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RESEARCH ARTICLE

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Past Experiences, Personality Traits, and Risk Aversion: Evidence from Individual Risk Attitudes during the COVID-19 Pandemic

Abstract Individuals' risk attitudes play an important role in economic decision making and policy evaluation, particularly in the midst of unprecedented uncertainty caused by the COVID-19 pandemic. We adopt a multiple-price-list elicitation method with real money incentives to measure precisely individuals' risk attitudes at different stake levels and the extent to which they are affected by personal and social shocks following the COVID-19 outbreak in China. We find that subjects who had previously experienced negative personal shocks are more risk-averse at medium and large stakes but more risk loving at very small stakes. For our sample, COVID-19 has no significant impact on risk attitudes, as it is more likely to be regarded as a social shock. The result indicates that the impact of COVID-19 on individual risk attitudes is not as influential as expected, unless the individual's personal life is affected directly.

Keywords risk attitude, risk instability, behavioral economics, negative shock, COVID-19 pandemic
JEL Classification C83, C91, D81, D91

1 Introduction

Individual risk attitudes play a fundamental role in economic decision making and policy evaluation, particularly in this era of unprecedented uncertainty posed by the COVID-19 outbreak (Baker et al., 2020a). On March 11, 2020, the World

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Health Organization declared the outbreak as a global pandemic. By September 22, 2020, more than 31 million cases have been confirmed, claiming 964,765 lives[1]. In response to the pandemic's threat, historical changes in economic activities at the micro level have been documented in almost all major economies. In China, overall consumer spending has decreased by 9.3% and household saving has increased by 10.6% by the end of June.[2] Estimation using daily transaction data in 214 Chinese cities reveals an expenditure decline of 33% and 34% on goods and services, respectively, with an almost 70% consumption reduction in Wuhan (Chen et al., 2020). With dramatic changes in consumer spending, household finance, and employment, and the closure of small businesses, individuals' beliefs about uncertainty and their risk attitudes have become of great policy relevance (Acemoglu et al., 2020; Fan et al., 2020; Glaeser et al., 2020; Li et al., 2020). Using standardized experimental economic methods with real money incentives, this study is among the first to investigate the effect of COVID-19 and previous shock experiences on individual risk attitudes in China. We provide a foundation for the growing literature that evaluates changes in individuals' economic behavior and the effect of reopening policies in the wake of the COVID-19 pandemic.

In this study, we adopt a multiple-price-list method with real money incentives (Holt and Laury, 2002) to measure precisely the stability of risk attitudes at different stake levels and examine the extent to which they are affected by individuals' experiences of personal and social shocks following the outbreak of the COVID-19 pandemic in China. Aside from the large body of behavioral economics literature on the risk attitudes of European and American individuals, Chinese scholars have also discussed the instability of individuals' risk perceptions and risk attitudes and the factors leading to such instability, including housing prices, household income, the vulnerability of household finances, and past exposure to behavioral economic decisions (Zhang and Liu, 2018; Zhang et al., 2016; Zhou et al., 2012). In particular, He and Hong (2018), based on the first

[1] The public health emergency declaration comes from the World Health Organization (https://www.who.int/) and the data on confirmed cases and death toll come from the World Health Organization (https://www.who.int/) and the Johns Hopkins Coronavirus Resource Center (https://coronavirus.jhu.edu/).

[2] The data on consumer spending comes from the National Bureau of Statistics of China (http://www.stats.gov.cn/), while the data on savings comes from the People's Bank of China (http://www.pbc.gov.cn/).

few rounds of laboratory multiple-price-list decisions, show how early exposure to risky environments leads subjects to a higher degree of risk aversion. We extend the "exposure to risky environment" idea to the COVID-19 pandemic's real-world threat and the subjects' personal experiences. Our finding that the subjects who have experienced negative personal shocks tend to be more risk-averse echoes the main finding of He and Hong (2018).

Existing psychology literature uses the personality theory to study decision making under uncertainty (DeYoung, 2010; van Egeren, 2009). In this study, we adopt the Neo Five-Factor Inventory questionnaire to measure the subjects' personality traits and relate these traits with their risk attitudes at different stake levels. Our questionnaire and incentivized survey with multiple-price-list decisions were administered in mid-April among Xiamen University (XMU) students in China. We compared the results in 2020 with data from our 2016 study on XMU students' personality traits. The subjects for these two studies are not the same student cohorts; yet, a comparison of the overall distributions of the subjects' scores in terms of five personality dimensions[3] is still meaningful. Figure 1 illustrates the differences in each personality dimension for the 2016 subjects (with no pandemic experiences) vs. the 2020 subjects (after the COVID-19 pandemic); the differences in all dimensions are statistically significant.[4] This preliminary observation suggests that, on average at the cohort level, experiencing exogenous negative shocks might contribute to a change in personality traits, which in turn affect individuals' risk attitudes.

The analyses of the 2020 data reveal the following main results. First, different personality traits affect risk attitudes at different stake levels, and they affect the stability of risk attitudes when an individual switches between stakes. Meanwhile, individuals' experiences of shocks that negatively influence their life attitudes can be divided into social shock and personal shock. Personal shocks significantly influence individuals' personality traits and risk attitudes, while a general exposure to social shocks or natural disasters has no significant effect on one's risk attitude. In addition, our regression results suggest that COVID-19 has no significant impact on an individual's risk attitude. One reason is that the

[3] The five dimensions are extraversion, neuroticism, openness, agreeableness, and conscientiousness. We provide a detailed review of the psychology literature regarding the meaning of these personality factors in Section 2.

[4] For more statistical comparison between the 2020 and 2016 survey on personality traits, please refer to Table A3 in Appendix C.

COVID-19 pandemic is more likely to be regarded as a social shock by subjects in our sample, who are recruited from various regions in China, without concentration from the epicenter. This result may indicate that the impact of the pandemic is not as influential on individuals' risk attitudes as expected; unless the individual's personal life has been affected directly by the pandemic.

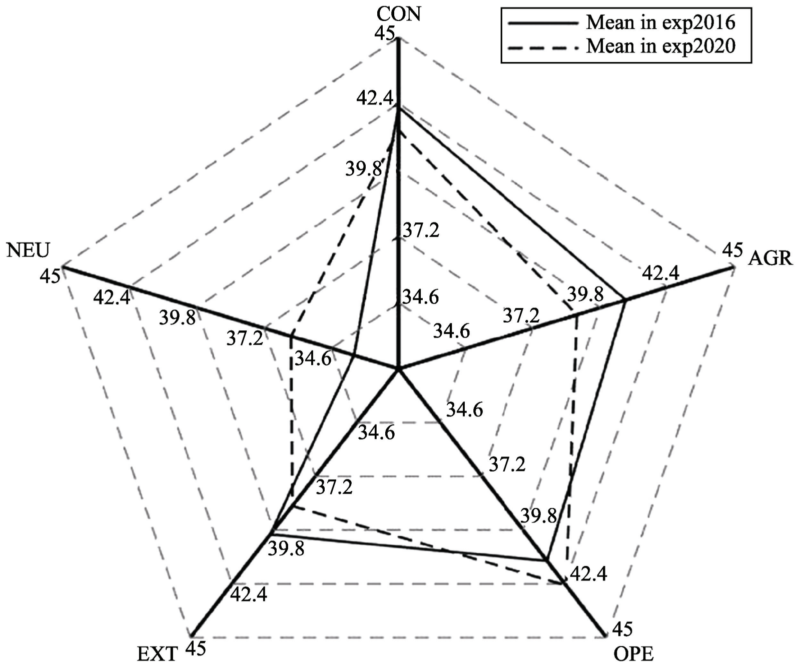


Figure 1 Mean Scores for the Five Dimensions: 2016 vs. 2020 Cohorts

Note: NEU = neuroticism, EXT = extaversion, OPE = openness, AGR = agreeableness, CON = conscientiousness.

This is the first study on how precisely measured individual risk attitudes are affected by past experiences and personality factors in the context of the COVID-19 pandemic. The degree of individuals' risk aversion and the (in)stability of risk attitudes in the wake of this historic disaster are of particular relevance to policymakers in designing the optimal lock-down, business re-opening, and other economic stimulus policies (Acemoglu et al., 2020; Baker et al., 2020b; Balla-Elliott et al., 2020; Glaeser et al., 2020; Harris, 2020) and in evaluating the effect of social distancing practices, which may become the "new normal" in the foreseeable future (Cronin and Evans, 2020; Gupta et al., 2020). Our findings suggest that previous negative shocks in one's personal life have a significant impact on increasing one's degree of risk aversion. The pandemic has become a negative shock for many people whose personal lives have been severely affected. Our study may shed light on future policy evaluations that target populations with an overall higher degree of risk aversion under uncertainties associated with the COVID-19 pandemic.

The rest of the paper is organized as follows. Section 2 reviews the related literature. Section 3 presents the survey design. Section 4 presents the empirical findings of a non-parametric comparison and the regression analyses. Section 5 provides the conclusions. The survey instructions and the main regression result of the 2016 survey study are included in the Appendix B and Table A4, Appendix C, respectively.

2 Literature Review

Our work relates to the growing literature that examines the impact of COVID-19 on individuals' economic behavior. Researchers have documented dramatic changes in various types of activities at the micro-economic level, including sharp increase-then-decrease patterns in household spending before and after the issuance of shelter-in-place orders in some U.S. states (Baker et al., 2020b; Dietrich et al., 2020), employee layoffs and closures of small businesses in the first couple of months of the disease's spread in the United States (Bartik et al., 2020), huge declines in consumer expenditure on goods and services in and out of the epicenters during the first wave of the pandemic (Chen et al., 2020; Goolsbee and Syverson, 2020), declines in non-COVID-19 healthcare facility visits (Alé-Chilet et al., 2020; Ziedan et al., 2020), or a U-shaped change in human mobility before and after several states' re-opening orders in the United States (Cronin and Evans, 2020; Glaeser et al., 2020; Nguyen et al., 2020).

With these drastic changes, individuals' perception of risks and their beliefs about future uncertainty have become particularly relevant to policy makers' decisions on the general lockdown and reopening of the economy (Acemoglu et al., 2020; Fan et al., 2020; Glaeser et al., 2020), the application of pro-automation technology in industries (Caselli et al., 2020; Chernoff and Warman, 2020), stimulus tools and recovery of employment in small businesses (Chetty et al., 2020), or voting and election (Barrios and Hochberg, 2020).

