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LITERATURE REVIEW

Beyond Rationality: How Cognitive Biases Shape Financial Decisions in an Imperfect World

Dilnoza Ruziboeva
Grade 11 Student, Al Beruniy International School
druzibaeva1@gmail.com

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Abstract

Conventional economic models consider how individuals choose the alternative that presents the highest expected payoff. While these models are useful for understanding the assumptions behind financial markets, they are limited in explaining the observed financial choices and behaviors of individuals. The choices individuals make are often influenced by several cognitive, emotional, and experiential constraints, and by the way information is presented to them. This paper studies present-biased discounting, loss aversion, overconfidence, mental accounting, and choice inertia in relation to saving, spending, borrowing and investing decisions. It carries out a comparative analysis of existing literature and secondary data from the OECD/INFE International Survey of Adult Financial Literacy and the World Bank Global Findex. The analysis indicates that financial decisions do not align with rational-choice assumptions. International survey data show a preference for short-term financial decisions. Experimental and field data show that overconfidence may lead to excessive trading and that loss aversion may influence financial decisions. Additionally, evidence suggests that commitment strategies can greatly enhance savings. These findings do not indicate that financial decisions lack reason. Rather, financial rationality is constrained by perceptions of risk and time, and by cognitive evaluations of decision outcomes and of losses. Recognizing these behavioral patterns can improve the design and implementation of financial policies and incentives.

Keywords: Behavioral Economics; Cognitive Biases; Financial Decision-Making; Loss Aversion; Present Bias; Overconfidence; Mental Accounting; Financial Literacy

1. Introduction

The basic tenet of most conventional decision-making models in economics is that people purposely choose the option that maximizes their expected utility whenever they make a choice. These models assume that people have stable preferences and respond to situations in expected and rational ways. Under these assumptions, it was relatively easy to explain phenomena of consumption, savings, and investment and to describe how the economic model and financial systems would work.

There are many situations of decision-making in the world of finances that happen in environments of time pressure, conflicting short-term and long-term goals, and emotions and that are characterized by incomplete and imperfect information, and cognitive constraints. Given these conditions, people often save for the future but spend today. Another example is an investor that uses the same information as the rest of the market, but is still overconfident in their forecasts. Another cognitive distortion is an investor refusing to sell losing positions. Because of holding losing positions, that investor doesn't realize the opportunity to reinvest and gain money in a new and more profitable position.

This brings us to the study of how cognitive biases and behavioral finance preferentially shape financial decisions and where the theories of rational economic models fall short. Unlike behavioral economics, the distinction is made between traditional economic assumptions and the real-world case of how individuals make decisions. Asymmetric reactions to gains and losses discussed by Kahneman and Tversky (1979) in Prospect Theory illustrate that most people have a stronger emotional reaction to a loss than they do to an equivalent gain.

Extensive research has identified many other factors that shape the process of financial decision making. For example, Laibson's work in 1997 was the first to study hyperbolic discounting. This phenomenon relates to an individual's immediate desire versus their long-term goals. According to hyperbolic discounting, an individual may intellectualize the importance of future consumption, but will still favor immediate rewards. This bias is evident in the trade-off of long-term value for short-term rewards and is especially evident in the choices made to plan for the future financially. Laibson's model is especially useful in analyzing the psychology of financial decisions that, initially, appear to be irrational and unrelated to basic financial management (Laibson, 1997).

Richard Thaler's 1999 work articulated the phenomena of mental accounting. It suggests that individuals distinguish their financial transactions as if they were performed in different accounts, despite fungibility of money. Money in the current state of economy can be replaced by money of the same denomination, without losing its unique characteristics. Mental accounting suggests that individuals develop cognitive accounts to reduce the complexity of financial transactions. These accounts are imposed with different rules, labels, and vantage points that influence financial decision-making. The mental accounting framework suggests that individuals develop cognitive accounts to structure financial decisions. For example, individuals may develop cognitive accounts to distinguish the source of income (salary versus bonus), the function of expenditures (entertainment versus essential utilities), or the outcome of gains and losses. Psychological segmentation may appear not to adhere to rational economic principles that treat money equivalently, but it has a considerable impact on individuals' financial decisions and behavior. Psychological classification of financial resources provides individuals the flexibility to apply different rules and expectations to different domains of financial resources. Consequently, individuals may achieve an ideal personal outcome from a classical economic perspective that otherwise cannot be achieved (Richard Thaler, 1999).

