



Research Paper

Risk preference's impact on decision time and portfolio selection in P2P lending - evidence from eye tracking experiments

Accepted 28th April, 2022

ABSTRACT

With the rapid development of online economy, investors have limited time and energy, and are unable to obtain and judge all information. Therefore, understanding how investors within online environment make information judgment is very important. On the other hand, risk appetite has always been the basis of financial theory, which has a great impact on decision-making results. This study uses eye tracking experiment to explore the impact of risk preference on the stage of investors' decision-making process by dividing the experimental participants into two groups of risk preference and risk aversion. The results show that in terms of investment decisions, investors with different risk preferences have certain differences in portfolio selection mechanism, and the investment proportion of risk-free assets of investors with risk preferences is significantly lower than that of investors with risk aversion. The study illustrated the impact of risk preference on decision-making time and portfolio selection during the decision-making process and the conclusions provide deep insights on how to review user behaviors in peer-to-peer lending market.

Yuelei Li¹, Hua Wang^{2*} and Jingru Yang¹

¹College of Management and Economics, Tianjin University

²Business School, Shenzhen Technology University, 3002 Lantian Road, Shenzhen, China, 518118

*Corresponding author. E-mail: wanghua@sztu.edu.cn

Key words: Risk preference, eye tracking, online lending, behavior experiment, investment decision-making, portfolio selection.

INTRODUCTION

Decisions in people's daily life are often made under uncertainty and have certain risks and those decisions can be called risk decisions. Once it comes to risk decision, an important influencing factor that must be considered is risk preference. Risk preference has always been the basis and core issue of financial theory and has a vital impact on financial decision-making. Many classical theories and inferences, such as CAPM model, are based on certain risk preference. The change of risk preference is of great significance to the prediction of actual results. Changes in a person's risk preference can be used to predict all aspects of labor market and health outcomes, addiction behavior, investment decision-making and immigration decision-making (Barsky et al., 1997; Hong et al., 2004; Bonin et al., 2007). Because risk appetite is very important for financial decision-making, it has always been the research focus of many scholars. However, with the development of

economy and technology, great changes have taken place in the current financial market compared with the early years. The rapid development of online economy has increased the source and quantity of information. Studies have shown that the amount of information supplied by human standards increases about four times every 10 years, but people's ability to process information does not increase with the amount of information supplied. The supply of this massive amount of information conflicts with people's limited time and energy and processing ability, resulting in a lack of attention (Yu and Zhang, 2012). In this decision-making environment, the information is more complex, which is mainly reflected in the excessive supply of information, the variety of collection channels, and it is difficult to collect it completely. However, investors' time and energy are limited, resulting in the dual pressure of decision-making

which refers to making decisions under the scenario of "large amount of information and limited time".

Decision making in the financial market is a typical decision-making scenario in a complex information environment, in which relatively simple consumer loans involve a lot of cost and bonus information, which is more important and complex than other markets (Kalayci and Serra, 2016). Online lending refers to individual to individual micro credit lending, which has three roles: investor, borrower and lending platform. The direct lending behavior between the investment and the borrower through the online lending platform rather than through financial institutions belongs to an important part of Internet finance. In online lending, the borrower submits the subject data and basic information of the loan to the online lending platform. After the online platform is released investors can identify risks and weigh benefits according to the subject information and decide whether to invest and how much to invest, so as to establish a lending relationship. Compared with other markets, it has the following advantages: first, the online lending market is a typical financial market, and the complexity and amount of decision-making information meet the conditions of complex environment. Second, all investors obtain the same information of borrowers on the online lending platform, avoiding the deviation of decision-making results caused by the inconsistency of the total amount of information collected by individuals. Third, the online lending market has more participation of individual investors, there is a large amount of individual micro data, and covers information from personal basic information, credit information, assets, income, work and so on, and all the information can be put into a single page web page, which can match the requirements of eye movement experiment.

Fourth, in online lending, high-quality targets tend to reach the full standard faster, so investors need to make decisions quickly in a short time. Liao et al. (2018) proposed that the full standard time of 25% targets in online lending is only 42 seconds. On the other hand, most of the online investors have limited time and energy, and are unable to obtain and judge all information. Therefore, understanding how investors within online environment make information judgment is very important. Furthermore, risk appetite has always been the basis of financial theory, which has a great impact on decision-making results. Based on the above consideration, this study uses eye tracking experiment to explore the impact of risk preference on the stage of investors' decision-making process. The investigation obtains the real loan targets and performance results on the platform through the way of online data crawler as experimental materials, and records the physiological data and behavior data of the information value perception process by using the experimental method of the combination of online lending investment platform and eye movement instrument written in Java language, in order to analyze the process of

information value perception. In this study, the experimenters randomly selected senior undergraduates, postgraduates and doctoral students who signed up for the experiment as experimental participants to study the impact of risk preference on investors' decision-making time and portfolio selection in complex information environment. The decision-making time and portfolio selection process is the key issue, because how to make the decision is the most important part from the whole complex information decision-making process. Therefore, the research on the impact of risk preference on decision-making time and portfolio selection is carried out from the aspect of information processing. Through eye movement investment experiment, this study mainly analyzes the characteristics and impact of investors with different risk preference on decision-making time and portfolio selection.