Therefore, understanding individuals' risk attitudes in response to the COVID-19 pandemic provides basis for policy analysis and evaluation. Bu et al. (2020) report survey results from college students in Wuhan, China after exposure to the health risk of the pandemic, using subjects' allocations of wealth to hypothetical risky investments to measure risk attitudes. Building upon these existing discussions, we adopt the standardized risk preference elicitation method (i.e., the multiple price list by Holt and Laury, 2002), using real money incentives to measure precisely individuals' degree of risk aversion under the context of the COVID-19 pandemic. To our knowledge, we are among the first to study the effect of COVID-19 and previous shock experiences on individuals' risk attitudes using an incentivized survey in China. Our investigation may provide primary evidence on this topic in the wake of the pandemic's first wave, facilitating the design of future studies on individuals' decision making under the uncertainty imposed by the global COVID-19 pandemic.

A large body of empirical literature has discussed the effects of negative shocks or natural disasters on the change in people's risk attitudes. Eckel et al. (2009) use Bayesian networks to study risk loving behavior after Hurricane Katrina and find that psychological factors often drive the change in risk attitudes. This is in line with the argument of Loewenstein et al. (2001). Page et al. (2014) find that homeowners in Australia tended to engage in risky gambles after a large loss caused by floods. Abatayo and Lynham (2019) conduct an artefactual field experiment with fishermen on a remote island in the Philippines and find that those directly hit by Typhoon Bopha were less risk-averse than those who were not.

Nonetheless, other research has documented an opposite direction in the change of risk attitudes; that is, people become more risk-averse after experiencing natural disasters (Castillo and Carter, 2011; Shupp et al., 2017). Cameron and Shah (2015) study villagers in Indonesia who suffered from floods or earthquakes and find a tendency toward risk aversion compared with other similar villagers who had not. Reynaud and Aubert (2020) investigate Vietnam villagers after a flood and find that those affected by the flood exhibited a higher degree of risk aversion to loss. These findings suggest a significant and lasting impact of negative emotions.

There is also empirical literature documenting the effects of past traumatic events on individuals' risk attitudes, including personal health shocks, exposure to violent crime and conflict, parenthood, and changes in financial circumstances (Anderson et al., 2006; Bogan et al., 2013; Callen et al., 2014; Görlitz and Tamm, 2015; Voors et al., 2012). Bucciol and Zarri (2013) provide evidence showing the relationship between financial risk attitude and negative events in one's life that are out of the individual's control. Kettlewell (2019) evaluates the effect of common life events on risk attitudes. Changes in financial circumstances, parenthood, and family loss could explain the results, while changes in consumption, state dependence, or changes in mental health and mood could not. The effect is mostly deterministic in the short term.

To measure individual risk attitudes and the change in attitudes at different stake levels, we employ the multiple-price-list method with real money incentives, as introduced by Holt and Laury (2002). This approach enables experimental researchers to estimate the risk parameter interval under certain assumptions of the utility curve. Holt and Laury (2002) is the most cited and widely used elicitation method in laboratories; thus, we also adopt this method in our incentivized survey. Regarding the analysis of data from individuals' choices over the multiple price list, the degree of risk-aversion/risk-seeking depends on the "switch point" between options. That is, an individual's risk attitudes is revealed by the threshold beyond which the expected utilities calculated using his/her Bernoulli utility function with the given monetary payoffs of option B exceed the expected utilities of option A. One potential problem may arise when there are "multiple switch points." Subjects may make inconsistent decisions by switching between lottery options more than once. Anderson et al. (2006) regard multiple switch points as a reflection of indifference between lotteries. Instead, subjects could be asked which row they would like to switch to ensure a unique switch point. Because such a technique may distort the elicitation results, in practice, most experimental researchers treat the data with multiple switch points as noise and remove them from the analysis.

While laboratory experiments often use small-stake gambles, in real life, the gambles relatively have large stakes. Experimental economists have also documented the so-called "stake effect" because the use of the multiple price list elicitation method is sensitive to the scale of the stakes when real money incentives are used (Beattie and Loomes, 1997; Holt and Laury, 2005; Wilcox, 1993). Moreover, we observe the stake effect in our survey sample, as we are also interested in the shock factors that affect the direction of such a stake effect.

Our work also relates to the literature on the relation between individuals' personality traits and risk attitudes. Psychologists have taken the perspective of personality traits to study risk and uncertainty in decision making. In psychology, personal traits are defined as "the relatively enduring patterns of thoughts, feelings, and behaviors that reflect the tendency to respond in certain ways under certain circumstances" (Roberts et al., 2008, p. 140). A long list of works has discussed the categories of different personality factors (Fiske, 1947; Goldberg, 1981; McCrae and Costa, 1987; Smith, 1967). Costa and McCrae (1992) develop the Neo Five-Factor Inventory (NEO-FFI) questionnaire as a tool to understand personality traits in five dimensions (the "Big Five"): extraversion, neuroticism, openness, agreeableness, and conscientiousness. This taxonomy has achieved a high degree of consensus over decades. Individual behavior can be predicted based on the scores from the Big Five test because an individual's characteristics, thoughts, and feelings are reflected in the multi-item questions (Almlund et al., 2011; DeYoung et al., 2010; van Egeren, 2009). Extraversion relates to gregarious behaviors in a social context, as well as being energetic or positive. Neuroticism refers to the fluctuation in mood against some negative affect. Openness refers to inquisitiveness, comprehension, and processing ability for both sensory and abstract information. Agreeableness reflects an empathic, sympathetic, and cooperative tendency. Conscientiousness indicates control power over tasks and ability to achieve long-term goals. The Big Five model should, in some way, generate individual behavior that is comparable with the variables in decision theory (DeYoung, 2010a; van Egeren, 2009).

In practice, the test for personal traits has been applied by economists as a predictor of behavioral patterns in many ways. Personality measures have been found to provide strong predictive power for important life outcomes such as mortality, divorce, and occupational attainment (Ozer and Benet-Martinez, 2006; Roberts et al., 2008). In connection with economic and finance decisions, Donnelly et al. (2012) show that conscientiousness positively relates to an individual's management of money. Brown and Taylor (2014) find that personality traits, such as extraversion, are significantly associated with household finances. Focusing on the domain of risk attitudes, neuroticism is positively associated with the degree of aversion toward risk and uncertainty. Similarly, Nicholson et al. (2005) find strong evidence of the correlation between personality and risk propensity, in that a high level of extraversion and openness with low neuroticism, agreeableness, and conscientiousness contribute to risk loving. Although a personality-based survey is not exhaustive and exclusive, combining psychology and decision theory nevertheless provides economists interesting insights regarding individual risk attitudes.

3 Design of the Incentivized Survey Questionnaire

3.1 Subjects and Procedure

The incentivized survey was completed online through the questionnaire platform (www.wjx.cn). We adopt the sampling method of the "social network snowball" (Browne, 2005; Etter and Perneger, 2000) to survey the target group, which, in our context, means distributing to specific WeChat groups among XMU undergraduate students.

The online questionnaire consists of three parts. First, the subjects answer 60 questions, which are used to evaluate their personal traits based on the Big Five model. Second, the subjects play three multiple-price-list gambling games (Holt and Laury, 2002) at different stake levels; and they are informed that their decisions will determine their actual monetary payments. Finally, the subjects answer questions for several demographic attributes, their feeling about the impact of COVID-19, as well as their past life experiences, particularly social and personal shocks. All questions in the questionnaire are in Chines e.

3.2 The NEO-FFI Questionnaire

To study the link between personality traits and the stability of risk attitudes, we use the NEO-FFI's 60-item measurement to calculate the subjects' points in the five dimensions, following Costa and McCrae (1992) and Konstabel et al. (2012). Each descriptive question is based on a 5-point Likert scale, from "strongly disagree" to "strongly agree." Examples of questions are "I see myself as someone who tends to be quiet" or "I see myself as someone who likes to cooperate with others," and so on. There are 12 questions for each of the five dimensions; thus, the score ranges from 12 to 60 for each dimension. The corresponding question numbers are presented in Table A2 of Appendix A.

3.3 Multiple Price List (MPL) Lottery

We adopt a revised version of Holt and Laury's (2002) MPL to elicit the subjects' risk attitudes, changing the payoff numbers while keeping the basic simple lottery structure. The subjects are shown two pairs of lotteries, which are called lottery choices A and B. For each game, the subjects are asked to make 11 consecutive choices between A and B.

Table 1 shows the payoff and probability associated with each choice in the medium-stake game. The large- and small-stake games share the same probabilities when multiplying the payoffs by 10 or 0.1. For example, the second row means that for lottery A, the subject will receive 10 yuan with a 10% chance and receive 8 yuan with a 90% chance. The logic applies similarly for lottery B. The two columns on the right-hand side list the expected payoff for the two lotteries. In the survey instructions, the subjects are informed that actual payments will be randomly selected from one of their lists of decisions. This guarantees that the subjects will be incentivized to report truthfully their risk attitudes through the MPL choices. Theoretically and experimentally, one random selection for the outcome ensures a stable and incentive-compatible pattern (Azrieli et al., 2018; Laury, 2006).

Table 1 Multiple Price List Payoff Matrix Used in Game 1 (Medium Stake)

Lottery A		Lottery B		*EVA*	*EVB*
P (10 yuan)	*P* (8 yuan)	*P* (19 yuan)	*P* (0.5 yuan)		
0	1.0	0	1.0	8	0.5
0.1	0.9	0.1	0.9	8.2	2.35
0.2	0.8	0.2	0.8	8.4	4.2
0.3	0.7	0.3	0.7	8.6	6.05
0.4	0.6	0.4	0.6	8.8	7.9
0.5	0.5	0.5	0.5	9	9.75
0.6	0.4	0.6	0.4	9.2	11.6
0.7	0.3	0.7	0.3	9.4	13.45
0.8	0.2	0.8	0.2	9.6	15.3
0.9	0.1	0.9	0.1	9.8	17.15
1.0	0	1.0	0	10	19

As one moves row-by-row from the top to the bottom of the list, the expected payoff of lottery B increases and exceeds the expected payoff of lottery A at some point. Theoretically, a risk-neutral agent will switch the choice from the “safe choice” lottery A to the “risky choice” lottery B when the latter has a higher expected revenue. We use this switching point to capture one's risk attitude. The earlier an individual switches from lottery A to lottery B, the more risk loving he/she is. The numbers between 1–4 represent risk loving, with lower numbers corresponding to a higher degree of risk loving; the number 5 represents risk neutrality; and the numbers between 6–11 represent an increasing degree of risk aversion. The choices of lottery A are denoted as "safe choices."

