Uncertainty, Risk, Income, and Decision-Making

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Abstract

This paper explores the relationship between risky decision-making and intolerance of uncertainty, particularly in relation to the psychological mindset of "wealthiness." A survey-based experimental design involving participants (N=336) who categorize themselves as either "wealthy" or "not so wealthy" was employed, examining an individual's tolerance to uncertainty and proneness to engage in risk-taking scenarios. Results suggested that worrying about finances, regardless of it being warranted, was associated with higher intolerance to uncertainty and lower risk-taking, highlighting the role of emotion in decision-making. This paper contributes to the understanding of how wealth perception influences decision-making processes, particularly under ambiguous conditions, by correlating these self-assessments with behavioral measures.

Keywords: Uncertainty, Risk, Income, Decision-Making.

1 INTRODUCTION

Uncertainty can be defined as the condition or state of not having complete or perfect information when making judgments or decisions. It is a common phenomenon in everyday life, yet highly impactful on risky decision-making, even without awareness. [Tve74]

It is essential, nevertheless, to differentiate between risk and ambiguity, the two most studied sources of uncertainty [Kah79]. Risk refers to situations where individuals have precise probabilistic information about possible outcomes, while ambiguity arises when individuals lack sufficient information to assign probabilities to outcomes [Cam92]. Take the example of gambling a deck of cards to explain decision-making in ambiguous situations. Participants will need to guess the card types correctly of three random cards picked out from a shuffled deck of cards that is composed of three different card types. A hint that participants have is the number of Type 1 cards in the deck. The number of Type 2 and Type 3 would be told under an ambiguous situation, for instance, different and contradicting information. If they guessed it correctly, they earn 10 dollars. The reward for gambling is 10 dollars, but participants can also

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choose to "pass" and earn 3 dollars for sure [Hsu05, Pus15]. The level of conflict in these trials is related to the extent of conflicting information about the cards in the deck. The fMRI neuroimaging data show that the amygdala, which is an integral part of the neural circuitry implicated in emotionally relevant aspects of decision-making, gets activated during decision-making that involves conflict or uncertainty. This implies that emotions such as fear actually do play a part in decision-making, especially where situations are unclear. Standard decision theory stipulates that vagueness should not influence decisions, but the experience of an emotion in the brain implies otherwise. It becomes clear that this link between the emotional and the cognitive makes decision theory more complicated by pointing out that decisions are not only rational but are affected by moods [Iye22].

Decision-making is not rational. In fact, Tversky and Kahneman (1974) [Tve74] describe that people use mental shortcuts or heuristics as cognitive tools to cope with uncertainty. These heuristics can lead to systematic biases and errors in judgment. Three heuristics are usually used for making decisions under uncertainty: (i) representativeness: when judging the probability of an object or event, people tend to evaluate how similar it is to pre-existing mental prototypes; (ii) availability of instances or scenarios; when asked to guess how often something happens or how likely it is to occur, people tend to base their answers on their recall of similar events. For instance, seeing a plane crash in the news can make people afraid of flying, believing a collision is a likely event; and (iii) adjustment from an anchor: due to this effect, a person using estimates would utilize an initial piece of information otherwise known as an anchor, regardless of how irrelevant it is in assessing the situation. For instance, in a bargaining encounter, a salesman is likely to start by asking for a price that is very high beyond the reasonable value of the commodity. It is a high price, which has the effect of shaping a buyer's perception of a reasonable price. A buyer may get anchored on a high price even if they are aware that they are being overcharged, and therefore, even when counter-offering, they end up paying more than would under normal circumstances. This tactic exploits specific psychological effects resulting in a decision. These heuristics are usually effective, but they lead to systematic and predictable errors [Tve74]. Furthermore, other factors, such as emotions and personality, will also result in errors of judgment [Zel08]). As illustrated in a study, the researchers compared high worriers (HW) and low worriers (LW) to understand the role of intolerance of uncertainty and intolerance of ambiguity in generalized anxiety disorder (GAD). The experiment used pictures categorized as safe, dangerous, or ambiguous based on a valence and arousal rating scale. Participants (n=46) split into two groups and had to answer various questionnaires to evaluate their worry tendencies, anxiety, depressive symptoms, and intolerance of uncertainty. The experiment process involved recording the participants' physiological responses and reaction times when anticipatory cues (indicating the type of picture to follow) were presented for 3 seconds, followed by a black screen for 3, 6, or 9 seconds. After that, a safe, dangerous, or ambiguous picture was displayed for another 3 seconds. The study found differences in how high and low worriers respond to the different

picture types in terms of physiological arousal and reaction times. They discovered that HW rated ambiguous pictures as more aversive and anxiety-inducing than LW. Additionally, HW had longer reaction times to all picture conditions, indicating increased cognitive processing [Kir16].