The structure of this study is as follows: the first chapter is the introduction, which expounds the background, research problems, research significance, research framework and narrative structure of this study. The second chapter is the literature review. From the experimental background, this study expounds the research on online lending platform, risk preference, eye movement technology and priming effect in experimental economics, which lays a theoretical foundation for the follow-up research. The third chapter describes the process and design of the whole experiment, and introduces the information of experimental participants, experimental instruments, experimental scale and starting effect method, experimental reward payment and so on. In addition, this chapter also introduces the common analysis methods and variables of the data obtained by the eye tracker, so as to lay the foundation for the relevant data analysis later. The fourth chapter first analyzes the differences between the decision results and eye movement attention from all experimental participants, and analyzes the patterns of decision-making time and portfolio Selection. The chapter then analyzes the differences in information scores between the two groups with different risk preferences - risk preference group and risk aversion group are discussed. Finally, the difference of decision-making time and portfolio selection between risk preference group and risk aversion group is compared and analyzed, and the influence of risk preference on decision-making time and portfolio selection is investigated. The fifth chapter summarizes the impact of risk preference on investors' decision-making time and portfolio selection and on this basis, summarizes the results of the study and the future research.

LITERATURE REVIEW

Complex decision environment - Online Lending

For online lending research area, many scholars pointed

out that investors will obtain and analyze the subject information provided by the borrower, and use the information provided by the borrower to identify the subject risk and return, so as to decide whether to invest (Iyer et al., 2009; Liao et al., 2014; Hu and Song, 2017). The research covers the impact of various types of information on investors' decision-making. In the research on the impact of personal basic information on investors' decision-making, Guo (2016) proposed that borrowers who use real names instead of nicknames do not gain more trust from investors, and the loan success rate does not increase but decreases, possibly due to adverse selection. Duarte et al. (2012) studied the relationship between the photos provided by the borrower and the underlying interest rate, success rate and default rate by using the data of prosper platform, and found that the more credible the photos look, the higher the success rate of the loan and the lower the underlying transaction interest rate. Ravina (2012) pointed out that when the borrower's work, credit and other financial information are the same, individual investors will pay more attention to personal information factors such as appearance, age and personal characteristics. Liao et al. (2015) found that when investors identify risks through education indicators, there will be deviations. People with high education have a higher probability of repaying as promised. Specifically, the higher the education level, the smaller the borrower's real default rate and the lower the credit risk. However, investors do not recognize the borrower's high education. The successful borrowing rate of highly educated borrowers is not high.

In the research on the impact of target information on investors, Freedman and Jin (2008) pointed out that the target invested in high interest rates has higher default risk, because the credit of borrowers with high interest rates may be bad. Li et al. (2016) believe that interest rate is one of the important reference factors for investors' decision-making. Hu and Song, (2017) analyzed the rational consciousness of investors on the online lending platform by establishing the theoretical model of expected utility and using the data of Renren loan. They pointed out that investors have rational consciousness and are not completely rational. They realize the pursuit of income and the avoidance of risk through the analysis of the target, and the expected utility presents an inverted U-shaped feature. Investors have the strongest preference for interest rate. In the research on credit and certification information, Herzenstein et al. (2008) used the data analysis of prosper platform to show that individual investors will focus on the efforts made by borrowers and financial status information to decide whether to invest. Puro et al. (2010) pointed out that investors pay attention to the borrower's credit score, loan ratio, loan history and other relevant information. Li et al. (2013) used the data of "paipai loan" to study and found that the borrower's age, credit rating and other orders in China's small loan market belong to statistical analysis. The loan interest rate, the

borrower's credit rating and the number of successful loans are directly proportional to the loan success rate, and the loan term, age and student status are inversely proportional to the loan success rate. It is pointed out that investors pay attention to the essential credit of investors before considering the rate of return. Klafft (2008) used prosper research to show that bank account information and credit rating are the key factors for loan success, and personal information will have an impact, but the impact is small.

Wang and Liao (2014) studied the impact of the credit mechanism of the online lending platform on the loan success rate, and believed that the online authentication mechanism can effectively reduce information asymmetry and improve the loan success rate, and the borrower's various authentication and credit ratings have a significant impact on the loan success rate. In the research on loan description, Peng et al. (2016) used the data of prosper online lending platform to study that loan statement can reduce the borrowing cost, but it does not necessarily increase the borrowing success rate. Michal (2012) states that information disclosures help to increase the loan success rate. The more information disclosed by borrowers with low credit rating, the more likely they are to obtain loans. Even if the disclosed information is not authenticated, it will increase the loan success rate. From the analysis, it can be seen that in online lending, investors identify the existing risks through the subject information. Most of them explore the impact of lending information on the lending success rate through empirical research, infer the possible investment behavior from the relationship between the data, and explore the relationship between the order itself and its yield and default rate. It is a research paradigm based on decision-making results. However, studies have shown that there are many explanations for the same decision-making results, and it is impossible to judge which is more reasonable (Schulte et al., 2011).

Experimental economics

Development of experimental economics

Before the emergence of experimental economics, the research of economics generally used the methods of logical deduction and econometric statistics to study related problems. Therefore, the emergence of experimental economics innovated the traditional research methods, and with its continuous development, economists rely more and more on the way of experiment to test practical problems. The earliest economic experiment can be traced back to the St. Petersburg game proposed by Nicholas Bernoulli in 1728. With the rapid development of experimental economics, it is now used to study auction theory, industrial organization and market equilibrium theory, individual choice theory, game theory,

public goods research and so on. With the progress of science and technology, scholars and experts continue to explore the experimental methods and instruments, and gradually develop from the initial questionnaire survey and paper pen experiment to the experimental method of using precision instruments. In the 1970s, eye tracker equipment was introduced into the experiment, which enriched the means of experimental research. The combination of neuro-economics and experimental economics provides good data support for the study of people's economic decision-making behavior, because we can not only collect relevant decision-making data in the experiment. It can also collect human physiological data with the help of instruments, which provides better behavioral data for the study of how people make decisions and how the brain thinks and operates.