We ask the subjects to complete two more MPL games of choosing the lottery lists with different payment scales. The payment levels are 1 yuan, 10 yuan, 100 yuan, respectively (1x, 10x, and 100x, hereinafter). To avoid the order effect (Holt and Laury, 2005), we do not adopt a game order that has a monotonically increasing or decreasing order of payments. Instead, we start from the game with the medium stake (10x) as a benchmark, and then move to the large- and small-stake games.

3.4 Demographic Characteristics and Past Experiences

We first ask for the subjects' age, gender, whether they are the only child, and the region of their high school (urban or rural). To study the effects of COVID-19 on personality and risk attitudes, we further add a section of questions featuring the impact of COVID-19 and the individuals' past experiences. Table 2 presents the descriptions of questions related to the subjects' past personal experiences and their perceived impact of the COVID-19 pandemic. We ask about the subjects' perception of the degree to which they are affected by the COVID-19 pandemic on a 5-point scale from "not affected" to "my life totally changed." We use this score to measure the COVID-19 pandemic's impact on the subjects' personal lives.

Next, we ask whether the subjects have past experiences of natural disasters or social shocks. If they choose "yes," they are then asked to describe further their feelings about such disasters and shocks from five alternatives—fearful, pessimistic, anxious, annoyed, and averse to uncertainty.

As previous literature has documented, an individual's economic behavior could change after a catastrophe. However, we distinguish the COVID-19 pandemic from a natural disaster based on two arguments. First, in addition to high-risk areas such as Hubei Province, all other regions in China implemented compulsory quarantine measures at a very early stage. Intuitively, this policy of keeping social distance would have a larger impact on economic outcomes than a natural disaster would. Sahm (2012) reports that changes in macroeconomic conditions are a major source of systematic variation in a household's risk tolerance. Malmendier and Nagel (2011) report that the generation affected by the Great Depression exhibit greater aversion to risky financial investments throughout their lives. Second, as an infectious disease, the COVID-19 pandemic affects not only a small specific group but instead, the general population, compared with relatively smaller geographical areas hit by natural disasters. This feature provides us with the opportunity to draw a broad and random sample in terms of demographic characteristics.

Table 2 Questions and Variables Related to Negative Shock

Question description	Corresponding variable	Question no.
Do you think the current COVID-19 affects your life attitude?	Degree of COVID-19 impact	73
Have you ever experienced any negative social shock or natural disaster, which changed your life attitude to some extent? (Such as the 2003 SARS pandemic, earthquake, flood, etc.)	Social shock	74
Have you ever experienced any changes in your personal life, which caused a blow and changed your life attitude to some extent?	Personal shock	76
Do you think the aforementioned experience helps to alleviate or aggravate the impact of COVID-19 on your life attitude?	Previous experience	78

Note: The scale for Question 73 is from 1 to 5: 1 means no impact, while 5 means extreme influence. The scale for Question 74 is 0 or 1: 0 means have never experienced such a shock, while 1 means have experienced such a shock. The scale for Question 76 is 0 or 1: 0 means have never experienced such a shock, while 1 means have experienced such a shock. The scale for Question 78 is 1 to 5: 1 means the previous shock alleviates the COVID-19 impact, while 5 means the previous shock aggravates the COVID-19 impact.

In addition to the negative shock caused by nature or social factors, we also consider the role of past experiences that affect an individual's life attitudes. Therefore, we ask subjects whether they previously have experienced life-changing negative personal shocks. We generate dummy variables for natural shock experiences and personal shock experiences to examine their correlation with the five dimensions of personality traits.

Finally, we ask all subjects to assess how they think their past experiences would affect their perceived impact of the COVID-19 pandemic based on a 5-point scale, specifically regarding whether the past trauma events would alleviate or aggravate the COVID-19 shock. All subjects, including those choosing no experience in either natural/social disasters or personal shocks, answer this question. For those who do not have real experience in either type of shock, this question is to elicit their hypothetical belief on how they would feel if they had previously experienced negative shocks. It is akin to asking what they think is the effect of past experiences had they experienced such shocks.

4 Empirical Results

4.1 Summary Statistics and Variable Definitions

4.1.1 Summary Statistics

The incentivized survey was distributed through a number of WeChat groups to XMU students in mid-April 2020, shortly after the first wave of the COVID-19 in China had come to an end and Hubei Province had reopened. We collect completed surveys from a total of 303 subjects, 119 of whom are male and 184 are female. Their ages range from 17 to 24, with a mean of 20.89 years and a standard deviation of 1.34 years. A total of 198 subjects are the only child in their families, and 105 subjects have one or more siblings. Almost all subjects (279) report that they came from an urban high school, and 24 subjects attended high school in a rural area.

The student subjects are recruited via ads that circulated on Chinese social media, the same way experimental economists usually recruit subjects for their studies (Cleave et al., 2013). Since our recruiting ads present very general terms of the decision task without specifically mentioning the key variables of our analysis, voluntary participation of the students would not cause a systematic bias to our estimation results. At the time of our survey, the student subjects were not on the XMU campus. We analyze the the regional distribution of the subjects in our sample according to the IP addresses where they completed the survey. We find that the subjects are from almost all of China’s provinces, without concentration in Hubei Province. In the MPL part of the survey, we use real monetary payments as incentives, with a guaranteed participation fee of 20 yuan as long as a valid response is made. Their performance in the games determines the rest of their monetary payments. The average amount of total payment is 33.4 yuan.

4.1.2 Variable Definitions

Table 3 lists the variables used in our regression, including their definitions. In addition to the variables directly obtained from our survey, we also collect a

Table 3 Description of Variables

Variable	Explanation
GAME1	Switching point in Game 1 (10x, medium stake)
GAME2	Switching point in Game 2 (100x, large stake)
GAME3	Switching point in Game 3 (1x, small stake)
Age	Subject's age, ranging from 17 to 24
Female	Dummy variable, male = 1 and female = 0
Have sibling	Dummy variable, only child = 1 and not only child = 0
Rural	Dummy variable, high school region, urban = 1 and rural = 0
Degree of COVID-19 impact	Degree of impact in COVID-19, 1 to 5 scale, with 1 means no impact, 5 means extremely being influenced
Social shock	Dummy variable, have experienced social shock or natural disaster = 1 and no experience = 0
Personal shock	Dummy variable, have experienced shock in personal life = 1 and no experience = 0
Shock	Interaction term, Social shock*Personal shock
Previous experience	The effect of previous shock experience on COVID-19, 1 to 5 scale, where 1 means previous shock dramatically alleviated the COVID-19 impact, 5 means previous shock dramatically aggravated it
Province confirmed	Number of confirmed cases of COVID-19 at provincial level
Province death	Number of deaths from COVID-19 at provincial level
Province 3A hospital	Number of 3A hospitals in one province
GDP per capita	GDP per capita (unit: 10,000 yuan per person) at provincial level
Population density	Population density (unit: 1,000 person per square kilometer) at provincial level

series of macroeconomic variables as control variables. Bu et al. (2020) survey the students of Wuhan University of Science and Technology and ask them regarding their feelings about the COVID-19 pandemic. Their results imply that the anxiety level of the subjects is linearly correlated with the severity of COVID-19 in their communities. In other words, subjective perceptions can be supported by objective statistics on confirmed cases and death toll in the corresponding areas. Therefore, we use provincial Gross Domestic Product (GDP) per capita to control for the economic development and population density, and the number of 3A hospitals to measure the medical care capacity in each province.[5]

4.2 Risk Attitudes, Personal Traits, and Experiences of Shocks

4.2.1 Risk Attitudes across Different Stake Levels

Figure 2 demonstrates the proportion of the "safe choice" lottery being chosen in the three MPL games. The gray line at number 5 represents the risk-neutral prediction. First, we find clear evidence of risk-averse choices, even with the smallest stake level. The further to the right the switching points of the downward pattern are, the higher the degree of risk aversion by the subjects. This finding is consistent with previous literature using the MPL method (Drichoutis and Lusk, 2016; Holt and Laury, 2002).

Second, we find that the degree of risk aversion increases when the payment scales up.[6] The so-called stake effect is in line with Holt and Laury (2002), as well as the qualitative results that decisions vary in different choice environments, as reported by Kachelmeier and Shehata (1992). Both the Wilcoxon and Kolmogorov-Smirnov tests render statistical significance ($p < 0.01$) for the difference between the small- and the medium-stake games and that for the medium- and large-stake games.

Finding 1: Subjects exhibit a certain degree of risk aversion, and they are more risk-averse at larger stakes.

This finding confirms the existing observations on risk aversion in the literature. From both the graphs and the statistical tests, we find a significant

[5] 3A is the highest rating for hospitals in the Chinese medicare evaluation system.
[6] The scale factor is 10 in our games.

higher level of risk aversion when the payment scales up. This result indicates the necessity to check the validity of the risk-neutrality assumptions on individuals' risk attitudes in other specific research contexts before conducting economic analysis, especially when the analysis heavily relies on such assumptions.

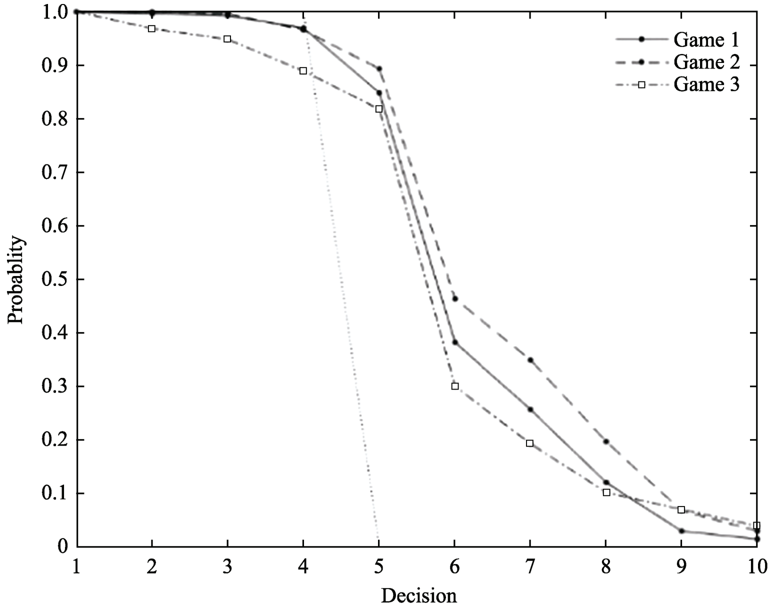


Figure 2 The Proportion of Safe Choices in Each Decision by Game: Data and Prediction

Note: (1) "Decision" on the horizontal axis means the switching point in each lottery game; "Probability" on the vertical axis means the proportion of all subjects who choose lottery A. (2) Game 1 means the switching point in the first MPL game. It measures the degree of risk aversion. Game 2 and Game 3 have a similar meaning.