This means that people might interpret uncertain or ambiguous information in a way that leans towards either a positive or negative viewpoint rather than staying neutral or objective. This natural human inclination to interpret things in a biased way is what researchers call "interpretation biases" [Izu10].

Another source of bias in decision-making derives from income. However, the impact could differ according to the wealth of an individual. In financial decision-making, the psychological thinking of having available income is crucial. The amount of income an individual earns cannot determine their psychological thinking of income availability. In other words, a billionaire can say that they worry about money and yet feel insecure about it. In contrary, another perspective from Hanna and Lindamood (2010) [Han10] describe that wealthy people, or those who view themselves as "wealthy," are more likely to engage in risky decision-making since they are able to cope with the associated cost. Decision-making, thus, can be viewed as a gambling task.

This paper is concerned with understanding the psychological and affective aspects of decision-making under conditions of risk and impulsivity, but underlining that people behave differently from what rational choice theory expectations prescribe. Current literature presents several individual characteristics (for example, impulsiveness and uncertainty) to explain risk perception. It does not pay enough attention to how cultural attitudes form perceptions about success, wealth, etc. For example, as mentioned by Zelizer (1989) [Zel89], the concept of the social meaning of money is also addressed, but further studies are still necessary to explain the differences in cross-cultural behaviors concerning money.

Even though Hsu et al. (2005) [Hsu05] and Churchwell and Yurgelun-Todd (2013) [Chu13] investigate neural systems and structural alterations linked to decision-making in terms of behavioral economics, the integration of neurobiology and behavioral economics is still in the nascent stage. More research can be done regarding how impulsivity at the neural level immediately influences financial and social outcomes.

2 METHODS

The experiment consisted of a survey exploring risk and uncertainty tolerance between those who view themselves as "wealthy" and those who view themselves as "not so wealthy", based on their responses to money concerns and purchase 'abilities' questions specially designed for the study. An additional question enquiring about being responsible for their finances was also included to control household responsibilities. An approximately 15-minute Google form was created and spread through convenience and snowballing sampling. Participants were mainly from mainland China, but individuals in the USA and Canada were

also included. All responses were anonymous, and no remuneration was offered for participation. A total of 336 (F=179, 53.4%) responses were collected over two months. The survey included sociodemographic questions (age, gender, level of education), the intolerance of uncertainty questionnaire [Car07], and the risk-taking questionnaire [Haa11]. The IUS-12 is a self-report measure of aversion to uncertain situations (i.e., 'unforeseen events upset me greatly' and 'the smallest doubt can stop me from acting'). It compares 12 items rated on a 5-point Likert scale ranging from 1-5, with high scores indicating higher intolerance. The scale is further subdivided into two factors, namely, Prospective and Inhibitory Anxiety. Whereas the first corresponds to preparation for future threats (i.e., 'I should be able to organize everything in advance'), the latter consists of paralysis related to anxiety (i.e., 'When I am uncertain, I cannot function very well').

The RT-18 is also a self-report measure of choices related to risky tasks (i.e., 'I often try new things just for fun or thrills, even if most people think it is a waste of time' and 'I often follow my instincts, hunches, or intuition without thinking through all the details'). Participants were asked to answer a series of "yes/no" questions, with more answers of "no" indicating less risk-taking behaviors.

Participants were split into two groups according to their responses to the questions: "Are you the person responsible for your finances" (YES=258, NO=78), "I do not have to worry about money" (YES=271, NO=39), "I do not worry about money" (YES=228, NO=67), and "I am able to buy the things I want when I want them" (YES=237, NO=58). Those who answered neutral, agree, and strongly agree were merged into one sample group, while those who disagreed and strongly disagreed were incorporated into another sample group.

3 RESULTS

3.1 Sample characteristics

A chi-square test demonstrated a balanced distribution of proportions between males and females in the sample ($X2 = 1.579$, $p = 0.209$). Significance thresholds were established at $\alpha = 95\%$. Given the abnormal distribution of the results, non-parametric tests were used. According to the non-parametric independent t-test (Mann-Whitney), there were also no significant differences between genders on the items: "I do not have to worry about money," "I do not worry about money," I am able to buy things I want when I want them," and "I am the one responsible for my finances" ($p = 0.447$, $p = 0.292$, $p = 0.992$, and $p = 0.867$, respectively). Age (age was categorized from 'under 18' to '65+' in increments of 10 years, with the majority of participants being between 25-44 years old (54.8%), level of education (categories ranged from 'less than a high school diploma' to 'doctorate,' with the most significant proportion of participants having a bachelors degree (38%), and the proportion of participants being responsible for their finances was 76.8%. Figure 1 depicts the distribution of

responses on items related to finance.