Application of eye movement technology in decision theory

Decision making has always been the focus of psychologists and economists. Simon won the Nobel Prize in economics in 1978 for putting forward the theory of bounded rationality in 1957, Kahneman won the Nobel Prize in economics in 2002 for putting forward prospect theory and framework effect in 1981, and Thaler, an economist, won the Nobel Prize in Economics in 1999 for psychological account, endowment effect. With the development of science and technology, Russo and Rosen introduced eye movement technology into decision-making research in the 1970s, which greatly promoted decision-making research (Russo and Rosen, 1975). At present, there are two research paradigms of decision-making. The traditional research paradigm based on decision results is to infer the causality through the analysis of the relationship between input and output variable data. The other is a process based research paradigm that analyzes the whole process of decision-making and how the input-output results are related (Svenson, 1979; Johnson et al., 2008; Wei and Li, 2015). At present, decision theory can be divided into non compensatory decision and compensatory decision (Johnson et al., 2008; Zhang et al., 2014). Non compensatory decision-making refers to the method of not processing and weighing all information, but considering the limitation of individual cognitive level and time and energy, not processing and integrating all information, and only using the limited information in decision-making to avoid weighing value, including satisfaction principle, dominant inspiration, equal decision-making and other modes (Payne and Bettman, 2004), whose search mode is attribute based information search mode.

With the development of technology, scholars began to use eye movement technology to test these decision-making models, and began to shift from decision-making results to in-depth research on decision-making process.

Wang and Li (2012) used eye movement instrument technology to test the integration model and dominant heuristic model of risk decision-making. Su et al. (2012) verified the hypothesis that decision makers only pay attention to common attributes when canceling common attributes with the help of eye tracker. The research results revealed the attribute based trade-off process based on multi-attribute decision-making, and put forward the ways through which marketers can influence consumer choices. In the field of behavioral finance, Shi and Zheng (2017) used eye tracking technology and laboratory experiments to study the face protection effect and consumer behavior decision-making preference under different types of moral threats. Devetag et al. (2013) used eye movement technology to study the single decision game, found that there was a certain correlation between the experimenter's eye movement and decision-making choice, and found that the experimenter tended to use simple decision rules, ignored the opponent's situation and did not analyze the opponent's behavior. And only some topics have both information search mode and selection compatible with specific cognitive level.

Priming effect

Priming effect is a process in which people can appear in the subconscious and activate the memory connection of relevant information when they are exposed to specific stimuli that improve the acquisition of certain types of information (Higgins and Kong, 1981; Higgins et al., 1977), when people are placed in a specific environment, this process will increase the available information of specific content, so it can affect the brain's analysis of information, and then affect decision-making (Baron and Byrne, 1997). At present, there are mainly studies on the priming effect, mainly focusing on the priming of risk preference, time preference and color. Gilad and Kliger (2008) compared the priming effect of experimental participants' pursuit of risk with the control group, discussed the impact of the priming effect of risk preference on financial decision-making, and found that financial consultants and professional certified public accountants of commercial banks. It is more affected than ordinary college students. In the field of financial decision-making, Kliger and Gilad (2012) used different background board colors to let the experimental participants make risk decisions. They found that red changed the proportion of experimental participants allocated to mutual funds, indicating that the priming effect of color has an impact on financial risk decision-making. Cohn et al. (2015) used pictures as the starting effect of economic prosperity and depression to explore the risk aversion of financial professionals in two scenarios, indicating that they show more risk aversion in economic depression. Erb (2002) used the priming effect of different risk preferences to study the risk aversion and self-confidence of people with different risk preferences,

and proved that the priming effect was indeed effective and had an impact on the behavior of investors. In addition, there is the impact of priming effect on time perception (Zauberman et al., 2009). The previous literature analysis shows that the priming effect is an effective experimental method and has a far-reaching impact on decision-making.

Risk appetite for investors

Under the framework of neoclassical finance, many financial theories, such as CAPM model, are analyzed based on risk preference. Risk preference is of great significance to predict individual investment behavior and market performance. Understanding the impact of different risk preferences on investment behavior is helpful to analyze the economic market. Risk preference people have a positive attitude towards the results and underestimate the possibility of loss, while risk averse people have a negative attitude towards the results. Overestimating the possibility of loss requires higher possibility of return and it is difficult to bear the risk. Schubert (1999) found that women are more risk averse in financial decision-making. Mather (2012) pointed out that risk aversion does not increase with age. Studies have shown that investors in lottery stocks are risk seekers, and only by trading in combination with unusual risk preference and market sentiment of individual investors can the problem of lottery stocks be solved (Fong and Mun, 2013). Niendorf and Ottaway (2002) investigated whether personal risk preference is the source of risk premium by studying the wealth characteristics of agents with different risk preferences. Chen (2006) pointed out through the risk tolerance questionnaire that investors with high risk tolerance scores have higher risk portfolios, and investors with more investment experience have higher risk tolerance and higher risk portfolios. Studies have shown that the change of risk preference can not only affect an individual's behavior in the financial market (Dyer and Sarin, 1982), but also predict all aspects of labor market and health outcomes, addiction behavior, investment decision-making and immigration decision-making (Barsky et al., 1997; Hong et al., 2004; Bonin et al., 2007), understanding the impact of personal risk preference on decision-making can better understand the development of financial markets and investors' decision-making behavior (Schildberghorich, 2018). Cohn (2015) found that investors are more risk averse during the recession than during the boom, so they will invest in more risk-free assets, which explains the long-term confusion that the stock risk premium seems to be higher than the boom during the recession. Therefore, participants in different markets may have different risk preferences. The market with low risk aversion reflects the market price faster than the theoretical market (Ang and Schwarz, 1985).

