
	[0.0217]	[0.0217]	[0.0218]	[0.0225]	[0.0317]	[0.0225]	[0.0317]
lnAGE	-0.668***	-0.668***	-0.668***	-0.742***	-0.384***	-0.743***	-0.383***
	[0.0525]	[0.0525]	[0.0525]	[0.0546]	[0.0765]	[0.0546]	[0.0765]
FEMALE	-0.245***	-0.246***	-0.245***	-0.298***	-0.0555	-0.299***	-0.0566
	[0.0412]	[0.0412]	[0.0412]	[0.0425]	[0.0592]	[0.0425]	[0.0592]
UGRAD	0.0999**	0.0994**	0.101***	0.0958**	0.103*	0.0951**	0.103*
	[0.0389]	[0.0389]	[0.0390]	[0.0403]	[0.0569]	[0.0403]	[0.0568]
GRAD	0.172**	0.171**	0.172**	0.204**	0.0457	0.203**	0.0469
	[0.0774]	[0.0774]	[0.0774]	[0.0811]	[0.112]	[0.0811]	[0.112]
INCOME	0.0500**	0.0603***	0.0335	0.0419*	0.0806***	0.0510**	0.0936***
	[0.0208]	[0.0210]	[0.0272]	[0.0216]	[0.0301]	[0.0217]	[0.0301]
SAVE	0.113***	0.114***	0.114***	0.104***	0.163***	0.104***	0.163***
	[0.0141]	[0.0141]	[0.0141]	[0.0146]	[0.0202]	[0.0146]	[0.0202]
SUSKILL	0.146**	0.146**	0.146**	0.121**	0.183**	0.121**	0.183**
	[0.0589]	[0.0589]	[0.0589]	[0.0618]	[0.0737]	[0.0618]	[0.0737]
OPPORT	0.515***	0.515***	0.518***	0.562***	0.436***	0.563***	0.434***
	[0.0519]	[0.0519]	[0.0520]	[0.0548]	[0.0684]	[0.0548]	[0.0685]
KNOWENT	0.368***	0.369***	0.369***	0.378***	0.336***	0.378***	0.335***
	[0.0433]	[0.0433]	[0.0433]	[0.0451]	[0.0586]	[0.0451]	[0.0586]
α_1	-0.578***	-0.511**	-0.675***				
	[0.205]	[0.203]	[0.229]				
α_2	0.174	0.241	0.0764				
	[0.205]	[0.204]	[0.230]				
α_j				0.969***	-1.725***	0.906***	-1.808***
				[0.212]	[0.305]	[0.210]	[0.304]
N	7,372	7,372	7,372	7,372		7,372	
Log likelihood	-3767.9	-3768.7	-3767.5	-3703.3		-3703.7	
Degree of freedom	13	13	14	24		24	
LR test (chi2)				129.4		129.9	
LR test (p-value)				0.000		0.000	

Note: The figures in brackets are standard errors. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 6

Marginal effects for "no interest," "interest only," and "action" in angel investing: ordered probit and generalized ordered probit models

	Ordered probit			Generalized ordered probit		
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
	No interest	Interest only	Action	No interest	Interest only	Action
R_RISK_AVERSE	1.540***	-0.890***	-0.650***	1.339**	-0.421	-0.917***
	[0.520]	[0.302]	[0.221]	[0.543]	[0.431]	[0.280]
DISC_RATE	-0.00975**	0.00563**	0.00411**	-0.0101**	0.00631	0.00383
	[0.00490]	[0.00283]	[0.00207]	[0.00503]	[0.00444]	[0.00306]
lnAGE	0.151***	-0.0870***	-0.0635***	0.166***	-0.129***	-0.0369***
	[0.0116]	[0.00686]	[0.00549]	[0.0120]	[0.0108]	[0.00748]
FEMALE	0.0554***	-0.0320***	-0.0234***	0.0668***	-0.0614***	-0.00546
	[0.00924]	[0.00536]	[0.00401]	[0.00946]	[0.00816]	[0.00572]
UGRAD	-0.0224**	0.0129**	0.00945**	-0.0212**	0.0113	0.00996*
	[0.00877]	[0.00507]	[0.00372]	[0.00900]	[0.00789]	[0.00548]
GRAD	-0.0386**	0.0223**	0.0163**	-0.0453**	0.0408**	0.00452
	[0.0174]	[0.0101]	[0.00738]	[0.0181]	[0.0164]	[0.0108]
INCOME	-0.0136***	0.00784***	0.00573***	-0.0114**	0.00238	0.00902***
	[0.00472]	[0.00273]	[0.00200]	[0.00485]	[0.00420]	[0.00291]
SAVE	-0.0256***	0.0148***	0.0108***	-0.0233***	0.00763***	0.0157***
	[0.00316]	[0.00185]	[0.00139]	[0.00324]	[0.00274]	[0.00199]
SUSKILL	-0.0330**	0.0190**	0.0139**	-0.0271**	0.0094	0.0177**
	[0.0133]	[0.00767]	[0.00562]	[0.0138]	[0.0111]	[0.00711]
OPPORT	-0.116***	0.0670***	0.0490***	-0.126***	0.0838***	0.0418***
	[0.0115]	[0.00680]	[0.00517]	[0.0120]	[0.0103]	[0.00669]
KNOWENT	-0.0830***	0.0480***	0.0350***	-0.0846***	0.0522***	0.0323***
	[0.00968]	[0.00566]	[0.00429]	[0.00999]	[0.00847]	[0.00571]
N	7,372	7,372	7,372	7,372	7,372	7,372

Note: The figures in brackets are standard errors. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. N indicates the number of observations.