Figure 1: Wealth questionnaire responses

3.2 Self-report data

The Mann-Whitney test was used to account for differences between groups on the series of items below. Within the sample of those who answered "I do not have to worry about money" (n=271), 247 people also endorsed the option "I do not worry about money" (p¡0.001), 271 people were responsible for their finances (p¡0.001), and 248 people agreed that they were able to buy the things they want when they want them (p¡0.001). We also noticed that those with a higher educational degree worry less about money (p=0.049). Within the sample of those who answered "I do not worry about money" (n=228), 223 people also endorsed the option "I do not have to worry about money" (p¡0.001), 228 confirmed being responsible for their finances (p¡0.001), and 213 people agreed that they were able to buy the things they want when they want them (p¡0.001). We also noticed that there were significant differences between groups for risk-taking tendencies. Those who answered "I do not worry about money" had an overall higher impulsivity score (p=0.003). Within the sample of those who responded they were responsible for their finances (n=258), 249 people also endorsed the option "I do not have to worry about money" (p¡0.001), 231 people chose the option "I do not worry about money" (p¡0.001), and 234 people agreed that they were able to buy the things they want when they want them (p = 0.030). We also noticed that the 258 people who were responsible for their finances had an overall higher score in both IUS-12 and RT-18, p = 0.005 and p = 0.007, respectively. Within the sample of those who reported that they were able to buy the things they wanted when they wanted them (n=237), 228 people also endorsed the option "I do not have to worry about money" (p¡0.001), 217 people selected the option "I do not worry about money"

(p¡0.001), and 237 people were responsible for their finances (p¡0.030).

3.3 Correlations

Spearman correlations indicated an association between level of education and not worrying about money (rho = 0.142, p = 0.015), suggesting that higher levels of education correspond to less worry. Not surprisingly, there were significant correlations between risk-taking behavior and not worrying about money (rho = 0.172, p = 0.003), which were not found with either the IUS or its subfactors. Being responsible for their finances correlated with the IUS (rho = 0.152, p = 0.005) and subfactors of anxiety.

4 DISCUSSION

We have divided the discussion into sections, which can be found below. The study revealed no significant gender differences in financial worry and risk-taking tendencies, challenging common stereotypes. Financial Worry — the stereotype that women worry more than men in monetary matters due to a constructive theory regarding the perception that women are more careful, allergic to risk, and sensitive to financial issues than men ever, and that is why they have a higher degree of monetary concern [Lus08]. Women are taken to be involved with issues such as debt, budgeting, and future financial status, while men are cast in a position of being confident to handle financial problems. The idea, risk-taking, another spread idea is that acting for a male is more provocative than for a female, though a female acts more cautiously than a male [Cro09]. Because girls are thought to be more careful with their money and not very trusting of anything new, they are expected to be most inclined toward what is regarded as conservative financial products like savings accounts and low-risk bonds. At the same time, boys are supposed to be more reckless and powerful and eager to take risks with their money, to go into stocks or startup businesses, and to highlight the role of context in financial behavior. Most participants expressed a lack of worry about money yet displayed a high intolerance to risk, influenced by societal norms equating wealth with success, suggesting socio-cultural factors significantly impact economic decisions; theoretical findings in behavioral economics predict that decision-making in individuals is adjusted towards the societal norms of the population. Individuals tend to focus on the pursuit of riches because society associates financial riches with an individual's value and standing. Social comparison theory explains that individuals' decisions in the financial domain are made based on the attempt to 'fit in' the overall population of society [Fes54]. Participants not worried about money exhibited higher impulsivity, possibly due to a psychological disconnect between perceived financial stability and spending behaviors.