Our proposed approach

Risk preference is one of the most important influencing factors of investment decision-making. In the current decision-making of financial market, investors are faced with multiple and complex information environment. How risk preference affects investment decision-making in this scenario needs us to explore. Through combing the previous literature, it is found that the financial market - online lending selected in this study has the general characteristics of diversified financial decision-making information, and because of the unity of information provided by its platform, it just provides a good platform for this research. However, from the above literature analysis, we also found that the research on online lending platforms mostly focuses on the research methods, mostly empirical research, and reasonable reasoning through data relations. From the research content, the research focuses on the information characteristics of the subject, such as lending success rate, lending cost, information risk identification, herding effect and so on. Few experimental methods are used to analyze and judge the online decision-making process with intuitive physiological data to help. Therefore, only inferring the rationality from the data is lack of strong support and evidence. Previous articles in the field of eye movement experiment mostly focused on the characteristics of eye movement information, the applicability of decision-making mode and the mode exploration of information search. They are all the exploration of theory and information processing mode. The experimental materials used are the simplification of real-world decision-making model to a certain extent, and lack the exploration of decision-making scenario of complex information in reality. Therefore, from the micro perspective of individual investors, this study will directly record the decision-making process of investors through eye movement technology, risk scale and priming effect, and analyze the impact of investors with different risk preferences on decision-making time and portfolio selection.

EXPERIMENTAL DESIGN

Experimental setting

In order to explore the impact of risk preference on decision-making time and portfolio selection within decision-making process of investors, this experiment uses eye tracker and web page to record data. An experimental platform for simulating investment is built on Tobii t60xl eye tracker. This platform is built with reference to the real online lending platform. During the experiment, eye tracker is used to collect the data concerned by investors' eyes, and the investment data collected by web pages. And use $2 \times$ according to the experimental design principle of 2, this research studies the impact of risk preference on

Table 1: information statistics of all experimenters

Risk Type	Management major	Engineering major	Others	Male	Female	Total
Risk Appetite	9	16	6	19	12	31
Risk Aversion	11	17	2	11	19	30
Total	20	33	8	30	31	61

investment concern. By randomly selecting the real investment target, it is designed into four combinations from the two dimensions of high / low risk of the target itself and investor risk preference / avoidance, and analyzes the relevant differences.

Experimental design

Experiment participants

This experiment was conducted by the WeChat public number. Participants were recruited from the official account of Tianjin University. 61 senior undergraduates, postgraduates and PhD candidates were selected from Tianjin University (including 30 boys and 31 girls). The specific situation is shown in **Table 1**. All participants did not participate in such experiments before and their eyesight was normal. They were interested in the experiment and participated voluntarily. After the experiment, according to the performance and investment income of the experimental participants in the experiment, give the experimental participants a certain amount of cash to reward them for seriously participating in the experiment and performing well.

Experimental equipment and environment

The equipment used in this experiment is Tobii60xl eye tracker, with accuracy of $[0.5]^\circ$, accuracy of $[0.22]^\circ$, 24 inch display screen and screen resolution of 1920×1200 pixels, sampling rate of 60 Hz, with the function of supporting the large-scale movement of the head of experimental participants, and stable line of sight tracking ability. This eye tracker is an integrated eye tracker, which is no different from ordinary computers. Therefore, it will not cause any discomfort to the experimental participants, and it cannot detect the collection process of eye movement information. The information that can be collected during the experiment includes fixation point, fixation time, repeated fixation times, fixation sequence, mouse events and other data, At the same time, we can also use the bottom data of the eye tracker for deep data processing, such as visualizing the eye movement data, and drawing auxiliary images such as gaze trajectory map and hot zone map with Tobii Studio software to improve the readability of the research results. In order to better simulate the real investment environment, the

experimental interface of this experiment is a web page written by using java language with reference to the real Renren loan interface layout and information. In order to eliminate the inducement of the marketing design of the original online platform, we design the text of the subject information in black and uniform size. In the audit status column, the approved indicators are indicated by a red check mark, Restore the current interface of Renren loan to the greatest extent, and present the experimental interface and record and analyze eye movement data through Tobii studio 3.2 software.