Table 7

Estimation results for angel investment action and interest by entrepreneurial experience: ordered probit and generalized ordered probit models

	Ordered probit		Generalized ordered probit			
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Entre. experience	No	Yes	No		Yes	
			No interest	Interest only	No interest	Interest only
R_RISK_AVERSE	-5.330*	-8.114*	-4.942*	-8.920**	-10.14*	-5.19
	[2.721]	[4.774]	[2.791]	[3.522]	[5.690]	[5.407]
DISC_RATE	0.0167	0.205***	0.0224	-0.00264	0.220***	0.217***
	[0.0234]	[0.0630]	[0.0241]	[0.0361]	[0.0688]	[0.0786]
lnAGE	-0.680***	-0.960***	-0.774***	-0.265***	-0.775***	-1.257***
	[0.0562]	[0.167]	[0.0583]	[0.0853]	[0.183]	[0.204]
FEMALE	-0.251***	-0.0804	-0.300***	-0.0557	-0.169	0.0938
	[0.0437]	[0.131]	[0.0450]	[0.0652]	[0.137]	[0.152]
UGRAD	0.0998**	0.210*	0.0937**	0.110*	0.205*	0.257*
	[0.0418]	[0.114]	[0.0431]	[0.0632]	[0.121]	[0.140]
GRAD	0.137*	0.615***	0.166*	0.0107	0.680***	0.627**
	[0.0831]	[0.231]	[0.0864]	[0.126]	[0.260]	[0.276]
INCOME	0.0592***	0.0284	0.0526**	0.0973***	0.021	0.0382
	[0.0225]	[0.0636]	[0.0233]	[0.0340]	[0.0675]	[0.0762]
SAVE	0.113***	0.109***	0.108***	0.145***	0.0716	0.185***
	[0.0152]	[0.0410]	[0.0157]	[0.0223]	[0.0437]	[0.0528]
SUSKILL	-0.0481	0.0627	-0.082	-0.00121	0.116	0.00341
	[0.0776]	[0.111]	[0.0807]	[0.1000]	[0.117]	[0.135]
OPPORT	0.563***	0.259**	0.636***	0.413***	0.237**	0.294**
	[0.0595]	[0.113]	[0.0627]	[0.0836]	[0.120]	[0.136]
KNOWENT	0.318***	0.492***	0.323***	0.306***	0.558***	0.384***
	[0.0476]	[0.113]	[0.0495]	[0.0671]	[0.119]	[0.139]
α_1	-0.547**	-2.125***				
	[0.215]	[0.711]				
α_2	0.236	-1.473**				
	[0.216]	[0.708]				
α_j			0.974***	-2.204***	1.652**	2.047**
			[0.222]	[0.340]	[0.785]	[0.856]
N	6,784	588	6784		588	
Log likelihood	-3267.4	-462.1	-3196.3		-450.7	

Note: The figures in brackets are standard errors. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. N indicates the number of observations.

Table 8

Marginal effects for "no interest," "interest only," and "action" in angel investing by entrepreneurial experience: generalized ordered probit models

Entre. experience	Generalized ordered probit					
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
	No			Yes		
	No interest	Interest only	Action	No interest	Interest only	Action
R_RISK_AVERSE	1.055*	-0.316	-0.740**	3.185*	-2.091	-1.093
	[0.596]	[0.462]	[0.292]	[1.777]	[1.588]	[1.139]
DISC_RATE	-0.00479	0.00501	-0.000219	-0.0691***	0.0232	0.0458***
	[0.00515]	[0.00462]	[0.00300]	[0.0211]	[0.0189]	[0.0163]
lnAGE	0.165***	-0.143***	-0.0220***	0.243***	0.0215	-0.265***
	[0.0123]	[0.0112]	[0.00716]	[0.0551]	[0.0457]	[0.0399]
FEMALE	0.0640***	-0.0594***	-0.00462	0.0532	-0.0729**	0.0197
	[0.00957]	[0.00834]	[0.00542]	[0.0429]	[0.0304]	[0.0320]
UGRAD	-0.0200**	0.0108	0.00916*	-0.0644*	0.0102	0.0542*
	[0.00919]	[0.00807]	[0.00524]	[0.0379]	[0.0316]	[0.0296]
GRAD	-0.0355*	0.0346**	0.000889	-0.213***	0.0813	0.132**
	[0.0184]	[0.0168]	[0.0105]	[0.0802]	[0.0705]	[0.0577]
INCOME	-0.0112**	0.00315	0.00807***	-0.00659	-0.00146	0.00805
	[0.00496]	[0.00435]	[0.00283]	[0.0212]	[0.0167]	[0.0160]
SAVE	-0.0231***	0.0111***	0.0120***	-0.0225*	-0.0165	0.0390***
	[0.00334]	[0.00283]	[0.00190]	[0.0136]	[0.0119]	[0.0110]
SUSKILL	0.0175	-0.0174	-0.0001	-0.0364	0.0357	0.000719
	[0.0172]	[0.0140]	[0.00829]	[0.0368]	[0.0298]	[0.0285]
OPPORT	-0.136***	0.102***	0.0342***	-0.0745**	0.0126	0.0619**
	[0.0132]	[0.0117]	[0.00704]	[0.0374]	[0.0304]	[0.0285]
KNOWENT	-0.0689***	0.0435***	0.0254***	-0.175***	0.0945***	0.0808***
	[0.0105]	[0.00909]	[0.00564]	[0.0355]	[0.0300]	[0.0289]
N	6,784			588		

Note: The figures in brackets are standard errors. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. N indicates the number of observations.