4.2.2 Risk Attitude and Personality Traits

In this section, we discuss the regression results of the personality trait variables and risk attitude variables, as well as their relationship with the negative shocks in one's life.[7] We apply both the personality theory in psychology and the decision theory in microeconomics, and provide relevant interpretations.

Table 4 illustrates the regression results of the individuals' degree of risk

[7] See Table A4 in Appendix C for regression results of the 2016 survey.

aversion on their personality traits based on the three games.[8] The column on the left side of each game is the baseline regression. We further add terms that interact the dummy control variables with personality traits based on the group heterogeneity.

Table 4 Regression of Risk Preference on Personality Traits

Variable	(1)	(2)	(3)	(4)	(5)	(6)
	Medium stake		Large stake		Small stake	
	Game 1	Game 1	Game 2	Game 2	Game 3	Game 3
Neuroticism	–0.0200	–0.0203	–0.0311**	–0.0310**	–0.0054	–0.0049
	(0.0133)	(0.0134)	(0.0153)	(0.0154)	(0.0166)	(0.0167)
Extraversion	–0.0186	–0.0420	0.0013	0.0027	–0.0313*	–0.0786
	(0.0145)	(0.0472)	(0.0165)	(0.0533)	(0.0184)	(0.0594)
Openness	0.0226	–0.0222	0.0213	0.0453	0.0228	–0.0210
	(0.0211)	(0.0484)	(0.0245)	(0.0544)	(0.0271)	(0.0601)
Agreeableness	–0.0564*	–0.0661**	–0.0457	–0.0541	0.0105	0.0040
	(0.0325)	(0.0326)	(0.0358)	(0.0358)	(0.0400)	(0.0402)
Conscientiousness	–0.0002	0.0156	–0.0076	–0.0580	0.0243	0.1076
	(0.0137)	(0.0550)	(0.0153)	(0.0618)	(0.0172)	(0.0732)
Openness× Have sibling	–0.0336		–0.0240		–0.0364	
	(0.0272)		(0.0308)		(0.0344)	
Agreeableness×Have sibling	0.0926**	0.1047***	0.0615	0.0702*	0.0298	0.0382
	(0.0367)	(0.0366)	(0.0408)	(0.0405)	(0.0454)	(0.0453)
Extraversion×Female		0.0041		0.0172		0.0099
		(0.0266)		(0.0301)		(0.0342)
Extraversion×Rural		0.0244		–0.0077		0.0478
		(0.0465)		(0.0522)		(0.0584)
Openness×Rural		0.0266		–0.0411		0.0214
		(0.0503)		(0.0565)		(0.0626)

(*To be continued*)

[8] The number of observations for each game are different since we do not delete the choices of a subjects in all three games if the subject makes multiple-switch choices in only one game. For example, if a subject has multiple-switch points in Game 1 but not in Game 2 and Game 3, we drop the choice in Game 1 and keep the choice in Game 2 and Game 3. We adopt this method for minimum loss of data. We also count the number of safer choices as proposed by Holt and Laury (2002) to replace the switching point method for a robustness check. The main results do not change.

(*Continued*)

Variable	(1)	(2)	(3)	(4)	(5)	(6)
	Medium stake		Large stake		Small stake	
	Game 1	Game 1	Game 2	Game 2	Game 3	Game 3
Conscientiousness× Rural		–0.0164		0.0528		–0.0881
		(0.0564)		(0.0634)		(0.0748)
Constant	9.2611***	11.9601***	8.6591***	10.3655***	6.9927**	7.4647
	(2.5883)	(3.5337)	(2.8760)	(3.9846)	(3.2431)	(4.5552)
Demographic controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	264	264	263	263	253	253
R-squared	0.054	0.051	0.038	0.041	0.048	0.049

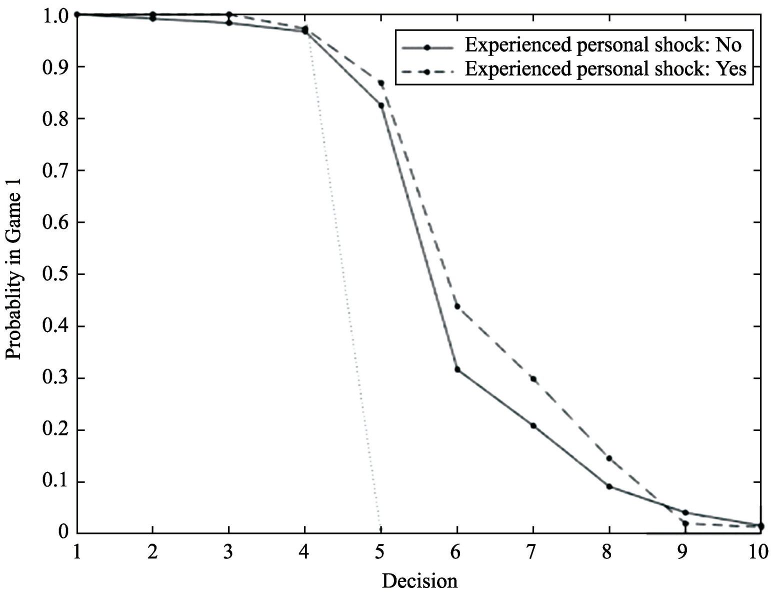
Note: (1) Standard errors are in parentheses. (2) *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. (3) The demographic controls include Age, Female, have sibling and Rural. (4) Game1 means the switching point in the first MPL game. It measures the degree of risk aversion. Game 2 and Game 3 have a similar meaning.

For Game 1, the coefficients of *Agreeableness* and the interaction term *Agreeableness*×*Have_Sibling* are significant. In Column (1), a one-point increase in the *Agreeableness* score lowers the probability of switching from the "safe choice" one row later by 0.0564. If the subject is the only child, one point higher in *Agreeableness*, on average, leads to a 0.0926 higher probability that the non-only child will switch from the "safe choice" to the "risky choice" one row later. The economic meaning of the coefficient applies similarly to that of Column (2). The degree of risk aversion in the large-stake game (Game 2) is significantly correlated with *Neuroticism*. The regressions on Columns (3) and (4) show a significant negative effect (at the 5% level) of *Neuroticism* on risk aversion. Column (3) indicates that a one point increase in the *Neuroticism* score contributes to a 0.0311 increase in the probability of switching from the "safe choice" to the "risky choice" one row later. The interaction between *Agreeableness* and *Have_Sibling* exhibits a positive effect at the 10% level in Game 2. For the small-stake game (Game 3), the *Extraversion* in Column (5) significantly and negatively affects the subjects' degree of risk aversion.

4.2.3 Risk Attitude and Past Shock Experiences

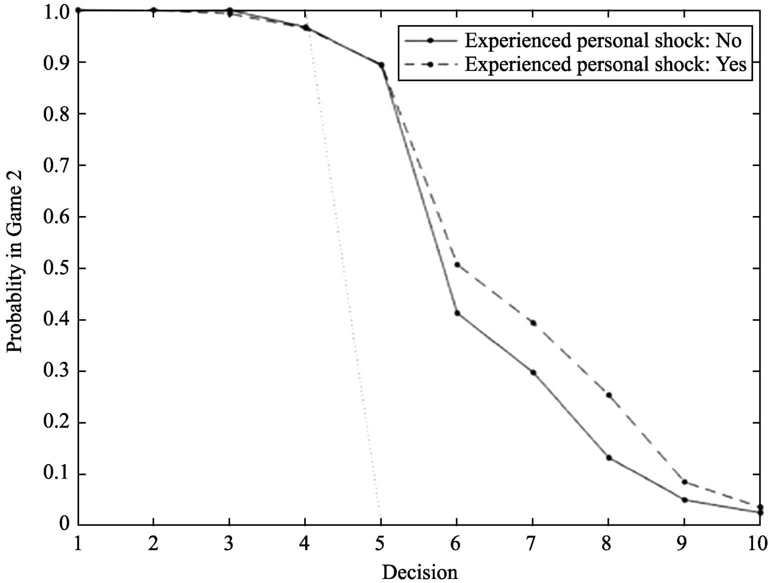
In this part, we examine the impact of the COVID-19 pandemic and the effect of previously experienced personal and/or social shocks on individuals' risk attitudes.

The subjects in our sample are divided into two sub-groups based on whether they have experienced "personal shocks."[9] Figure 3 shows the proportion of the "safe choice" lotteries by each sub-group in each game. Differences between the two groups are statistically significant, with the Wilcoxon tests all rendering $p < 0.01$. From Figures 3-1 and 3-2, we notice that the subjects who have experienced previous personal shocks exhibit a higher degree of risk aversion at the medium- and large-stake games. In contrast, we observe the opposite pattern of choices in the small-stake game. Figure 3-3 indicates that the proportion of "safe choice" lotteries chosen by subjects with no previous experience of personal shocks first-order stochastic dominates the "safe choices" of the subjects with personal shock experiences. In other words, at a very small stake, the subjects with personal shock experiences are less risk-averse than those without such shock experiences.

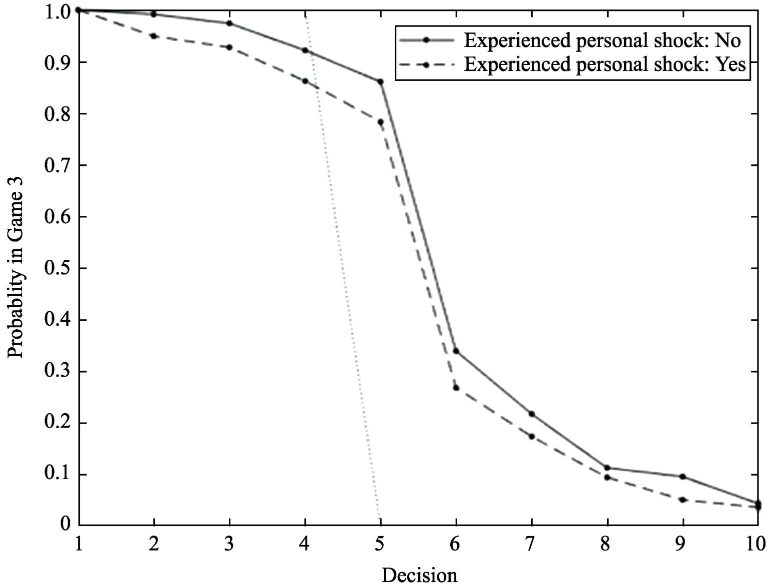


3-1: Game 1 (Medium stake)

[9] Since our subjects are undergraduates, the personal shocks here refer to exogenous incidents (e.g., illness, parents' divorce, loss of a family member, etc.) rather than self-determined incidents (e.g., investment failure or bankruptcy).