During the experiment, it is displayed in the form of single page full screen. In order to reduce the sight shift caused by the experimental participants' keyboard input, the way of mouse slider in the lower right corner is specially designed to set the investment amount. The experimental participants only need to manipulate the mouse in the whole experimental process, so as to maximize the tracking of the eye movement and decision-making behavior of the experimental participants. There is only one experimental instructor and one experimental participant in the experimental room. The environment is quiet to ensure that the experimental participants are not disturbed by external factors, and the indoor light is sufficient and suitable for cold and heat. A comfortable and stable back chair with adjustable height is set in front of the eye tracker. According to the requirements of the eye tracker, the distance between the experimenter and the eye tracker should be controlled at about 64 cm during each experiment to ensure the best distance between the experimenter and the eye tracker. The line of sight is adjusted to the center of the screen during correction to ensure that the experimenter can move his head within the maximum range. High sampling rate can be guaranteed.

Experimental process

The experiment is divided into eight steps. The experimental participants need to fill in a questionnaire to collect the basic information, investment experience and attitude towards the online lending platform of the experimental participants. The experimental participants read the experimental instructions and arrange the experimental instructors to explain the interface information and operation methods of the experiment, and then arrange corresponding tests to ensure that the experimental participants understand the rules of the experiment accurately and then they can enter the test

stage. The test stage is exactly the same as the formal experimental stage, but there are only two groups of subjects. The purpose is to make the experimental participants more familiar and clear about the interface layout, various information and operation methods of the whole experiment, ensure that they are fully familiar with the operation interface and experimental rules, exit the test stage, and then with the participation of the experimental instructors, let the experimental participants participate in the measurement of risk attitude and priming effect, and then directly enter the formal experiment. The method of risk priming effect of Erb (2002) is adopted, and its rules are as follows: according to the risk measurement results, the 15 words of different experimenters in relevant groups are ranked from high to low in your application, and the risk preference group (risk loving, enterprising, bold, risky, polite, orderly, conceited, colorful, cheating, disagreement, gratitude, anxiety, worry, timidity transition anxiety) risk aversion group (responsible, responsible, careful, considerate, polite, orderly, conceited, colorful, deceptive, disagree, thank you, lack of assertiveness, recklessness, inconceivable, risk).

Eye movement data analysis method

There are four common eye movement data analysis and visualization methods: hot area mapping method, AOI (area of interest) method, scanning path method and three-dimensional space method (Cheng and Sun, 2014). The hot zone map method is intuitive and easy to understand. It is one of the most commonly used methods. It describes the attention of experimental participants to different information and supports the visualization of superposition of multiple experimental records, but it cannot represent the sequence and path of fixation points. AOI area of interest method is used to test the degree of attention of specific interface elements. It can be superimposed between different stimulus materials and different experimenters to show visual distribution, which is helpful to analyze the attention of experimental participants to the specific area of the whole interface elements. When AOI area of interest method is used to analyze the influence of different interface elements, the division of area of interest is particularly important. The scanning path method can record the whole process of the experimenter's line of sight conversion path in the whole experimental process, which is convenient for us to understand the experimenter's information search process. However, when the scanning paths overlap each other, this method will make the visual image quite complex and is not suitable for the research with long observation time and more overlapping experimental participants. In view of the long experimental time in this study, which is between 10-30 min, a large number of scanning sequences and connecting lines will be

generated, so the scanning path method cannot be used for research. Therefore, the area of interest and hot area method are used for the overall analysis from the perspective of the combination of figure and data. Because the amount of interface layout information in this experiment is large, and the subjects' line of sight will overlap between different information, when selecting the area of interest, the research area is just covered as the area of interest under the condition of line of sight overlap, forming 38 rectangular areas of interest.

Experimental data variables and data selection

In order to analyze the impact of risk preference on decision-making time and portfolio selection during the decision-making process among investors with different risk preferences, this study selects the eye movement data generated in the process of experiment and the time and times of investors' attention to information for analysis. The number of fixation represents the importance or attention of information (Hristova and Grinberg, 2008; Wang and Li, 2012; Su et al., 2012), fixation time represents importance (Wang and Li, 2012; Su et al., 2012). FD (fixation duration) indicates the sum of continuous attention time in a region of interest, in seconds. The larger the index, the more time the experimental participants spend paying attention to the information. On the one hand, the subjects pay attention to the information or think it is important. This study eliminates the data error caused by the understanding of the information through explanation, test and pre experiment before the experiment. FC (fixation counts) refers to the number of fixation times of experimental participants in a region of interest, in times. The larger the index, it can be understood that the experimental participants pay more attention to the information, indicating that the information is more important or concerned in the decision-making process of the subjects. Similarly, this study eliminates the data error caused by the understanding of the information through explanation, test and pre-experiment before the experiment. This study selects 61 participants, and analyzes the eye movement data, self-report data and web investment data of 38 interest areas in the whole investment experiment process from investors' decision-making time and portfolio selection during the decision-making process.