Table 9

Estimation results for angel investment action and interest: conditional logit and nested logit models

	Conditional logit		Nested logit	
	(i)	(ii)	(iii)	(iv)
	Interest only	Action	Interest only	Action
R_RISK_AVERSE	-4.000	-16.50***	-2.35	-19.16**
	[5.298]	[5.335]	[6.458]	[7.616]
DISC_RATE	0.0712	0.112*	0.061	0.134
	[0.0458]	[0.0658]	[0.0552]	[0.0962]
lnAGE	-1.453***	-1.089***	-1.516***	-0.920**
	[0.112]	[0.171]	[0.169]	[0.374]
FEMALE	-0.718***	-0.166	-0.822***	0.0818
	[0.0905]	[0.129]	[0.204]	[0.449]
UGRAD	0.128	0.291**	0.0931	0.382*
	[0.0837]	[0.120]	[0.114]	[0.227]
GRAD	0.416***	0.241	0.431**	0.231
	[0.157]	[0.228]	[0.180]	[0.312]
INCOME	0.0649	0.173***	0.0587	0.199**
	[0.0455]	[0.0656]	[0.0530]	[0.0941]
SAVE	0.0853***	0.383***	0.0299	0.500**
	[0.0311]	[0.0448]	[0.100]	[0.207]
SUSKILL	0.0176	0.394**	-0.0757	0.564
	[0.127]	[0.158]	[0.226]	[0.381]
OPPORT	0.956***	0.986***	0.990***	0.908***
	[0.107]	[0.147]	[0.149]	[0.283]
KNOWENT	0.570***	0.860***	0.501***	1.015***
	[0.0904]	[0.125]	[0.165]	[0.331]
stage2_tau			1.622	
			[1.093]	
Constant	2.608***	-2.286***	3.023***	-4.689
	[0.418]	[0.678]	[0.814]	[4.127]
N	22,116		22,116	
N. of respondents	7,372		7,372	
Log likelihood	-3701.2		-3701	
Degree of freedom	22		22	
LR test for IIA			0.332	
p-value for IIA test			0.564	

Note: The figures in brackets are standard errors. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. N indicates the number of observations.

Table A1
Definitions of variables

Variable	Symbol	Definition
Angel investing	Action	1 if the individual has, in the past three years, personally provided funds for a new business started by someone else, and 0 otherwise.
	Interest only	1 if the individual has an interest in angel investing (investment to an entrepreneur or a new venture) and Action = 0, and 0 otherwise.
Absolute risk aversion	A_RISK_AVERS	See Eq. (3).
Relative risk aversion	R_RISK_AVERS	Multiple of A_RISK_AVERSE and INCOME.
Discount rate	DISC_RATE	See Eq. (4).
Income	INCOME	Logarithm of the median of the range of the individual's annual income. The range is (1) < 1 million JPY, (2) 1–3 million JPY, (3) 3–5 million JPY, (4) 5–10 million JPY, (5) 10–20 million JPY, (6) 20–50 million JPY, and (7) 50 million JPY+.
Savings	SAVE	Logarithm of the median of the range of the individual's savings. The range is (1) < 1 million JPY, (2) 1–3 million JPY, (3) 3–5 million JPY, (4) 5–10 million JPY, (5) 10–20 million JPY, (6) 20–50 million JPY, and (7) 50 million JPY+.
Age	lnAGE	Logarithm of individual's age (in years) at the survey.
Female	FEMALE	1 if the individual is female; and 0 if the individual is male.
Under graduation	UGRAD	1 if the individual has post-secondary experience (undergraduate education); and 0 otherwise.
Graduation	GRAD	1 if the individual has graduate experience (graduate education); and 0 otherwise.
Entrepreneurial attitudes	SUSKILL	1 if the individual has the knowledge, skill, and experience required for starting a business; and 0 otherwise.
	OPPORT	1 if in the next six months, there will be viable opportunities for starting a business in the area where the individual lives; and 0 otherwise.
	KNOWENT	1 if the individual personally knows someone who started a business in the past two years; and 0 otherwise.
Entrepreneurial experience	ENTRE	1 If the individual has entrepreneurial experience; and 0 otherwise.

Table A2

Four options and results for the discount rate question

		r_1	r_2	r_3	r_4
Choice conditions	Timings (A or B)	0 or 7 days	90 or 97 days	0 or 90 days	90 or 180 days
	Amount for A	1 million JPY	1 million JPY	1 million JPY	1 million JPY
	Alternative imputed interest rate (discount rate) for B	−2% to 300%	−2% to 300%	−2% to 300%	−2% to 300%
Descriptive statistics (discount rate)	Mean (%)	73.30	82.97	88.66	94.06
	SD	95.09	98.27	98.07	98.77

Note: The number of observations is 7,372. SD indicates standard deviation.

Table A3

Estimation results for (general) investment action and interest: ordered probit and generalized ordered probit models.