3-2: Game 2 (Large stake)



3-3: Game 3 (Small stake)

Figure 3 Proportion of Safe Choices in Each Decision by Game: Data and Prediction

Why do previous personal shocks show a significant correlation with individuals' risk attitudes? One possible reason concerns personality traits;

that is, a person's experiences of shocks may affect some dimensions of his/her personality traits, which in turn correlate with risk attitudes. Table 5 reports the regression results of the five personality traits on previous shock experiences. These results indicate that experiencing shocks significantly correlates with Neuroticism, Openness, and Agreeableness, at the 1%, 1%, and 10% significance levels, respectively. On average, the subjects who experienced personal shock score 2.7948 higher in Neuroticism, 2.8582 higher in Openness, and 1.3400 lower in Agreeableness than those who do not have such experiences. Meanwhile, being involved in a social shock or natural disaster significantly (5% level) increases the score in Openness by 5.2251. At the same time, the coefficient of "shock" is significantly negative. Experiencing either social shock or personal shock significantly and positively correlates with an individual's degree of openness. However, the subjects who have experienced both social shocks and personal shocks exhibit lower degrees of openness compared with those who do not have either type of experiences.

Table 5 Regression of Personality Traits on Shock

Variable	(1) Neuroticism	(2) Extraversion	(3) Openness	(4) Agreeableness	(5) Conscientiousness
Personal shock	2.7948***	–0.2434	2.8582***	–1.3400*	–1.5021
	(1.0473)	(0.8872)	(0.8046)	(0.7148)	(0.9312)
Social shock	1.0206	–0.5221	5.2251**	–1.8602	–1.5963
	(2.7799)	(2.3550)	(2.1358)	(1.8974)	(2.4717)
Shock	–0.6065	1.7570	–5.2598**	1.4511	2.4028
	(3.4114)	(2.8900)	(2.6209)	(2.3284)	(3.0331)
Constant	39.7071***	26.4446**	33.0185***	46.6966***	40.4908***
	(13.4997)	(11.4364)	(10.3717)	(9.2140)	(12.0029)
Demographic controls	Yes	Yes	Yes	Yes	Yes
Economic controls	Yes	Yes	Yes	Yes	Yes
Observations	294	294	294	294	294
R-squared	0.035	0.046	0.125	0.074	0.034

Note: (1) Standard errors are in parentheses. (2) *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. (3) The demographic controls include Age, Female, Have sibling and Rural. The economic controls include Province confirmed, Province death, Province 3A hospital, GDP per capita, Population density.

In the analysis above, both Table 5 and Figure 3 indicate that past experiences of personal shocks do affect some dimensions of an individual's personality traits and risk attitudes. In particular, the two sub-groups—those who have previously experienced personal shocks and those who have not—differ significantly in their degree of risk aversion. In the context of COVID-19, we examine whether the two sub-groups also differ in their attitudes toward the impact of this pandemic. Specifically, we further investigate to what extent the two sub-groups perceive that the impact of COVID-19 is correlated with their past shock experiences (for those who have such experiences) or hypothesized personal shocks (for those who do not have such experiences). Question 78 in the survey asks the subjects to evaluate whether past negative personal experiences would help alleviate or aggravate the impact of COVID-19 in one's life. Figure 4 plots the percentages of the subjects' responses, ranging from "dramatically alleviate" to "dramatically aggravate." It is interesting to note that the subjects who have previously experienced negative shocks in their personal lives tend to think that such experiences help alleviate the impact of COVID-19, while those who have never experienced personal shocks are more likely to view such shocks as a factor that aggravates the negative impact of COVID-19. The results of the two sample tests are significant at the 1% level.

Table 6 presents the results of the regression analyses that extend the regressions in Table 4 by including variables regarding individuals' past experiences and the impact of the COVID-19 pandemic. The columns on the left side of each game indicate the significant effect of personal shock on the individuals' risk attitudes. Note that the coefficient is –0.4811 (significant at the 10% level) for the small-stake game. This result confirms the observation from Figure 3-3 that subjects with previous shock experiences are more risk loving at small stakes. We regard this observation as a form of "stake effect," in the sense that when the impact of shocks in life projects onto the decision on risk, the degree of the impact varies with the payoff scale. Meanwhile, the coefficient 0.4977 in Column (1) (significant at the 5% level) and the coefficient 0.3877 in Column (3) (significant at the 10% level) indicate significant effects of personal shock experiences on individuals' degree of risk aversion. The subjects who have previously experienced personal shocks are generally more risk-averse when the payment scale is relatively large. These results also confirm the differences in "safe choices" between the two sub-groups, as illustrated in Figures 3-1 and 3-2. In other words, the shock experience leads to risk aversion when the stake is large enough. On the right side columns of each game in Table 6, we include a series of variables that are associated with COVID-19 and previous shock experiences. Again, we observe a positive and significant effect of personal shocks on individuals' risk attitudes in the medium- and large-stake games. In the large-stake game, *Neuroticism* still negatively and significantly affects individuals' risk attitudes. In the small- and medium-stake games, higher scores in *Agreeableness* are positively correlated with a higher degree of risk aversion.

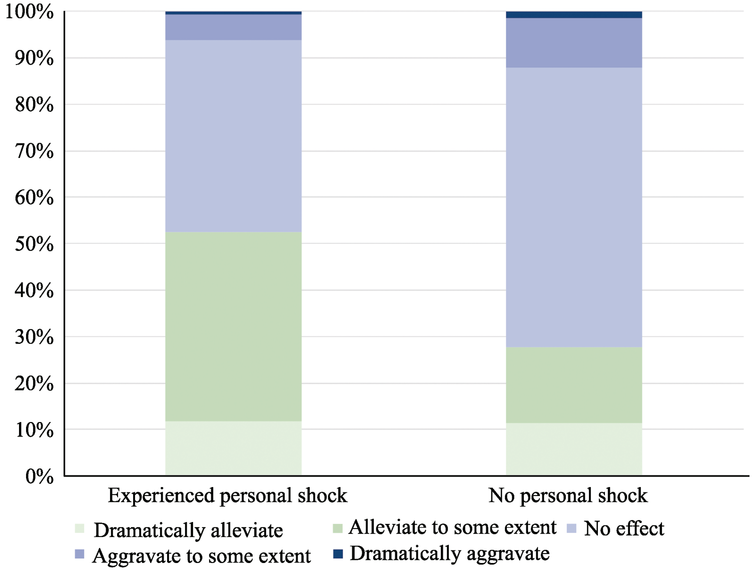


Figure 4 Previous Shock Experience and the Impact of COVID-19

Note: (1) Subjects are divided into two groups based on whether they previously experienced personal shocks. (2) The vertical axis represents the percentage of each group.

Finding 2: Personal shock experiences significantly affect individuals' personality traits and risk attitudes, but involvement in social shock or natural disaster has no significant effect.

So far, we do not observe any sign that the COVID-19 pandemic significantly affects people's risk attitudes. However, it is worth noting that based on our regression analyses, shock experiences that change one's life

Table 6 Regression of Risk Preference on Shock and COVID-19

Variable	(1)	(2)	(3)	(4)	(5)	(6)
	Medium stake		Large stake		Small stake	
	Game 1	Game 1	Game 2	Game 2	Game 3	Game 3
Neuroticism	–0.0220	–0.0171	–0.0363**	–0.0335**	–0.0013	0.0019
	(0.0135)	(0.0136)	(0.0154)	(0.0156)	(0.0167)	(0.0171)
Extraversion	–0.0171	–0.0142	–0.0012	–0.0037	–0.0294	–0.0212
	(0.0146)	(0.0147)	(0.0165)	(0.0167)	(0.0183)	(0.0188)
Openness	–0.0028	–0.0124	0.0065	–0.0065	0.0087	0.0065
	(0.0142)	(0.0145)	(0.0156)	(0.0161)	(0.0175)	(0.0182)
Agreeableness	0.0201	0.0330*	0.0050	0.0150	0.0285	0.0378*
	(0.0167)	(0.0169)	(0.0186)	(0.0190)	(0.0203)	(0.0211)
Conscientiousness	0.0002	–0.0068	–0.0107	–0.0132	0.0193	0.0151
	(0.0139)	(0.0139)	(0.0153)	(0.0156)	(0.0172)	(0.0177)
Social shock	0.5171		–0.5394		–0.6384	
	(0.4868)		(0.5420)		(0.6284)	
Personal shock	0.4977**	0.3381*	0.3877*	0.3650*	–0.4811*	–0.3955
	(0.1975)	(0.1958)	(0.2202)	(0.2195)	(0.2470)	(0.2487)
Shock	–0.6681		0.8533		1.1442	
	(0.6313)		(0.6741)		(0.7961)	
Degree of COVID-19 impact		–0.1066		–0.1509		–0.0128
		(0.1023)		(0.1176)		(0.1328)
Previous Experience		–0.2413**		–0.0985		–0.0773
		(0.1107)		(0.1259)		(0.1385)
Constant	7.3107***	7.5837***	7.6358***	8.6377***	7.3927***	6.3753**
	(2.0490)	(2.1726)	(2.3070)	(2.4360)	(2.5724)	(2.7690)
Demographic controls	Yes	Yes	Yes	Yes	Yes	Yes
Economic controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	264	256	263	255	253	246
R-squared	0.044	0.1002	0.051	0.0853	0.058	0.0724

Note: (1) Standard errors are in parentheses. (2) *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. (3) The demographic controls include Age, Female, Have sibling and Rural. The economic controls include Province confirmed, Province death, Province 3A hospital, GDP per capita, Population density. (4) Game 1 means the switching point in the first MPL game. It measures the degree of risk aversion. Game 2 and Game 3 have a similar meaning.

attitude can be divided into two types: social shock and personal shock. The results in Table 5 show that personal shocks significantly affect Neuroticism, Openness, and Agreeableness. Involvement in social shock or natural disaster affects individuals' degree of openness. According to the literature on personality, openness is used as a benchmark for measuring the ease of accepting new things, which is highly related to social value and is not a matter of personal decision-making. People with higher scores in Openness tend to hold nontraditional beliefs about social issues through social interactions with others. Meanwhile, individuals' risk attitudes are more relevant to personal choice, with no direct links through the channel of social interaction. To verify this argument, we check the survey answers to question No. 75 of the subjects who have previously experienced a social shock or natural disaster.[10] Even for this group of subjects, most people respond that their feelings are best described by "anxiety caused by future uncertainty." Note that the empirical literature we have reviewed focuses on the aftermath of natural disasters such as flood, earthquake, hurricane, and so on. These disasters have extremely affected the lives of those involved, as they may have been injured, lost their family members, or experienced huge financial losses. In these cases, the systematic changes in individuals' risk attitudes actually result from the shock in their personal lives.