4.1 Gender

Our sample had a balanced distribution between males and females and did not show any particular significance in the Mann-Whitney test, including in the items "I do not have to worry about money," "I do not worry about money," and the IUS-12. We also noticed that there were no significant differences between males and females in risk-taking (p=0.731). Impulsivity, an associated construct with risk-taking, is usually defined as a tendency to act without thinking and without consideration of future consequences [Wit09, Per08], is generally thought of as a male trait, but this has been disputed [Chu13]. "In humans, women discount more steeply than men, but sex differences on measures of impulsive action depend on tasks and subject samples" [Wea14]. The results of the survey show that men and women suffer from financial concerns; this is somewhat logical as finance is a rather delicate subject. Stress has a universal social aspect because of reasons like economic unpredictability, security in the workplace, deficits or savings, investment, and others that know no gender. This dismisses the conventional thinking about women being more worried about finances than men because the pressure is equal on anyone. Men and women are equally concerned regarding financial concerns such as budgets, credit, or lack thereof, and looking to the future, especially in issues such as the household budget. In the current unstable and unpredictable economic environment, every person faces financial problems like increased cost of living, instability at the place of work, or lack of work. Thus, financial worry cannot be associated with gender at all; it is the economy and the financial conditions of the given subject; both sexes are similar and equally worried about their financial outlook. Behavioral impulsivity is thought to consist of two distinct components: impulsive action and impulsive choice [Pat95]. Impulsive action (also known as behavioral inhibition) involves difficulty inhibiting or controlling behavior. In contrast, impulsive choice refers to the tendency to prefer more petite, immediate rewards to more significant, delayed rewards, indicative of problems in delaying gratification. Together, these components provide a comprehensive view. In impulsivity, impulsive action deals with the failure to inhibit actions, while impulsive choice deals with decision-making tendencies favoring immediate rewards [ea15].

4.2 Uncertainty/ Worry

Results suggested that 91.4% of the participants agreed that they "do not have to worry about money," and 87.0% percent reported that they "do not worry about money." There could be many reasons behind these results. Viviana A. Zelizer, a professor of Sociology at Princeton University, states that "the modern world portrays money as a key instrument in the rationalization of social life." She explains this by separating the interpretation of money into two distinct concepts, known as "market money" and "special monies," focusing on how money's role extends beyond its economic functions to embody significant social and symbolic dimensions. On the one hand, "market money" dives into the purpose and function, describing money as a tool that acts as a medium for

exchange, in other words, transactions or measuring values. In contrast, "special monies" illustrate a much more complex relationship between the mere functions of money and the influence of society, including the social means, cultural practices, and social structure [Zel89]. Societal norms such as wealth being a representation of success influence the mindset of financially secure people. Being "wealthy" is often associated with being successful and influential and shows a certain degree of social status. This norm leads individuals to have the desire to pursue higher incomes and display their wealth (often through cars, clothes, bags, houses, etc.) as a symbol of their social status. Furthermore, beliefs of "saving for the future," where individuals save money as a backup for ensuring future security and stability; "financial independence," where an individual achieves a certain financial status indicating that they can support themselves independently, as well as freedom in financial choices; "debt as a burden," where borrowing is often viewed as a harmful practice, are common phenomena seen. Thus, due to the fear of financial instability, individuals will likely be less tolerant of facing risks and uncertainty. Through the underlying social structures that guide these perceptions of money, it becomes evident that the economic behaviors of individuals cannot be fully understood without considering their social and cultural contexts. Despite the participant's confidence in their financial ability, their intolerance to risk and uncertainty can be seen as a reflection that deeper societal values and norms are prioritized over the tangible financial possession of money. Understanding these factors requires us to look beyond the surface of money decisions and consider the socio-cultural influences that shape our perspectives towards money, risk, and uncertainty.

4.3 Risk-taking tendencies

Something interesting that we noticed in the answers of those who endorsed the "I do not worry about money" question is that the risk-taking behavior is significant with a p-value of 0.003, in comparison with those who agreed to "I do not have to worry about money," which did not significantly correlate with risk-taking ($p = 0.200$). This result might be due to the fact that, mentally, individuals do not worry about money, regardless of the actual amount of their finances. When people do not have to be concerned about any consequences, such as spending money, their risk-taking behavior tends to be higher. [Bar00, Con01].