	Ordered probit			Generalized ordered probit			
	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)
				No interest	Interest only	No interest	Interest only
A_RISK_AVERSE	-49.18***		-26.33	-53.39***	-43.53***		
	[13.44]		[71.40]	[14.47]	[14.25]		
R_RISK_AVERSE		-8.638***	-4.087			-9.538***	-7.703***
		[2.377]	[12.56]			[2.562]	[2.499]
DISC_RATE	0.00326	0.00318	0.00323	-0.00831	0.0212	-0.00847	0.0212
	[0.0179]	[0.0179]	[0.0179]	[0.0187]	[0.0191]	[0.0187]	[0.0191]
lnAGE	-0.0248	-0.0253	-0.025	-0.316***	0.321***	-0.317***	0.321***
	[0.0429]	[0.0429]	[0.0429]	[0.0447]	[0.0457]	[0.0447]	[0.0457]
FEMALE	-0.241***	-0.242***	-0.241***	-0.235***	-0.270***	-0.235***	-0.270***
	[0.0332]	[0.0332]	[0.0332]	[0.0346]	[0.0349]	[0.0346]	[0.0349]
UGRAD	0.254***	0.253***	0.254***	0.259***	0.256***	0.259***	0.255***
	[0.0314]	[0.0314]	[0.0315]	[0.0325]	[0.0326]	[0.0325]	[0.0326]
GRAD	0.331***	0.331***	0.331***	0.316***	0.361***	0.315***	0.361***
	[0.0726]	[0.0726]	[0.0726]	[0.0773]	[0.0755]	[0.0773]	[0.0755]
INCOME	0.0566***	0.0703***	0.0630**	0.0650***	0.0671***	0.0802***	0.0791***
	[0.0169]	[0.0172]	[0.0260]	[0.0176]	[0.0178]	[0.0179]	[0.0181]
SAVE	0.283***	0.283***	0.283***	0.260***	0.296***	0.259***	0.297***
	[0.0115]	[0.0115]	[0.0115]	[0.0119]	[0.0120]	[0.0119]	[0.0120]
SUSKILL	0.0768	0.0768	0.0768	-0.00917	0.122**	-0.00923	0.122**
	[0.0572]	[0.0573]	[0.0573]	[0.0607]	[0.0591]	[0.0607]	[0.0591]
OPPORT	0.281***	0.281***	0.281***	0.367***	0.261***	0.366***	0.260***
	[0.0510]	[0.0510]	[0.0510]	[0.0546]	[0.0529]	[0.0546]	[0.0529]
KNOWENT	0.178***	0.178***	0.178***	0.240***	0.143***	0.240***	0.143***
	[0.0395]	[0.0395]	[0.0395]	[0.0417]	[0.0415]	[0.0417]	[0.0414]
α_1	1.660***	1.737***	1.695***				
	[0.174]	[0.173]	[0.206]				
α_2	2.021***	2.097***	2.056***				
	[0.175]	[0.173]	[0.206]				
α_j				-0.485***	-3.487***	-0.567***	-3.555***
				[0.183]	[0.192]	[0.181]	[0.190]
N	7,372	7,372	7,372	7,372		7,372	
Log likelihood	-6521	-6521.1	-6521	-6169.0		-6168.8	
Degree of freedom	13	13	14	24		24	
LR test (chi2)				704.1		704.5	
LR test (p-value)				0.000		0.000	

Note: The figures in brackets are standard errors. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. N indicates the number of observations.

Table A4

Marginal effects for "no interest," "interest only," and "action" in (general) investing

	Ordered probit			Generalized ordered probit		
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
	No interest	Interest only	Action	No interest	Interest only	Action
R_RISK_AVERSE	2.968***	-0.0435**	-2.924***	3.323***	-0.81	-2.513***
	[0.815]	[0.0171]	[0.803]	[0.891]	[0.592]	[0.814]
DISC_RATE	-0.00109	0.000016	0.00108	0.00295	-0.00987***	0.00692
	[0.00616]	[0.0000904]	[0.00607]	[0.00652]	[0.00382]	[0.00622]
lnAGE	0.00868	-0.000127	-0.00856	0.110***	-0.215***	0.105***
	[0.0147]	[0.000220]	[0.0145]	[0.0154]	[0.00930]	[0.0148]
FEMALE	0.0830***	-0.00122***	-0.0818***	0.0819***	0.00626	-0.0881***
	[0.0113]	[0.000359]	[0.0111]	[0.0119]	[0.00675]	[0.0113]
UGRAD	-0.0869***	0.00127***	0.0857***	-0.0901***	0.00694	0.0832***
	[0.0107]	[0.000370]	[0.0105]	[0.0112]	[0.00534]	[0.0105]
GRAD	-0.114***	0.00167***	0.112***	-0.110***	-0.00792	0.118***
	[0.0249]	[0.000581]	[0.0245]	[0.0269]	[0.0150]	[0.0245]
INCOME	-0.0241***	0.000354***	0.0238***	-0.0279***	0.00215	0.0258***
	[0.00588]	[0.000129]	[0.00579]	[0.00623]	[0.00352]	[0.00588]
SAVE	-0.0971***	0.00142***	0.0957***	-0.0904***	-0.00634***	0.0967***
	[0.00351]	[0.000381]	[0.00346]	[0.00377]	[0.00193]	[0.00345]
SUSKILL	-0.0264	0.000387	0.026	0.00322	-0.0430***	0.0398**
	[0.0197]	[0.000309]	[0.0194]	[0.0211]	[0.0109]	[0.0193]
OPPORT	-0.0964***	0.00141***	0.0950***	-0.127***	0.0425***	0.0850***
	[0.0174]	[0.000458]	[0.0172]	[0.0189]	[0.0115]	[0.0172]
KNOWENT	-0.0612***	0.000898***	0.0603***	-0.0837***	0.0369***	0.0468***
	[0.0135]	[0.000310]	[0.0133]	[0.0145]	[0.00883]	[0.0135]
N	7,372	7,372	7,372	7,372	7,372	7,372

Note: The figures in brackets are standard errors. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. N indicates the number of observations.

Table A5

Estimation results for (general) investment action and interest: conditional logit and nested logit models.