Agreeableness is a trait that closely correlates with empathy and altruism. At a relatively low stake, people perceive the monetary incentive to be not that important.[11] By controlling for the shock variables, we find a significant positive effect of Agreeableness on risk attitudes at a small stake. We conjecture that agreeable subjects tend to overestimate the severity of the COVID-19 based on media reports, even when COVID-19 pandemic has not severely hit the area (considering the number of confirmed cases and deaths). Subjects who are relatively more agreeable feel compassion for the people in the news, who have suffered from the calamity, and thus magnify their feelings (Hirsh et al., 2010). However, this phenomenon occurs only when the stake is small, that is, when the monetary incentives are relatively unimportant. Conscientiousness measures the individual's long-term goal-planning and self-discipline. Our result shows no clear cut-off for predicting the behavioral

[10] See Appendix B.

[11] For example, having a meal at XMU's canteen usually costs 10 yuan, which is 10 times of the small stake we had in our incentivized survey.

outcomes according to the *Conscientiousness* level (Müller and Schwieren, 2012).

In addition to the previous discussion on social shock and personal shock, we further regress the variable Degree of COVID-19 Impact on the variables related to different types of shocks. Table 7 reports the regression results. The subjects who have experienced social or natural shocks score, on average, 0.4902 higher on a 5-point scale that measures the impact of COVID-19 than those who have not experienced such shocks.

Table 7 Regression of COVID-19 on Personality Traits and Shock

Variable	Degree of COVID-19 impact		
	(1)	(2)	(3)
Social shock	0.5808**	0.4953*	0.4902*
	(0.2745)	(0.2918)	(0.2942)
Personal shock	0.1239	0.1534	0.1286
	(0.1064)	(0.1116)	(0.1157)
Shock	–0.5657	–0.4126	–0.3911
	(0.3429)	(0.3580)	(0.3601)
Previous experience		0.0617	0.0379
		(0.0633)	(0.0639)
Constant	1.2629	0.5601	0.2318
	(0.8119)	(1.4198)	(1.6284)
Demographic controls	Yes	Yes	Yes
Personality controls	No	No	Yes
Economic controls	No	Yes	Yes
Observations	303	294	294
R-squared	0.059	0.067	0.093

Note: (1) Standard errors are in parentheses. (2) *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. (3) The demographic controls include Age, Female, Have sibling and Rural. The personality controls include Neuroticism, Extraversion, Openness, Agreeableness, Conscientiousness. The economic controls include Province confirmed, Province death, Province 3A hospital, GDP per capita, Population density.

Finding 3: Our experimental sample shows that COVID-19 has no significant impact on individuals' risk attitudes.

An explanation for this finding is as follows. In our sample, the subjects are recruited from various regions in China, without concentration from the epicenter (Hubei Province). The regression results in Table 7 suggest that the COVID-19 pandemic is more likely to be regarded as a social shock within our sample, which may indicate that the impact of the pandemic is not as influential on the individuals' risk attitudes as expected, unless an individual's personal life is directly affected by the pandemic.

There is a growing literature on the impact of the COVID-19 pandemic on people's economic and professional choices, in particular for people who live in the epicenter and had their personal lives affected directly when the pandemic hit. Cartwright et al. (2020) investigate the healthcare workers in Wuhan, and reach the conclusion that these workers have become more risk loving after the COVID-19 shock. Bu et al. (2020) find evidence of risk aversion after COVID-19 in a sample of college students in Wuhan. We do not intentionally survey people in the epicenter; thus, our sample does not contain many subjects who live in Wuhan or Hubei Province. Other than the people in Wuhan, among those living in other Chinese provinces, the chance of one's personal life being dramatically changed by the COVID-19 pandemic is very low. At the same time, our subjects' daily lives are, to some extent, affected by the lockdown and subsequent social distancing measures.

4.3 The Change of Risk Attitudes, Personality Traits, and Past Shock Experiences

In the previous section, we find that different personality traits affect risk attitudes at different stake levels. Next, we examine which personality traits play a key role in the change of risk attitudes when the payment scales change.

We conduct multinomial regressions for the difference between small- and medium-stake games and for the difference between medium- and large-stake games. We capture the changing direction of switching points between games and divide it into three categories: increase, decrease, and constant. In other words, there are three possible cases for a subject's switching points to change between two games.[12] We define the constant choices between games as the

[12] Suppose a subject chooses to switch at Option 4 in Game 1; he/she may choose to switch earlier at Option 3 or later at Option 5 in Game 2. We consider the changing direction to "increase" if a subject chooses Option 4 at small stake and chooses Option 5 at medium stake. The opposite direction means "decrease."

baseline outcome.[13] Table 8 reports the multinomial regression results. The dependent variable in the first two columns is the relative risk ratio (*RRR*) between medium and large stakes, where

$$RRR=\frac{P\left(Game(2-1)>0\mid NEU=x+1\right)/P\left(Game(2-1)=1\mid NEU=x+1\right)}{P\left(Game(2-1)>0\mid NEU=x\right)/P\left(Game(2-1)>0\mid NEU=x\right)}.$$

The coefficient of *Extraversion* for the "increase" category is significant at the 5% level, which means that the subjects with higher levels of extraversion are more likely to exhibit higher degrees of risk aversion, relative to exhibiting constant risk attitude when the payment scales up from medium to large stake. Alternatively, the dependent variable in the last two columns is the *RRR* between small and medium stakes. The subjects' level of Neuroticism significantly (at the 10% level) affects the odds of exhibiting risk loving, relative to a constant risk attitude when the payment scale changes from small to medium stake.

Table 8 Regression of Relative Risk Ratio on Personality Traits and Shock

Variable	Relative risk ratio between large stake–medium stake		Relative risk ratio between medium stake–small stake	
	(1)	(2)	(3)	(4)
Decrease				
Neuroticism	1.0088	1.0107	1.0505*	1.0497*
	(0.0273)	(0.0299)	(0.0281)	(0.0291)
Extraversion	1.0000	0.9962	1.0065	1.0063
	(0.0298)	(0.0320)	(0.0295)	(0.2968)
Openness	1.0011	0.9862	1.0383	1.0417
	(0.0271)	(0.0301)	(0.0284)	(0.0314)
Agreeableness	1.0113	1.0287	1.0185	1.0201
	(0.0336)	(0.0387)	(0.0326)	(0.0333)
Conscientiousness	1.0014	1.0123	1.0297	1.0340
	(0.0284)	(0.0327)	(0.0287)	(0.0295)
Personal shock		2.8829**		0.8028
		(1.2142)		(0.3131)
Degree of COVID-19 impact		1.0027		0.9682
		(0.2333)		(0.2038)

(*To be continued*)

[13] The subject chooses the same option to switch at both games.

(*Continued*)

Variable	Relative risk ratio between large stake–medium stake		Relative risk ratio between medium stake–small stake	
	(1)	(2)	(3)	(4)
Previous experience		0.6893		1.1824
		(0.1624)		(0.2621)
Constant	0.2734	0.2709	0.0068	0.0238
	(1.1068)	(1.2421)	(0.0277)	(0.1038)
Demographic controls	Yes	Yes	Yes	Yes
Economic controls	No	Yes	No	Yes
Constant	Base outcome			
Increase				
Neuroticism	1.0194	1.0163	1.0283	1.0313
	(0.0200)	(0.0207)	(0.0210)	(0.0223)
Extraversion	1.0505**	1.0453**	1.0581**	1.0540**
	(0.0228)	(0.0232)	(0.0238)	(0.0246)
Openness	1.0020	0.9876	0.9899	0.9733
	(0.0199)	(0.0212)	(0.0202)	(0.0219)
Agreeableness	0.9731	0.9832	0.9759	0.9913
	(0.0228)	(0.0238)	(0.0235)	(0.0253)
Conscientiousness	1.0024	1.0075	0.9876	0.9893
	(0.0203)	(0.0209)	(0.0209)	(0.0220)
Personal shock		1.4804		1.4716
		(0.4225)		(0.4346)
Degree of COVID-19 impact		0.9923		0.8600
		(0.1521)		(0.1393)
Previous experience		0.9679		0.8826
		(0.1596)		(0.1521)
Constant	4.0459	21.9798	0.9934	3.5932
	(11.8713)	(68.6002)	(2.9979)	(11.5587)
Demographic controls	Yes	Yes	Yes	Yes
Economic controls	No	Yes	No	Yes

Note: (1) Standard errors are in parentheses. (2) *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. (3) The demographic controls include Age, Female, Have sibling and Rural. The economic controls include Province confirmed, Province death, Province 3A hospital, GDP per capita, Population density. (4) Large–Medium means Game 2–Game 1, Medium–Small means Game 1–Game 3. Game1 means the switching point in the first MPL game. It measures the degree of risk aversion. Game 2 and Game 3 have a similar meaning.

We repeat the steps to add the COVID-19-related variables. Consistent with the results in Columns (1) and (3), a higher score in Neuroticism implies a higher probability of relative risk loving when the stake changes from small to medium. The subjects with higher levels of extraversion are more likely to exhibit higher degrees of risk aversion, relative to exhibiting constant risk attitude when the payment scales up from medium to large stake and scales up from small to medium stake. These results indicate that the degree of extraversion plays an important role in determining the relative risk aversion ratio as the payment scale changes. When the stake changes from medium to large, personal shock significantly affects the relative risk ratio.

Finding 4: Different personality traits affect an individual's risk attitude at different stake levels and the instability of risk attitude across stakes. Personal shock experiences could induce a change in risk attitudes across different payment scales.