Behavioral economics traces implications and phenomenon of financial decisions. Saving embodies gratification later versus consumption now. Investing encompasses decisions about decisions with uncertainty. Borrowing enables consumption prior to earning income, but also binds the cost for future obligations. There are opportunities for cognitive biases to impact economic activity in all of these financial activities.

Financial decisions have been more accessible, prompting an increasing focus on the effect of these decisions on economic activities. The expanding electronic banking, online investment, and the availability of consumer credit and increasingly sophisticated financial tools has created a depth and

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breadth of financial choices. Poor financial decisions stop not encroaching on the individual family, but also impacting household long-term savings, retirement, and the national economy.

Current empirical data suggest that international studies show that financial knowledge in one area does not equate to the best possible financial conduct. The 2023 International Survey of Adult Financial Literacy, conducted by the OECD/INFE, covered 39 countries and economies and reported an average financial literacy score of 60 out of 100, with only 34% of survey respondents achieving the benchmark score of 70. The survey further showed that although 70% of surveyed adults claimed they assessed the affordability of a purchase, only 26% of respondents actually compared financial products offered by multiple vendors (OECD, 2023).

Recognizing a financially advantageous option vs. actually making that option is the foundation of behavioral economics. Financial literate persons exhibit present bias, loss aversion, and overconfidence, etc. This suggests the problem is not a lack of information. The purpose of my research is to study the cognitive processes of people when they make financial decisions and determine if there are cognitive biases that can be described by deviations from the standard rational choice theory. This research focuses on four aspects of financial behavior: saving, spending, borrowing, and investing. This research starts with a review of the rational financial choice system. Then, behavioral economics and the theory of bounded rationality along with Prospect theory, discounted hyperbolic systems, mental accounting, and overconfidence frameworks are reviewed. Predictions of the cognitive biases and financial decisions are made in the hypotheses section. In the data and methodology section, I use publicly available quantitative data and conduct empirical studies. I evaluate the hypotheses in the results section using international surveys and the existing behavioral finance studies. The last two sections explore the financial educations systems and the policy implications as well as provide financial theory critique.

This paper is primarily concerned with developing an understanding of rational financial decisions. It argues that psychological mechanisms have systematically identified human financial decision-making patterns that traditional models have failed to describe. Understanding these mechanisms will allow for more accurate definition and/or description of individual economic choices.

2. Literature Review

Traditional economic rationality models provide a basic framework of understanding towards decision making, but begin to fail when they come into contact with the many complexities of real world human interaction. The rational decision-making model in traditional economics postulates that individuals display consistent preferences and choose alternatives that maximize expected utility. In finance, this construct defines investors who, first and foremost, consider the available information to make decisions on an optimal risk-return investment. Traditionally, the efficiency of financial decisions made is largely judged relative to this model. By the yardstick of this model, an individual is deemed to have made an inefficient choice if they opt for a course of action that will yield a lower expected return for the same level of risk. The applicability of the model becomes more and more limited as the decision maker's information and attention constraints increase and where preferences veer outside the psychological domain of the model.

Simon introduced the concept of bounded rationality as a framework for analyzing the limitations to the assumption of complete optimization. He argued that individuals are limited by cognitive, temporal and informational factors. Therefore, in place of complete optimization, decision makers settle for satisficing, that is, stopping the search as soon as a satisfactory, though sub-optimal, alternative is found.

This is especially apparent in retail finance. Consumers rarely consider the whole array of available checking accounts, loans, or investment products. They typically choose the first feasible option. This obviously is not the most optimal solution. Although it is clear that individuals are not maximizing utility, it saves both time and effort for individuals to employ this heuristic, or simplified solution, in the face of cognitive and time constraints. This heuristic was the starting point for much of the work done in behavioral economics. It is reported that, as with deviations from strict rationality, these heuristics tend to exhibit systematic patterns rather than random behavior.

Prospect Theory by Kahneman and Tversky is one of the main theories in behavioral economics. In 1979 they presented what became known as the expected utility hypothesis, and showed that individuals tend to evaluate gains and losses relative to a reference point, rather than evaluating the state of their wealth as in the case of traditional theories (Kahneman and Tversky, 1979).

A key element of the framework incorporating Prospect Theory is the idea of loss aversion. Loss aversion refers to a cognitive asymmetry that leads people to evaluate outcomes in a relative sense, rather than in absolute terms. When this asymmetry is at work, people are observed to be much less satisfied by a gain of, for example, $100, than they are pained by a loss of the same $100. The value function of Prospect Theory is built to be more steep when we are in the domain of losses as opposed to the domain of gains. This means that the subjective cost that someone feels when they lose a given amount of money is greater than the subjective benefit that someone feels when they gain that same amount of money. This cognitive asymmetry is the opposite of expected utility theory where symmetric evaluation of changes in wealth is the norm.