	Conditional logit		Nested logit	
	(i)	(ii)	(iii)	(iv)
	Interest only	Action	Interest only	Action
R_RISK_AVERSE	-12.19*	-17.38***	-16.15***	-16.37***
	[7.019]	[4.944]	[4.775]	[4.742]
DISC_RATE	-0.0259	0.0154	-0.00501	-0.00153
	[0.0478]	[0.0343]	[0.0316]	[0.0314]
lnAGE	-1.962***	0.198**	-0.620***	-0.476***
	[0.113]	[0.0870]	[0.236]	[0.141]
FEMALE	0.0625	-0.432***	-0.297***	-0.340***
	[0.0867]	[0.0645]	[0.0984]	[0.0621]
UGRAD	0.274***	0.489***	0.401***	0.418***
	[0.0856]	[0.0598]	[0.0608]	[0.0564]
GRAD	0.342*	0.653***	0.522***	0.541***
	[0.202]	[0.141]	[0.137]	[0.135]
INCOME	0.135***	0.158***	0.121***	0.124***
	[0.0463]	[0.0334]	[0.0303]	[0.0310]
SAVE	0.0699**	0.507***	0.402***	0.430***
	[0.0345]	[0.0219]	[0.0574]	[0.0237]
SUSKILL	-0.491***	0.114	-0.0353	0.000487
	[0.171]	[0.109]	[0.125]	[0.104]
OPPORT	0.505***	0.571***	0.530***	0.540***
	[0.131]	[0.101]	[0.0948]	[0.0941]
KNOWENT	0.449***	0.346***	0.373***	0.373***
	[0.0989]	[0.0785]	[0.0713]	[0.0711]
stage2_tau			0.0612	
			[0.146]	
Constant	4.693***	-4.626***	-0.482	-1.11
	[0.420]	[0.368]	[0.931]	[0.683]
N	22,116		22,116	
N. of respondents	7,372		7,372	
Log likelihood	-6195.6		-6181	
Degree of freedom	22		22	
LR test for IIA			29.17	
p-value for IIA test			0.000	

Note: The figures in brackets are standard errors. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. N indicates the number of observations.

Table A6

Estimation results for angel investment action and interest of (general) investors: ordered probit and generalized ordered probit models.

	Ordered probit			Generalized ordered probit			
	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)
				No interest	Interest only	No interest	Interest only
A_RISK_AVERSE	-30.00*		-76.73	-22.22	-52.77**		
	[17.32]		[99.09]	[18.45]	[21.55]		
R_RISK_AVERSE		-4.541	7.67			-2.972	-8.443**
		[2.808]	[16.03]			[3.006]	[3.416]
DISC_RATE	0.0654**	0.0653**	0.0657**	0.0793**	0.0429	0.0795**	0.0413
	[0.0300]	[0.0300]	[0.0300]	[0.0317]	[0.0375]	[0.0316]	[0.0375]
lnAGE	-0.749***	-0.749***	-0.749***	-0.813***	-0.603***	-0.813***	-0.601***
	[0.0780]	[0.0780]	[0.0780]	[0.0833]	[0.0964]	[0.0833]	[0.0964]
FEMALE	-0.072	-0.0728	-0.0714	-0.156**	0.129*	-0.157**	0.128*
	[0.0586]	[0.0586]	[0.0586]	[0.0614]	[0.0720]	[0.0614]	[0.0721]
UGRAD	0.0521	0.052	0.0522	0.0579	0.0217	0.0574	0.0225
	[0.0533]	[0.0533]	[0.0533]	[0.0559]	[0.0668]	[0.0559]	[0.0668]
GRAD	0.0895	0.0894	0.0889	0.162	-0.0726	0.161	-0.0702
	[0.0966]	[0.0966]	[0.0966]	[0.104]	[0.126]	[0.104]	[0.126]
INCOME	0.0346	0.0412	0.0237	0.0258	0.041	0.0305	0.0516
	[0.0289]	[0.0290]	[0.0367]	[0.0303]	[0.0354]	[0.0304]	[0.0355]
SAVE	0.0365*	0.0366*	0.0365*	0.0341*	0.0496**	0.0346*	0.0489**
	[0.0191]	[0.0191]	[0.0191]	[0.0201]	[0.0238]	[0.0201]	[0.0238]
SUSKILL	0.206***	0.206***	0.205***	0.208***	0.199**	0.208***	0.200**
	[0.0726]	[0.0726]	[0.0726]	[0.0771]	[0.0849]	[0.0771]	[0.0849]
OPPORT	0.409***	0.409***	0.411***	0.452***	0.358***	0.453***	0.356***
	[0.0674]	[0.0674]	[0.0675]	[0.0722]	[0.0795]	[0.0722]	[0.0796]
KNOWENT	0.383***	0.383***	0.383***	0.394***	0.369***	0.394***	0.369***
	[0.0585]	[0.0585]	[0.0585]	[0.0621]	[0.0703]	[0.0621]	[0.0703]
α_1	-1.703***	-1.657***	-1.771***				
	[0.329]	[0.327]	[0.359]				
α_2	-1.090***	-1.044***	-1.158***				
	[0.329]	[0.327]	[0.358]				
α_j				2.019***	0.434	1.983***	0.362
				[0.350]	[0.404]	[0.348]	[0.402]
N	3,112	3,112	3,112	3,112		3,112	
Log likelihood	-2228.4	-2228.5	-2228.2	-2193.6		-2193.5	
Degree of freedom	13	13	14	24		24	
LR test (chi2)				69.5		70.05	
LR test (p-value)				0.000		0.000	

Note: The figures in brackets are standard errors. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. N indicates the number of observations.