Neuroticism shows a significant effect on an individual's risk attitude at a large stake, while the effects of Agreeableness and Conscientiousness are significant when the payment scale is relatively low. Extraversion is a "sensitive" factor in terms of inducing the change in individuals' risk attitudes across stakes. In the regressions above, the coefficients of Neuroticism are significant (at the 5% level) for all large-stake games. In the Big Five personality theory, neuroticism measures emotional instability.[14] More importantly, we find that Extraversion has a significant and positive effect on triggering a change in risk attitude across stakes. In the personality traits literature, extraversion has been documented as encompassing the general tendency toward a positive affect, especially in a social context (Rustichini et al., 2016). Meanwhile, extraversion reflects sensitivity to reward, from both an incentive perspective[15] and a consummatory perspective[16] (Denissen and Penke, 2008; DeYoung, 2010b; DeYoung et al., 2010). Our results are consistent with these existing findings. For each separate game, the subjects with higher levels of extraversion are more risk loving. This can be explained partially by the "Excitement-Seeking" and "Positive Emotions" facets. Meanwhile, extraverts have a very keen sense of changing stakes, they respond quickly and sensitively to adjust their options

[14] https://www.psychestudy.com/general/personality/big-five
[15] The incentive perspective refers to cues that indicate the possibility of rewards.
[16] The consummatory perspective refers to the reaction to receiving rewards.

when they capture the latest information.

5 Conclusion and Discussion

In this study, we examine whether exposure to previous life shocks, and in particular the on-going COVID-19 pandemic, affects people's subsequent risk attitudes. In an incentivized field survey setting, our subjects make Holt-and-Laury MPL decisions between two lotteries with different degrees of risk at different payment stake levels. We also supplement the MPL elicitation with a survey of the subjects' personality traits, their past life events, their negative shock experiences, and their perceived impacts of the COVID-19 pandemic. Interrelating the Big Five personality theory with individuals' risk attitudes broadens the domain of risk application in real life. Knowing how risk attitudes change after experiencing a shock in life allows us to predict people's subsequent economic behavior, and this is of great relevance for policymakers during and after the pandemic period.

We have four main findings. First, people exhibit a certain degree of risk aversion, and they are more risk-averse when the stakes are large. Second, different personality traits affect an individual's risk attitude at different stake levels. Neuroticism shows a dominant effect on an individual's risk attitude at a large stake, while agreeableness and conscientiousness are more significant when the payment scale is low. Extraversion is a "sensitive" factor in terms of inducing the change in risk attitude across stake levels. Regarding one's life experiences, the shock that changes one's life attitude can be divided into social or personal shocks. Third, personal shock experiences significantly affect an individual's personality traits and risk attitudes, but involvement in social shocks or natural disasters has no significant effect. Fourth, our regression results show that people are more likely to regard COVID-19 as a social shock, which may indicate that the impact of the pandemic is not as influential on individuals' risk attitudes as expected, unless an individual's personal life is directly affected by the pandemic.

Our study is among the first to investigate the change in individuals' risk attitudes in the wake of the COVID-19 pandemic. We expect further extensions on this topic in the future. The NEO-FFI questionnaire with 60 items that we adopt is a truncated version of the original NEO Personality Inventory-Revised (NEO-PI-R) questionnaire with 240 items. Under the Five

Factors of personality, there are six facets for each personality factor.[17] Such a meticulous classification gives a more accurate prediction of individuals' behavior. It is intuitive that "Impulsiveness" and "Vulnerability to Stress" in the neuroticism dimension are more important than other facets when analyzing risk-seeking behavior. The Big Five model is a relatively comprehensive theory in psychology; therefore, the result will be more significant if the specific facets are taken as explanatory variables. In addition, it might be hard to find a criterion to distinguish clearly the social shock and personal shock aspects for people in an area where the pandemic directly hit.

We notice that very few studies have evaluated the change in people's risk attitudes as a consequence of the COVID-19 pandemic; perhaps because the pandemic is not yet fully contained in many parts of the world, and it might be too early to measure individuals' risk attitudes in the midst of the crisis. Therefore, our investigation using college students in China in April 2020 may provide some primary evidence on this topic after the pandemic's first wave in China. We hope our study can serve as a building block for the design of future studies on individuals' decision making under the uncertainties imposed by the COVID-19 pandemic worldwide.

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[17] See Table A1 in Appendix A in detail.

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Appendix A

Table A1 The Five Factors and Their Facets (NEO-PI-R), Acronyms in Parenthesis

Factor	Facets
Neuroticism (*N*)	Anxiety (*N1*), Angry hostility (*N2*), Depression (*N3*), Self-consciousness (*N3*), Impulsiveness (*N5*), Vulnerability to stress (*N6*)
Extraversion (*E*)	Warmth (*E1*), Gregariousness (*E2*), Assertiveness (*E2*), Activity (*E4*), Excitement-seeking (*E5*), Positive emotions *(E6*)
Openness (*O*)	Fantasy (*O1*), Aesthetics (*O2*), Feelings (*O3*), Actions (*O4*), Ideas (*O5*), Values (*O6*)
Agreeableness (*A*)	Trust (*A1*), Straightforwardness (*A2*), Altruism (*A3*), Compliance (*A4*), Modesty (*A5*), Tender-mindedness (*A6*)
Conscientiousness (*C*)	Competence (*C1*), Order (*C2*), Dutifulness (*C3*), Achievement-striving (*C4*), Self-discipline (*C5*), Deliberation (*C6*)

Table A2 Big Five Factors and Corresponding Question Numbers

Big Five factor	Question number in questionnaire
Neuroticism	1, 6, 11, 16, 21, 26, 31, 36, 41, 46, 51, 56
Extraversion	2, 7, 12, 17, 22, 27, 32, 37, 42, 47, 52, 57
Openness	3, 8, 13, 18, 23, 28, 33, 38, 43, 48, 53, 58
Agreeableness	4, 9, 14, 19, 24, 29, 34, 39, 44, 49, 54, 59
Conscientiousness	5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60

Appendix B Personality and Risk Preference

Introdution

Thank you very much for participating in our experiment. This experiment studies the relationship between personality types and the degree of risk aversion in different situations. The experiment has two parts, the first part is the NEO personality questionnaire, and the second part is the lottery choice experiment.

We will randomly select participants who enter the experiment and reward them based on the results of the experiment. All the content you fill in will be kept strictly confidential. Complete the experiment effectively and you will get a basic remuneration of 20 yuan, then the rest of remuneration is determined by your choice in the experiment.

Part 1：NEO personality questionnaire

1. I am not a worrier. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

2. I like to have a lot of people around me. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

3. I like to spend my time daydreaming to explore possibilities. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

4. I try to be polite and polite to everyone I meet. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

5. I keep my belongings neat and clean. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

6. Sometimes I feel angry and full of resentment. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

7. I laugh easily. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

8. I like to cultivate and develop new hobbies. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

9. Sometimes, I use threats or flattery to persuade others to do what I want. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

10. Iam pretty good about pacing myself so as to get things done on time. [Mu ltiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

11. When Iam under a great deal of stress, sometimes I feel like I'm going to pieces. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

12. I usually prefer to do things alone. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

13. I am intrigued by the patterns I find in art and nature. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

14. Some people thing I am selfish and egotistical. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

15. I am often not ready yet when things are approaching. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

16. I rarely feel lonely or blue. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

17. I really enjoy talking to people. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

18. I believe letting students hear controversial speakers can only confuse and mislead them. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

19. I am ready to fight back if anyone provokes a dispute. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

20. I try to perform all the tasks assigned to me conscientiously. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

21. I often feel tense and jittery. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

22. I like to be where the action is. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

23. Poetry has little or no effect on me. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

24. I have a very high opinion of myself. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

25. I have a clear set of goals and work toward them in an orderly fashion. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

26. Sometimes I feel completely worthless. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

27. I usually avoid crowded occasions. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

28. It is difficult for me to let my mind imagine freely. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

29. After being treated rudely, I will try to forgive and forget about it. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

30. I waste a lot of time before settling down to work. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

31. I rarely feel fearful or anxious. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

32. I often feel as if I am bursting with energy. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

33. I seldom notice the moods or feelings that different environments produce. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

34. I believe that human is kind by nature. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

35. I work hard to accomplish my goals. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

36. I often get angry at the way people treat me. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

37. I am a cheerful, high-spirited person. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

38. I often experience many different feelings or emotions. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

39. Some people think of me as cold and calculating. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

40. When I make a commitment, I can always be counted on to follow through. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

41. Too often, when things go wrong, I get discouraged and feel like giving up. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

42. I do not really like chatting with people. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

43. Sometimes when I am reading poetry or liking at a work of art, I feel a chill or wave of excitement. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

44. I am hard-headed and tough-minded in my attitudes. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

45. Sometimes Iam not as dependable or reliable as I should be. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

46. I am seldom sad or depressed. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

47. My life is fast-paced. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

48. I have little interest in speculating on the nature of the universe or the human condition. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

49. I generally try to be thoughtful and considerate. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

50. I start and end things well, and I am very capable. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

51. I often feel helpless and want someone else to solve my problems. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

52. I am a very active person. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

53. I have a lot of intellectual curiosity. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

54. If I do not like people, I let them know it. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

55. I never seem to be able to get organized. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

56. At times I have been so ashamed I just wanted to hide. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

57. I would rather go my own way than be a leader of others. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

58. I often enjoy playing with theories or abstract ideas. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

59. If necessary, I am wiling to manipulate people to get what I want. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

60. I strive for excellence in everything I do. [Multiple choice] *
○1 strongly disagree ○2 disagree ○3 uncertain ○4 agree ○5 strongly agree

61. This question is a test question, please fill it in carefully, otherwise the questionnaire will be invalid. [Multiple choice] *

○ fill in randomly without looking at the options

○ fill in carefully

Part 2：Lottery choice

The lottery choice part contains three games. In each game, the reward you may get is different. For example, if you choose lottery A, the maximum profit you may get is 10 yuan, 100 yuan and 1 yuan respectively.

Each game contains 11 multiple-choice questions, requiring you to choose between lottery A and lottery B. Columns 2 to 5 of the table indicate the probability that you may get the corresponding amount if you choose the lottery, which is expressed by P (xx yuan). For example, when the number 3 of Game 1 is selected, you have a 20% probability of Getting 10 yuan and an 80% probability of getting 8 yuan choosing lottery A; a 20% probability of getting 19 yuan, and an 80% probability of getting 0.5 yuan choosing lottery B.

Please note that the probability of return for each group selection is subject to change. Please answer all multiple-choice questions completely after careful consideration, because this will affect your return. For convenience, we give the expected return of lottery A and lottery B in the 6th and 7th columns of the table, expressed by *EVA* and *EVB* respectively.