INFLUENCE OF RISK PREFERENCE ON DECISION TIME AND PORTFOLIO

Risk preference on portfolio characteristics

People with different risk preferences have different attitudes towards expected returns and risks, which will lead to different investment amounts and different

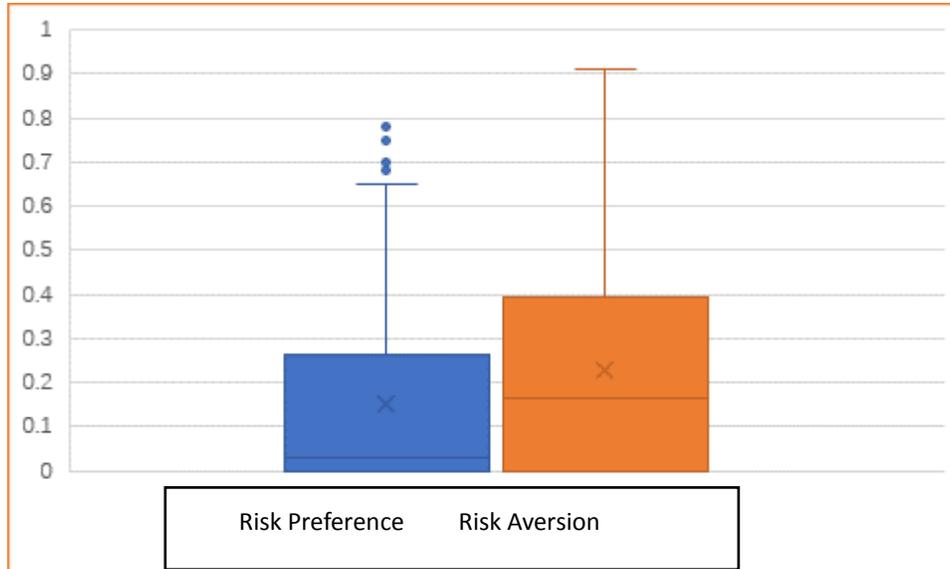


Figure 1: comparison of investment proportion of risk-free assets between risk preference group and risk aversion group.

Table 2: mean t-test of investment proportion of risk-free assets in risk preference group and risk aversion group.

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
Risk preference	186	0.149032	0.01476	0.201298	0.119913	0.178152
Risk aversion	180	0.225556	0.017504	0.23484	0.191015	0.260096
combined	366	0.186667	0.011577	0.221476	0.163901	0.209432
Diff		-0.07652	0.022839		-0.12144	-0.03161
diff = mean(0) -mean(1)					t = -3.3506	
Ho: diff = 0					degrees of freedom =364	
Ha: diff < 0			Ha: diff != 0	Ha: diff > 0		
Pr(T < t) = 0.0004			Pr(T > t) = 0.0009	Pr(T > t) = 0.9996		

distribution proportions of risk assets. Investors with risk preferences are more tolerant of risks, more positive in the expectation of results, and tend to buy high-risk assets, such as stocks and financial derivatives. Therefore, even if the borrower has a high risk, under the situation of poor overdue times, overdue amount, credit limit and credit score, people with risk preference will still comprehensively measure the income and risk to invest. However, risk averse people who have low tolerance for risk, will be more negative for the expected results, and will overestimate the possibility of loss. Therefore, they are more inclined to buy low-risk or even risk-free assets. However, if they find the subject matter with high risk, they may choose not to invest and choose the remaining amount to invest in risk-free assets. Therefore, this study analyzes the investment proportion of risk preference investors and risk averse investors in risk-free assets. It can be seen from Figure 1 that the proportion of risk preference group investing in risk-free assets is smaller than that of risk averse group in terms of mean value and range, and the inter group difference risk of the proportion

of two groups investing in risk-free assets can be seen from Table 2. The average proportion of risk preference group investing in risk-free assets is 0.149, and the average proportion of risk aversion group investing in risk-free assets is 0.226. The difference between them is -0.076, and the p value is 0.0009, which is significant at the level of 1%, indicating that there is a significant difference in the investment amount of risk-free assets between the two groups. This is in line with the risk perception of risk preference and risk aversion investors. Risk preference investors tend to invest assets in risk assets to obtain benefits, while risk aversion investors tend to risk-free assets to avoid the generation of risk.

Influence of risk preference on decision time

It can be seen from the previous analysis that the difference analysis of seven types of information between the risk preference group and the risk aversion group shows that in addition to credit information, investors in

Table 3: distribution of decision-making time interval of experimental participants

Decision time	Risk preference	Total %	Risk aversion	Total %
1-7Sec	0.127	0.127	0.169	0.169
8-15Sec	0.334	0.461	0.418	0.587
16-22Sec	0.291	0.751	0.213	0.800
23 Sec or more	0.249	1.000	0.200	1.000

Table 4: t-test of mean decision-making time of experimental participants

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
Risk Preference	1688	16.78969	0.183168	7.525509	16.43043	17.14895
Risk Aversion	1669	15.19607	0.190366	7.777105	14.82269	15.56945
combined	3357	15.99739	0.132757	7.691882	15.7371	16.25768
Diff		1.593622	0.264128		1.075753	2.111491
diff = mean(0) mean(1)					t =	6.0335
Ho: diff = 0					degrees of freedom =	3355
Ha: diff < 0		Ha:diff !=0			Ha: diff > 0	
Pr(T < t) = 1.0000		Pr(T > t) = 0.0000			Pr(T > t) = 0.0000	

the risk preference group pay more attention to the other six types of information than the risk aversion group, and it is observed from the experimental process that people who encounter high-risk targets tend to skip directly. It can be inferred that whether the single decision-making time of investors in the risk preference group will be longer than that in the risk aversion group? Therefore, this study divides the single decision-making time of the risk preference group (1668 decisions) and the risk aversion group (1669 decisions) into four intervals for statistical analysis, as shown in [Table 3](#). The proportion of the number of decisions made by the risk aversion group in a short time (within 7 sec and 15 sec) to the total number of decisions is much higher than that of the risk preference group. The ratio of the number of decision-making times to the total number of decision-making times in a long time (more than 15 sec) is much lower than that in the risk preference group. According to the difference analysis results between groups in [Table 4](#), the average decision-making time of investors in the risk preference group is 16.790 seconds, and that of investors in the risk aversion group is 15.196 seconds, P value is 0. There is a significant difference in the decision-making time between the two groups at the significant level of 1%. It can be seen that investors in the risk preference group take longer to obtain and analyze the overall information of the subject than those in the risk aversion group.