Table A7

Marginal effects for "no interest," "interest only," and "action" in angel investing of (general) investors

	Ordered probit			Generalized ordered probit		
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
	No interest	Interest only	Action	No interest	Interest only	Action
R_RISK_AVERSE	1.356	-0.524	-0.831	0.874	0.728	-1.602**
	[0.838]	[0.325]	[0.514]	[0.883]	[0.705]	[0.647]
DISC_RATE	-0.0195**	0.00753**	0.0119**	-0.0234**	0.0155**	0.00784
	[0.00894]	[0.00347]	[0.00549]	[0.00928]	[0.00779]	[0.00711]
lnAGE	0.223***	-0.0864***	-0.137***	0.239***	-0.125***	-0.114***
	[0.0225]	[0.00911]	[0.0145]	[0.0235]	[0.0204]	[0.0183]
FEMALE	0.0217	-0.0084	-0.0133	0.0463**	-0.0705***	0.0243*
	[0.0175]	[0.00676]	[0.0107]	[0.0180]	[0.0142]	[0.0137]
UGRAD	-0.0155	0.006	0.00952	-0.0169	0.0126	0.00428
	[0.0159]	[0.00615]	[0.00976]	[0.0164]	[0.0135]	[0.0127]
GRAD	-0.0267	0.0103	0.0164	-0.0472	0.0605**	-0.0133
	[0.0288]	[0.0111]	[0.0177]	[0.0304]	[0.0283]	[0.0239]
INCOME	-0.0123	0.00476	0.00755	-0.00897	-0.000815	0.00979
	[0.00864]	[0.00334]	[0.00531]	[0.00893]	[0.00709]	[0.00673]
SAVE	-0.0109*	0.00422*	0.00669*	-0.0102*	0.000896	0.00928**
	[0.00570]	[0.00221]	[0.00350]	[0.00589]	[0.00478]	[0.00451]
SUSKILL	-0.0615***	0.0238***	0.0377***	-0.0612***	0.0234	0.0379**
	[0.0216]	[0.00840]	[0.0133]	[0.0226]	[0.0175]	[0.0161]
OPPORT	-0.122***	0.0472***	0.0749***	-0.133***	0.0657***	0.0675***
	[0.0198]	[0.00790]	[0.0123]	[0.0208]	[0.0168]	[0.0150]
KNOWENT	-0.114***	0.0442***	0.0701***	-0.116***	0.0457***	0.0701***
	[0.0172]	[0.00682]	[0.0108]	[0.0179]	[0.0145]	[0.0133]
N	3,112	3,112	3,112	3,112	3,112	3,112

Note: The figures in brackets are standard errors. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. N indicates the number of observations.

Table A8

Estimation results for angel investment action and interest of (general) investors by entrepreneurial experience: ordered probit and generalized ordered probit models

	Ordered probit		Generalized ordered probit			
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Entre. experience	No	Yes	No		Yes	
			No interest	Interest only	No interest	Interest only
R_RISK_AVERSE	-3.728	-3.221	-2.592	-9.710**	-3.822	-1.712
	[3.408]	[5.328]	[3.566]	[4.595]	[6.305]	[5.912]
DISC_RATE	0.0314	0.267***	0.0517	-0.014	0.268***	0.307***
	[0.0326]	[0.0813]	[0.0342]	[0.0424]	[0.0921]	[0.0945]
lnAGE	-0.723***	-1.019***	-0.814***	-0.496***	-0.781***	-1.274***
	[0.0854]	[0.204]	[0.0904]	[0.108]	[0.231]	[0.245]
FEMALE	-0.0701	-0.0542	-0.147**	0.141*	-0.159	0.0855
	[0.0632]	[0.160]	[0.0660]	[0.0795]	[0.172]	[0.177]
UGRAD	0.0682	0.104	0.073	0.0368	0.0514	0.206
	[0.0583]	[0.140]	[0.0609]	[0.0750]	[0.153]	[0.164]
GRAD	0.0791	0.406	0.141	-0.08	0.469	0.433
	[0.106]	[0.254]	[0.113]	[0.145]	[0.286]	[0.297]
INCOME	0.0419	0.00752	0.0341	0.0528	0.0109	-0.00279
	[0.0317]	[0.0777]	[0.0331]	[0.0401]	[0.0842]	[0.0893]
SAVE	0.022	0.0961*	0.0241	0.0259	0.0797	0.119*
	[0.0208]	[0.0533]	[0.0217]	[0.0263]	[0.0580]	[0.0638]
SUSKILL	0.113	-0.0168	0.121	0.0823	0.0506	-0.0809
	[0.0979]	[0.136]	[0.103]	[0.117]	[0.146]	[0.156]
OPPORT	0.401***	0.334**	0.474***	0.304***	0.286*	0.388**
	[0.0792]	[0.138]	[0.0846]	[0.0977]	[0.151]	[0.159]
KNOWENT	0.308***	0.558***	0.303***	0.327***	0.665***	0.443***
	[0.0657]	[0.137]	[0.0696]	[0.0807]	[0.148]	[0.158]
α_1	-1.625***	-2.749***				
	[0.357]	[0.863]				
α_2	-0.992***	-2.193**				
	[0.357]	[0.861]				
α_j			2.017***	0.0654	1.892*	3.046***
			[0.377]	[0.451]	[0.986]	[1.005]
N	2,741	371	2741		371	
Log likelihood	-1886.9	-321.7	-1847.2		-315.1	

Note: The figures in brackets are standard errors. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. N indicates the number of observations.