We will randomly select a game and a multiple-choice question, and pay you based on the choices you make. For example, if we randomly draw the number 3 of your Game 1, and your choice for this question is lottery A, then we will use a random number generator with a value range between 0 and 100. If the random number generated is less than 20 (inclusive), we will pay you 10 yuan. If the random number generated is between 21–100, we will pay you 8 yuan. Similarly, if we randomly draw the number 2 of your game 2, and your choice for this question is lottery B, then when the random number generated is less than 10 (inclusive), we will pay you 190 yuan, and if the random number is between 11–100, we will pay you 5 yuan.

Game 1

No.	A		B		$EVA = P(10)\times 10 + P(8)\times 8$	$EVA = P(19)\times 19 + P(0.5)\times 0.5$
	P(10 yuan)	P(8 yuan)	P(19 yuan)	P(0.5 yuan)		
1	0	1.0	0	1.0	8	0.5
2	0.1	0.9	0.1	0.9	8.2	2.35
3	0.2	0.8	0.2	0.8	8.4	4.2
4	0.3	0.7	0.3	0.7	8.6	6.05
5	0.4	0.6	0.4	0.6	8.8	7.9
6	0.5	0.5	0.5	0.5	9	9.75
7	0.6	0.4	0.6	0.4	9.2	11.6
8	0.7	0.3	0.7	0.3	9.4	13.45
9	0.8	0.2	0.8	0.2	9.6	15.3
10	0.9	0.1	0.9	0.1	9.8	17.15
11	1.0	0	1.0	0	10	19

62. This question is a test question of rule comprehension. The experiment result is regarded as valid if the answer to this question is correct.

In Game 1, what is the expected return if choose the number 2 of lottery A ? [Fill in the blank] *

____

63. The answer to the test question is 8.2, please choose whether the answer is correct [Multiple choice] *

○ Correct (Please skip to question 66)

○ Wrong (Please skip to question 64)

64. In Game 1, what is the expected return if choose the number 3 of lottery B ? [Fill in the blank] *

____

65. The answer to the new test question is 4.2, please choose whether you have understood the game rules. [Multiple choice] *

○ Correct and I understood the game rules. (please skip to question 6(

○ Wrong, but I still do not understand the game rules.

66. Game 1 lottery choice [Numerical questions] *

	Choose the lottery
No.1	
No.2	
No.3	
No.4	
No.5	
No.6	
No.7	
No.8	
No.9	
No.10	
No.11	

Game 2

No.	A		B		$EVA = P(100)\times100 + P(80)\times80$	$EVA = P(190)\times190 + P(5)\times5$
	P(10 yuan)	P(8 yuan)	P(19 yuan)	P(0.5 yuan)		
1	0	1.0	0	1.0	80	5
2	0.1	0.9	0.1	0.9	82	23.5
3	0.2	0.8	0.2	0.8	84	42
4	0.3	0.7	0.3	0.7	86	60.5
5	0.4	0.6	0.4	0.6	88	79
6	0.5	0.5	0.5	0.5	90	97.5
7	0.6	0.4	0.6	0.4	92	116
8	0.7	0.3	0.7	0.3	94	134.5
9	0.8	0.2	0.8	0.2	96	153
10	0.9	0.1	0.9	0.1	98	171.5
11	1.0	0	1.0	0	100	190

67. Game 2 lottery choice [Numerical questions] *

	Choose the lottery
No.1	
No.2	
No.3	
No.4	
No.5	
No.6	
No.7	
No.8	
No.9	
No.10	
No.11	

Game 3

No.	A		B		$EVA = P(1)\times 1 + P(0.8)\times 0.8$	$EVA = P(1.9)\times 1.9 + P(0.05)\times 0.05$
	P(10 yuan)	P(8 yuan)	P(19 yuan)	P(0.5 yuan)		
1	0	1.0	0	1.0	0.8	0.05
2	0.1	0.9	0.1	0.9	0.82	0.235
3	0.2	0.8	0.2	0.8	0.84	0.42
4	0.3	0.7	0.3	0.7	0.86	0.605
5	0.4	0.6	0.4	0.6	0.88	0.79
6	0.5	0.5	0.5	0.5	0.9	0.975
7	0.6	0.4	0.6	0.4	0.92	1.16
8	0.7	0.3	0.7	0.3	0.94	1.345
9	0.8	0.2	0.8	0.2	0.96	1.53
10	0.9	0.1	0.9	0.1	0.98	1.715
11	1.0	0	1.0	0	0.10	1.9

68. Game 3 lottery choice [Numerical questions] *

	Choose the lottery
No.1	
No.2	
No.3	
No.4	
No.5	
No.6	
No.7	
No.8	
No.9	
No.10	
No.11	

Part 3: Personal background

You have completed the test questions. This part will ask some questions about your personal background. It is anonymous and does not involve privacy. Please feel free to answer.

69. Age [Fill in the blank] *

____

70. Gender [Multiple choice] *

○ Male

○ Female

71. Are you the only child in your family? [Multiple choice] *

○ Yes

○ No

72. The area of your high school [Multiple choice] *

○ Urban

○ Rual

73. Do you think the COVID-19 pandemic has affected your attitude towards life? [Multiple choice] *

○ Totally no effect

○ Has some effect

○ Has general effect

○ Greatly affect me

○ Totally change me

74. Have you personally experienced natural disasters or social shocks, and this experience has changed your life attitude to a certain extent (such as in Beijing or Guangdong during SARS in 2003, Wenchuan earthquake in 2008 or other earthquakes/tsunami/landslides, etc.)? [Multiple choice] *

○ Yes, I have. (Please skip to question 75)

○ No, I have not. (Please skip to question 76)

75. How do you think you feel about such natural disasters or social shocks? [Multiple choice, you could choose more than one answer] *

□ Fear

□ Pessimistic

□ Be anxious about the uncertainty caused by the disaster

□ Be disturbed by the uncertainty caused by the disaster

□ Hope to avoid the unceratiaity caused by the disaster

76. Have you experienced any changes in your personal life that have hit you and affected your life attitude? [Multiple choice] *

○ Yes, I have.

○ No, I have not.

77. How many times have you experienced the above-mentioned types of natural/social shocks and personal shocks in total? [Multiple choice] *

○ 0

○ 1

○ 2

○ 3

○ more than three times

78. Do you think the above past experience has diluted or aggravated the impact of the COVID-19 pandemic on your life attitude? [Multiple choice] *

○ Past experience made me calm when facing the COVID-19 pandemic.

○ To a certain extent, it has diluted the impact of the COVID-19 pandemic.

○ It has no effect on my attitude towards the COVID-19 pandemic.

○ To a certain extent, it has aggravated the impact of the COVID-19 pandemic.

○ Past experience made me very nervous when facing the COVID-19 pandemic.

Appendix C Results of 2016 Baseline Experiment

We have 211 subjects in 2016, with the age range of 17 to 24. The mean age is 20.12, with 0.98 standard deviation. Among all subjects, 92 of them are male and 112 of them are female.

Table C1 summarizes the mean scores of five personality factors in 2016 and 2020 Experiment. We observe significant differences in five personality factors between two experiments.

Table C1 Statistics of Scores in Five Dimensions

Big five factor	Year	Max	Min	Mean	Standard deviation	*P*-value
Neuroticism	2016	55	17	33.72	7.15	0.000
	2020	58	13	36.15	8.28	
Extraversion	2016	55	20	40.02	6.72	0.012
	2020	58	20	38.63	7.02	
Openness	2016	56	27	41.29	5.63	0.016
	2020	60	23	42.48	6.78	
Agreeableness	2016	51	26	40.78	4.74	0.000
	2020	54	20	38.90	5.82	
Conscientiousness	2016	56	27	42.26	5.76	0.061
	2020	60	18	41.35	7.40	

Table C2 reports the regression results in 2016.

Table C2 Regression of Risk Preference on Personality Traits, 2016 Experiment

Variable	(1) Medium stake Game1_2016	(2) Large stake Game2_2016	(3) Small stake Game3_2016	(4) Medium stake Game1_2016	(5) Large stake Game2_2016	(6) Small stake Game3_2016
Neuroticism_2016	0.0493	0.0519	0.0121	0.0499	0.0475	0.0138
	(0.0311)	(0.0329)	(0.0306)	(0.0316)	(0.0327)	(0.0304)
Extraversion_2016	0.0290	0.0089	0.0262	–0.1106	–0.5461**	–0.2467
	(0.0333)	(0.0357)	(0.0331)	(0.2294)	(0.2421)	(0.2228)
Openness_2016	–0.0252	0.0090	–0.0949***	–0.0466	–0.1112	–0.2397
	(0.0319)	(0.0344)	(0.0318)	(0.1966)	(0.2081)	(0.1915)
Agreeableness_2016	–0.0063	–0.0418	–0.0652*	–0.0391	–0.0885	–0.1072
	(0.0379)	(0.0405)	(0.0378)	(0.0656)	(0.0664)	(0.0648)
Conscientiousness_2016	0.0128	0.0468	0.0742**	–0.1422	–0.1934	0.0200
	(0.0324)	(0.0342)	(0.0311)	(0.1250)	(0.1322)	(0.1214)
Agreeableness×Have-Sibling_2016				0.0510	0.0793	0.0682
				(0.0782)	(0.0801)	(0.0776)
Extraversion×Female_2016				–0.0220	0.0118	–0.1017*
				(0.0550)	(0.0588)	(0.0558)
Extraversion×Rural_ 2016				0.1450	0.5495**	0.3128
				(0.2270)	(0.2397)	(0.2205)

(*To be continued*)

(*Continued*)

Variable	(1) Medium stake Game1_2016	(2) Large stake Game2_2016	(3) Small stake Game3_2016	(4) Medium stake Game1_2016	(5) Large stake Game2_2016	(6) Small stake Game3_2016
Openness×Rural_2016				0.0235	0.1160	0.1592
				(0.1992)	(0.2112)	(0.1936)
Conscientiousness× Rural_2016				0.1661	0.2436*	0.0569
				(0.1272)	(0.1347)	(0.1234)
Constant	1.6752	3.9225	0.7228	16.1606	44.3394**	22.3281
	(4.9109)	(5.3654)	(4.9698)	(16.3328)	(17.3167)	(15.8707)
Demographic controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	118	117	118	118	117	118
R-squared	0.049	0.077	0.164	0.071	0.140	0.221

Note: (1) Standard errors are in parentheses. (2) *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. (3) The one-child and region data are missing in the second session of 2016 Experiment, so we have less observations. (4) The demographic controls include Age, Female, Have Sibling and Rural. (5) Game1_2016 means the switching point in the first MPL game in 2016. It measures the degree of risk aversion. Game2_2016 and Game3_2016 have a similar meaning.