From the previous analysis, it can be seen that the investors in the risk preference group take a longer time to make a single decision than those in the wind direction avoidance group, and pay more attention to the information related to income than those in the risk avoidance group. Therefore, it is because the investors in the risk preference group weigh the income on the basis of analyzing and evaluating the risk. The investors in the risk aversion group only avoid the risk and less consider the information related to the income, resulting in a short

decision-making time, which is verified in this study. If it is because of the above situation, the investment amount of risk averse investors in the inferior target of the high-risk group must be lower than that of the risk preference group. Therefore, this study carries out 2 according to the two variables of target risk and risk preference \times 2 experimental design to detect the difference of risk preference in the investment amount of the subject matter of the high-risk group and the subject matter of the low-risk group. From the previous analysis, it can be known that the information most concerned by investors is the information related to credit that is, serious overdue and overdue times. It can be known that this is the more important information for investors to analyze the subject matter risk. Therefore, in this study, 60 subjects are divided into two groups according to the number of serious overdue and overdue times. The subjects with more overdue times are the subjects with higher risk, and the subjects with less overdue times are the subjects with lower risk. The mean value analysis of all investment amounts is carried out according to two dimensions, and the results are shown in [Figure 2](#).

It can be seen that whether they are high-risk subjects or low-risk subjects, the investment amount of risk preference group is higher than that of risk aversion group. In addition, in order to test the difference between the investment amount of high-risk subjects in the risk preference group and the risk aversion group, this study makes an inter group t-test analysis on the investment amount of high / low-risk subjects in the risk preference group and the amount of risk aversion group. The results are shown in [Tables 5](#) and [6](#). The average investment amount of the risk preference group in the high-risk subjects group is 581.466 and the average value of risk aversion investors is 492.11. The difference between the mean values is 89.358, and the difference between the two groups is significant at the level of 10%. In the face of high-

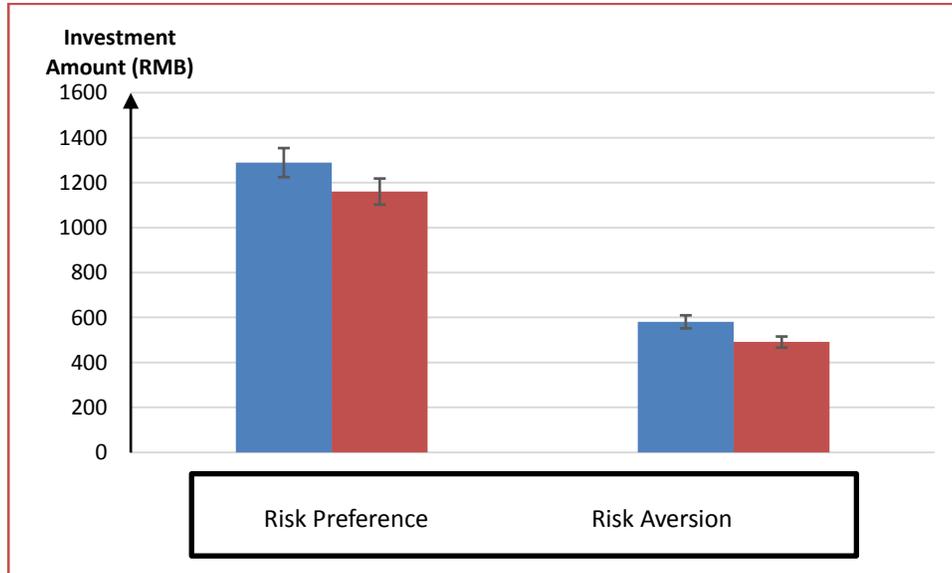


Figure 2: comparison of investment amount of participants in different risk target groups.

Table 5: t-test for investment amount of high-risk subjects by experimental participants.

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
Risk Preference	839	581.47	36.577	1059.458	509.6736	653.2585
Risk Aversion	830	492.11	32.202	927.7265	428.9017	555.3152
combined	1669	537.03	24.4	996.8315	489.1699	584.8864
Diff		89.358		48.76668	-6.292791	185.008
diff = mean(0) -mean (1)					t = 1.8323	
Ho: diff = 0					degrees of freedom =1667	
Ha: diff < 0		Ha: diff != 0		Ha: diff > 0		
Pr(T < t) = 0.9665		Pr(T > t) = 0.0671		Pr(T > t) = 0.0335		

Table 6: t-test for investment amount of low-risk subjects by experimental participants.