Table A9

Marginal effects for "no interest," "interest only," and "action" in angel investing of (general) investors by entrepreneurial experience

Entre. experience	Generalized ordered probit					
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
	No			Yes		
	No interest	Interest only	Action	No interest	Interest only	Action
R_RISK_AVERSE	0.745	0.923	-1.668**	1.262	-0.795	-0.467
	[1.024]	[0.877]	[0.787]	[2.082]	[1.856]	[1.615]
DISC_RATE	-0.0148	0.0172**	-0.0024	-0.0885***	0.00486	0.0837***
	[0.00980]	[0.00838]	[0.00728]	[0.0296]	[0.0263]	[0.0249]
lnAGE	0.234***	-0.149***	-0.0851***	0.258***	0.0896	-0.348***
	[0.0251]	[0.0217]	[0.0186]	[0.0726]	[0.0628]	[0.0579]
FEMALE	0.0422**	-0.0664***	0.0242*	0.0526	-0.0759*	0.0233
	[0.0189]	[0.0150]	[0.0136]	[0.0565]	[0.0394]	[0.0484]
UGRAD	-0.021	0.0147	0.00633	-0.017	-0.0392	0.0562
	[0.0175]	[0.0144]	[0.0129]	[0.0504]	[0.0425]	[0.0445]
GRAD	-0.0406	0.0544*	-0.0137	-0.155*	0.0365	0.118
	[0.0324]	[0.0306]	[0.0249]	[0.0931]	[0.0844]	[0.0803]
INCOME	-0.00978	0.00072	0.00906	-0.00359	0.00435	-0.000762
	[0.00950]	[0.00764]	[0.00689]	[0.0278]	[0.0224]	[0.0244]
SAVE	-0.00692	0.00247	0.00445	-0.0263	-0.00618	0.0325*
	[0.00623]	[0.00503]	[0.00451]	[0.0190]	[0.0170]	[0.0173]
SUSKILL	-0.0349	0.0207	0.0141	-0.0167	0.0388	-0.0221
	[0.0296]	[0.0232]	[0.0201]	[0.0482]	[0.0385]	[0.0426]
OPPORT	-0.136***	0.0840***	0.0523***	-0.0945*	-0.0114	0.106**
	[0.0239]	[0.0202]	[0.0168]	[0.0492]	[0.0401]	[0.0420]
KNOWENT	-0.0870***	0.0309*	0.0561***	-0.220***	0.0985***	0.121***
	[0.0198]	[0.0162]	[0.0139]	[0.0450]	[0.0378]	[0.0419]
N	2,741	2,741	2,741	371	371	371

Note: The figures in brackets are standard errors. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. N indicates the number of observations.

Table A10

Estimation results for angel investment action and interest of (general) investors: conditional logit and nested logit models.

	Conditional logit		Nested logit	
	(i)	(ii)	(iii)	(iv)
	Interest only	Action	Interest only	Action
R_RISK_AVERSE	2.472	-11.54**	7.656	-17.41*
	[6.761]	[5.843]	[10.89]	[10.07]
DISC_RATE	0.138**	0.126*	0.131	0.137
	[0.0656]	[0.0711]	[0.114]	[0.135]
lnAGE	-1.340***	-1.461***	-1.210***	-1.634***
	[0.171]	[0.186]	[0.346]	[0.425]
FEMALE	-0.657***	0.129	-1.386	0.893
	[0.140]	[0.137]	[0.906]	[0.944]
UGRAD	0.15	0.0469	0.226	-0.0386
	[0.120]	[0.128]	[0.226]	[0.255]
GRAD	0.514**	-0.00993	0.892	-0.537
	[0.200]	[0.240]	[0.547]	[0.767]
INCOME	0.0458	0.0838	0.0164	0.116
	[0.0660]	[0.0696]	[0.123]	[0.138]
SAVE	-0.0151	0.124***	-0.149	0.292
	[0.0429]	[0.0470]	[0.182]	[0.225]
SUSKILL	0.185	0.442***	-0.0929	0.756
	[0.161]	[0.162]	[0.476]	[0.524]
OPPORT	0.704***	0.802***	0.767**	0.717*
	[0.146]	[0.153]	[0.326]	[0.387]
KNOWENT	0.520***	0.818***	0.221	1.156**
	[0.128]	[0.132]	[0.447]	[0.499]
stage2_tau			2.975	
			[2.578]	
Constant	3.201***	2.186***	2.703*	-0.237
	[0.711]	[0.771]	[1.473]	[3.350]
N	9,336		9,336	
N. of respondents	3,112		3,112	
Log likelihood	-2190.3		-2190.1	
Degree of freedom	22		22	
LR test for IIA			0.538	
p-value for IIA test			0.463	