Loss aversion accounts for many paradoxes in financial decision-making. A lot of potential market participants disregard positive expected return assets or whole portfolios. The reason for this regret is that the negative possibility of capital losing value, even if the positive value is expected, creates psychological barriers and discourages market participation. For equity markets, loss aversion provides a framework for the disposition effect. Investors do not like to sell poor performing stocks. This poor stock is the realized loss that investors want to avoid. For investors, selling stock is like locking in a loss. They want to avoid this mind state. So investors often fail to liquidate these stocks. Furthermore, loss aversion provides a rational framework for investors' persistent failure to liquidate poor performing stocks. Poor performing stocks, which investors want to avoid selling, become a negative mental state for investors. Since the reference point for an investor is the price that they paid for the stock, investors hope that poor stocks eventually return to the price that they paid for it.

In 1991, Kahneman, Knetsch, and Thaler contributed to the loss aversion principle by studying and describing other phenomena such as the endowment effect and status quo bias. Their work shows how the satisfaction of needing to own something and possessing it changes someone's perception of the value of that something. Since giving something up is a loss, the subject values the item in the marketplace at a price higher than what he was willing to pay to possess it. This conflicts with the neoclassical economic theory, which says that if the higher willingness to pay and the lower willingness to accept are not too far apart, the individual feels the change of income. Once the status quo is fixed, the bias is loss aversion. This makes people more apt to remain in their current situation, even if clearly better alternatives are found (Kahneman, Knetsch, and Thaler, 1991).

In financial markets, these tendencies can lead to decisions that are not explained solely by expected returns and risk.

Traditional rational-choice models have major shortcomings in understanding how individuals make intertemporal financial decisions primarily due to the focus on short-term rewards. The temporal dimension

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of deciding whether to save or spend money plays an important role. There is a trade-off. The money you save today cannot be spent today. It is had at a future date. This has created a permanent dilemma in each of us. We subconsciously weigh the value of our current consumption against the value we will derive from future consumption.

To deal with this permanent dilemma, Laibson in 1997 described a formal model of hyperbolic discounting. This describes the preference in which people give higher weight or importance to an immediate consumption than to a future consumption. Ultimately, this preference can result in dynamically inconsistent preferences. A person can say he will save more in the future, but when the future comes and is present, he breaks his promise and cannot delay his consumption. He has to eat those savings. Due to this behavior, saving for the future is the hardest part of financial planning. A stated future resolution has the greatest chance to fail because of this behavior. This shows how short-term thinking can defeat long-term financial goals. This model shows how short-term, thinking acts against long-term goals. Long term goals should guide short-term actions. This is a dilemma of economics that has not be addressed. This bias should be a focus area when planning your individual finances and should be the basis of designing long term savings and investment focused policies (Laibson, 1997).

This psychological tendency offers a structure to understand the barriers that hamper individuals from accumulating the resources necessary for their retirement and from practicing systematic long-term saving. Though the barriers may not be attributed to a lack of comprehension of saving. The psychological tendency of present bias may consume one's financial decision making at the expense of the long-term goal of saving. The bias is present when people save, for example, they may feel drawn to ignore long-term goals of saving. These preferences may be more important to a person than saving. It tends to drive spending over the necessity of long-term financial planning.

The Organisation for Economic Co-operation and Development (OECD) International Network on Financial Education (INFE) provides empirical evidence of theoretical preferences on saving. The survey was conducted across many countries and economies, and it found a clear case of present bias. For the case of present bias, the stated preference of 56% of adults, was to live for today, and to let tomorrow take care of itself, so they agreed with this statement. For the statement of saving vs. spending, the preference is to spend and be satisfied. Only 44% of adults stated the opposite of this preference. About 57% of participants agreed that "spending money is more satisfying than saving it for the long term." In contrast, about 43% agreed that saving money now is better and more satisfying than spending it later. These findings demonstrate that, at an individual level, behavioral factors have a significant impact on the population's financial decisions (OECD, 2023).

These findings do not place present bias at the absolute center of saving failures. Still, these findings are important because they demonstrate present bias and its effect on financial decisions.