Moreover, this result may be influenced by underlying personal traits and perceived levels of risk or uncertainty. A study by Tzagarakis et al. (2013) [Tza13] explored the influence of impulsivity on behavior under uncertain conditions through a controlled experiment using a reaching task. The study underscored the complexity of impulsivity as a trait influencing behavior, particularly in scenarios where quick decision-making is critical under varying degrees of uncertainty. The behaviors of participants were observed and analyzed when reacting to cues that predicted the direction of a target at different levels of uncertainty, ranging from one cue (no uncertainty) to three cues (high uncertainty). The researchers analyzed the participants' response times (RT), early

errors (errors of commission), precision errors, and impulsivity was assessed using the Barratt Impulsiveness Scale [Pat95], applying statistical models to explore the interactions among impulsivity and uncertainty. Tzagarakis et al. elaborate that "the analysis of the effect of RT and impulsivity on precision errors showed a different pattern for high Vs low impulsiveness in the high uncertainty (3-cue) condition" [Tza13]. This indicates that an individual's level of impulsivity distinctly modulates the behavioral responses to uncertainty. In addition, the findings highlight that the pattern of errors and responses varied significantly with impulsivity levels and were influenced by the level of uncertainty presented in the task. For example, highly impulsive individuals showed different error patterns under high uncertainty conditions compared to those with low impulsivity. This suggests that impulsivity modulates how individuals deal with uncertain situations in tasks requiring quick and precise responses.

4.4 Age, Responsibility, and Impulsivity

Results showed significant correlations between individuals who are not responsible for their finances and both uncertainty and risk-taking tendencies. This can be explained by taking into account the maturity level of those who do not earn, manage, and spend their income. According to our data, the population that is not responsible for their finances lay in the range of teenagers, with many still attending school full-time from the sociodemographic questions of age and education. It is likely that many of them have not truly experienced the hardships in the journey to earning income and do not have a whole concept of finance just yet. Churchwell and Yurgelun-Todd's (2013) findings suggest a developmental aspect, claiming that insula thickness and non-planning impulsivity show an inverse relationship with age [Chu13]. This developmental trajectory implies that younger individuals may exhibit more impulsivity related to financial decisions due to a lower brain maturity level. Thus, the decision-making process in financial contexts can be profoundly influenced by neurodevelopmental factors, which will evolve with aging.

Another explanation for this finding refers to the context where individuals display impulsive behavior. For instance, due to pressure or seeking psychological fulfillment, people at a younger age may want to display themselves as a "wealthier" person. In an era where advances in technology penetrate everyone's lives daily, social media plays a crucial role in influencing the mindset of young individuals, inspiring them to present themselves as wealthier than they are [Buc07]. Many young people feel pressured to appear successful and affluent on platforms like Instagram or TikTok, which often display the glamorous lifestyles they see celebrities and influencers portray. For instance, a young person might post photos of themselves at upscale restaurants, wearing designer clothes, or traveling to exotic destinations, regardless of their actual financial situation. They might even go to the extent of renting luxury cars or designer outfits just for the photo shoot to enhance their social media profile. This behavior is typically driven by a desire for social validation and acceptance, as well as an internalized belief that wealth and material success are critical to

personal worth and happiness. Churchwell's research highlights the neurological underpinnings that might explain this phenomenon. It states, "Insula function has been associated with emotional regulation, adjusting to changing outcomes under risk, reward and loss anticipation, discounting of future rewards, and self-rated impulsivity" [Chu13]. The insula, therefore, plays a crucial role in how individuals process their financial security and the associated risks. When individuals say they "do not worry about money," it may reflect a psychological state where immediate gratification outweighs the potential future consequences linked to a heightened activity in the insula.

4.5 Limitations and Future Directions

The study predominantly included participants from mainland China (90%), with very few responses from the USA and Canada. This geographical concentration might lead to biases and limit the generalizability of the findings across different cultural and economic contexts. Future studies could benefit from a more globally diverse sample to enhance the applicability of the results. Furthermore, the conducted survey relies on self-reported measures, which may lead to social desirability and inaccurate self-assessment, with participants not revealing their true thoughts or being biased. This could affect the reliability of data concerning participants' tolerability of uncertainty, decision-making motivations, and risk-taking tendencies. While we included controlling factors like financial responsibility in the study, there are many other important variables, such as employment status, marital status, or past financial trauma, that may have been overlooked, which could influence decision-making under uncertainty.

Future research could include experimental components where participants are placed in controlled decision-making scenarios to perform real-time behaviors rather than relying solely on self-reported data. This approach would help in understanding the immediate effects of different types of financial information on decision-making. Exploring additional psychological constructs such as stress levels, financial literacy, and personality traits could enrich the understanding of how other factors influence financial decision-making. Conducting similar studies across various cultural backgrounds could shed light on how cultural norms and values influence financial behaviors and decision-making under uncertainty. This could also explore how different societies view wealth and financial security. Investigating the influence of technology and social media on financial decisions, particularly among younger demographics, would be crucial. This includes understanding how the portrayal of wealth on social media platforms impacts financial anxiety and decision-making processes.

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