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
Risk preference	849	1289.694	50.45418	1470.114	1190.664	1388.723
Risk aversion	838	1160.74	47.05862	1362.264	1068.373	1253.107
combined	1687	1225.637	34.53874	1418.613	1157.894	1293.381
diff		128.9539	69.02799		-6.435733	264.3435
diff = mean(0) -mean(1)					t = 1.8681	
Ho: diff = 0					degrees of freedom = 1685	
Ha: diff < 0		Ha: diff != 0		Ha: diff > 0		
Pr(T < t) = 0.9690		Pr(T > t) = 0.0619		Pr(T > t) = 0.03		

risk subjects, the investment amount of risk averse investors is indeed low. The average investment amount of investors in the risk preference group in the low-risk target is 1289.694, and the investment amount of investors in the risk aversion group in the low-risk target is 1160.74, with a p value of 0.0619, which is significant at the 10% level. A similar conclusion is obtained for the high-risk target, which also verifies the previous guess. In addition, this study makes a comparative analysis of the decision-making time of the high-risk target group and the low-risk target group for the risk preference group and the

risk aversion group for a single target. It can be seen from **Figure 3** that the decision-making time of the risk preference group is longer than that of the risk aversion group. This difference is significant, as shown in **Table 7** and **Table 8**. The decision-making time of risk preference investors is 14.268 seconds and that of risk aversion investors is 13.474 seconds. The difference between the two groups is significant at the level of 5%. For the subject matter of low-risk group, the decision-making time of risk preference investors is 19.088 seconds and that of risk aversion investors is 16.975 seconds. In addition, both

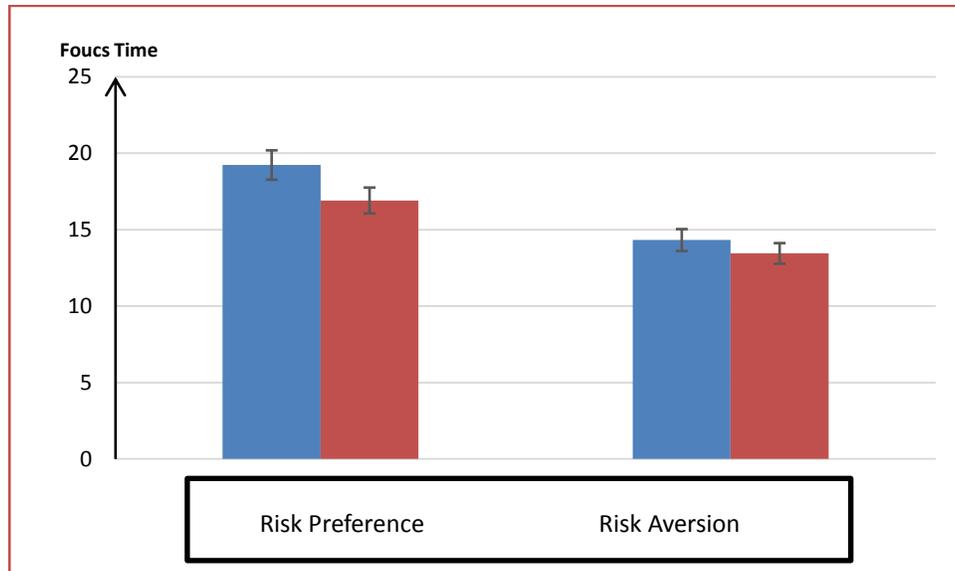


Figure 3: Comparison of total attention time of experimental participants to high (low) risk target group.

Table 7: t-test for the mean time of total attention of experimental participants to high-risk subjects.

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
Risk Preference	839	14.32181	0.261692	7.580051	13.80816	14.83546
Risk Aversion combined	830	13.45904	0.271337	7.817128	12.92645	13.99162
diff	1669	13.89275	.1886903	7.708641	13.52266	14.26284
diff = mean(0) - mean(1)		0.862776	0.376907		.1235138	1.602037
Ho: diff = 0					t = 2.2891	
Ha: diff < 0					degrees of freedom = 1667	
Pr(T < t) = 0.9889					Ha: diff != 0	Ha: diff > 0
					Pr(T > t) = 0.0222	Pr(T > t) = 0.0111

Table 8: t-test for the mean of total attention time of two groups of low-risk subjects.

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
Risk Preference	849	19.2285	0.227407	6.626105	18.78216	19.67485
Risk Aversion	838	16.90811	0.253905	7.350089	16.40975	17.40648
combined	1687	18.07587	0.172587	7.088673	17.73737	18.41438
diff		2.32039	0.340625		1.652298	2.988481
diff = mean(0) - mean(1)					t = 6.8122	
Ho: diff = 0					degrees of freedom = 1685	
Ha: diff < 0					Ha: diff != 0	Ha: diff > 0
Pr(T < t) = 1.0000					Pr(T > t) = 0.0000	Pr(T > t) = 0.0000

groups pay more attention to low-risk subjects for a long time, because for low-risk subjects, investors can choose a wider investment amount, resulting in a long time.

CONCLUSION

This study obtains the real investment information of the online loan platform, and studies the research questions with the help of eye tracker equipment. The results show

that investors with different risk preferences have different portfolios, and the proportion of risk preference investors investing in risk-free assets is significantly lower than that of risk avoidance investors. Risk preference investors take longer to make decisions than risk averse investors, because they have a certain pursuit of income on the basis of risk aversion. Specifically, the investment amount of high-risk target group and low-risk target group is higher than that of risk averse investors, because the optional investment amount is relatively wide. Therefore,

and time discounting: Subjective time perception and inter-temporal preferences." *J. Marketing Res.* 46(4): 543-556.

Zhang Y, Rao L, Liang Z, et al (2014). Verification of risk decision-making process: new understanding and new evidence of the dispute between compensation / non compensation model [J]. *Progress of psychological science.* 22 (2): 205-219.