Note: The figures in brackets are standard errors. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. N indicates the number of observations.
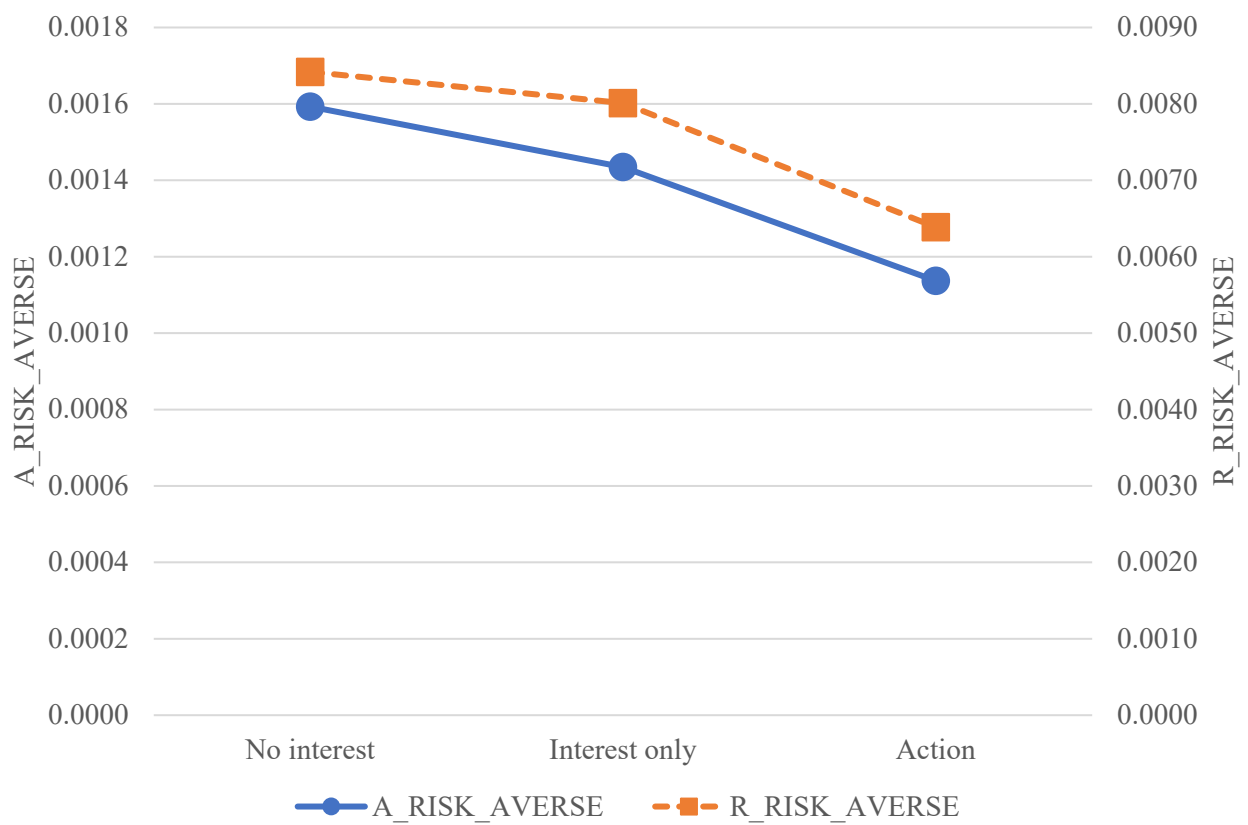
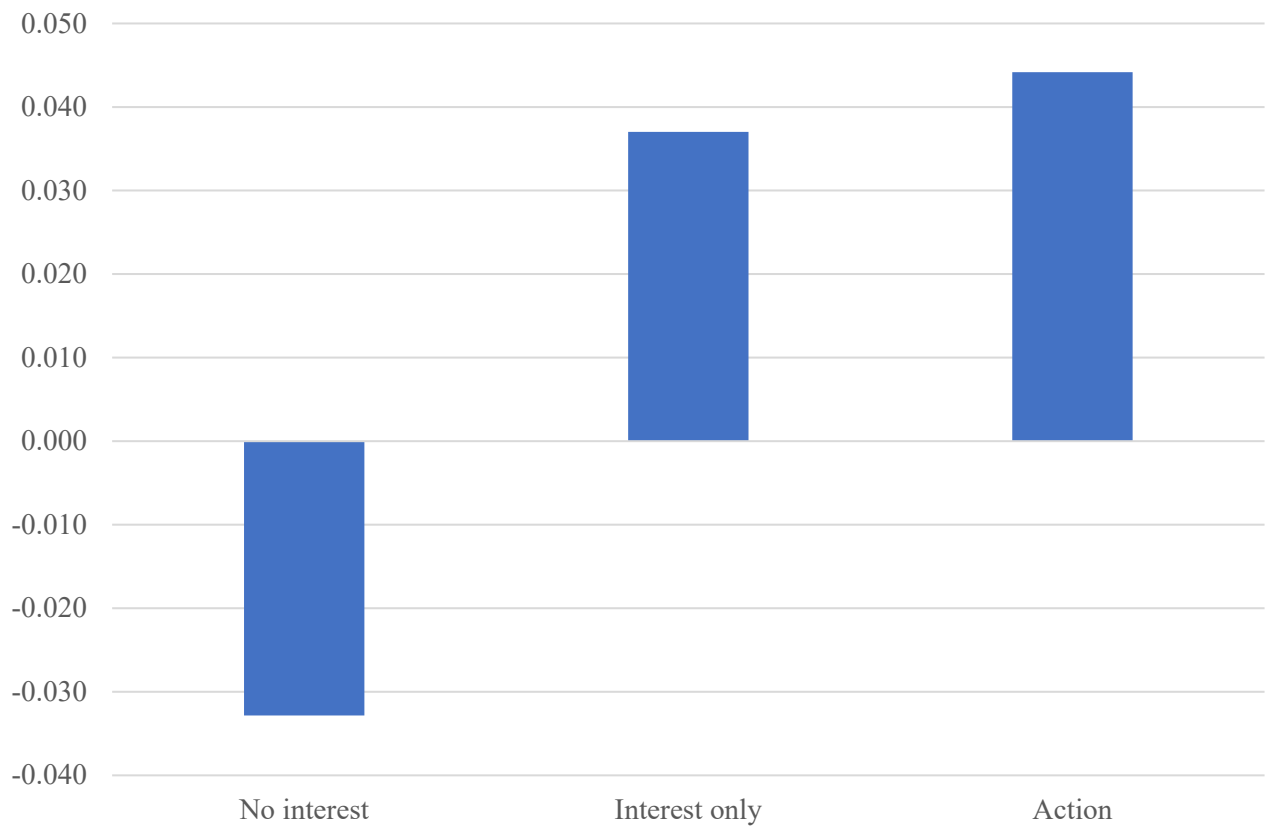Fig1.

Means of absolute and relative risk aversion by angel investing.

Fig2.

Mean of the discount rate by angel investing.