People Tend to have a different perception of their wealth depending on how they classify it mentally. Thaler's mental accounting theory provides a unique view on certain observed deviations from assumptions of rational economic thinking. It says people have a systematic psychological process that helps them think about and manage their economic activities. For most people, their financial resources are not considered as one. Instead, they put their financial resources into different mental accounts, which they sometimes label according to a use or source. Mental accounts can be set-aside amounts for daily living, future security, investment, and professional development, or 'piggy banks' of savings. There is a problem with mental accounts. Although people use them to manage their finances, they do not abide by the law of fungibility in economics. Mental accounts and economic interchangeability often contradict each other to the detriment of rational economic thinking. One example is the preference some people have for not

withdrawing money from the savings account to finance a purchase, even though it would require a credit card to be used, and the savings account would instead earn interest. People would also treat a windfall from a bonus as different from the equivalent amount earned via their normal pay, even though they have the same purchasing power. For this reason, mental accounts can be described as a behavior that is a major influencer of financial decisions.

This concept describes the effect that the context in which financial decisions are presented has on people's choice-making, especially when this context is not directly related to financial outcomes. Mental accounting provides a framework for analyzing personal financial behavior like budgeting, saving and spending, and even borrowing.

An example is the case when an individual will not use savings to buy something, but does not hesitate to make the same purchase using a credit card. From an economic perspective, both activities have an impact on their financial position, however, from an emotional perspective, using savings in place of a credit card has an entirely different psychological effect.

Mental accounting has its pros and cons. It has the potential to undermine financial discipline, but on the other hand, it has the potential to bring financial order. For example, if a family dedicated a mental account for savings, the family will be less likely to spend that money.

Overconfidence in their knowledge and ability leads to overestimation of people's predictions of future events, resulting in poor decisions. Behavioral economics suggests that irrationality does not always lead to negative consequences. This is because certain behavioral finance theories can be harnessed to improve the quality of financial decision-making. Overconfidence is one them. This is the bias when people believe that they are more logical and rational than they actually are. This is also evident when investment decisions are made. Overconfident people will deal in the market more frequently than is warranted.

According to De Bondt and Thaler, financial models alone fail to describe market patterns. Psychology has a significant role to play in filling the gaps. Behavioral mechanisms pertinent to financial decisions which include overconfidence and overemphasis of importance to certain signals, have been documented as critical (De Bondt and Thaler, 1994).

Barber and Odean performed a study using data from 66,465 client accounts at a large discount brokerage firm for the years 1991 to 1996. Their research identified that the test group which exhibited the highest trading frequency yielded an average annual return of 11.40%, compared to a return on the market yield of 17.90% over the same period. These authors offered overconfidence as a reason for both elevated trading and a subsequent poor return (Barber and Odean, 2000).

Since then, the overconfidence and trading phenomenon have been the focus of research. Daniel and Hirshleifer argue that overconfidence explains most of the deviations from fully rational expectations in terms of trading behavior and the observed patterns of financial returns (Daniel and Hirshleifer, 2015).

The implications of this praise are significant and are particularly salient in financial markets. Since individuals have the potential to trade a number of times, such cognitive bias can lead to financial losses.

An individual's level of Financial literacy dictates the level of influence of behavioral biases on their financial decisions. Financial literacy is often cited as the solution to financially irresponsible decisions. One argument states that knowing about financial concepts such as inflation, compounding, diversification, and the time value of money will enable people to make better decisions. Lusardi and Mitchell define financial literacy as a component of human capital and argue that it has an important role to play in the making of economic decisions and the overall well-being of the community (Lusardi and Mitchell, 2014).

Financial literacy doesn't automatically get rid of behavioral biases. People can have a good cognitive

understanding about financial concepts, but it can still affect their financial choices and decision making. People can comprehend the principles about compounding, but it doesn't stop them from having a strong desire to consume now. Similarly, people can understand the principal of diversifying their investments, but they may still concentrate their investments in the same assets.

The 2023 OECD/INFE Survey illustrates this disconnection between knowledge and practice. In the case studies surveyed, 84 percent of adults were able to define inflation. However, only 63 percent of adults were able to answer a question about the time value of money. Additionally, only 42 percent of the adults answered a different question about compounding.

Prior research in this area notes that two factors influence the decisions people make regarding their finances. First, the breadth and depth of available financial information is important. This involves the financial information available regarding market trends, investment options, economic conditions, and the like, but it also involves how accessible and easy to understand that information is. Either, the data is plentiful to the point of feeling overwhelming, or it is presented in a way that is only interpretable to those with certain advanced skills. So, the amount, quality, and ease of use will determine how the data is initially perceived.

3. Methodology

This study uses a comparative secondary data research design to examine cognitive bias in context of financial decision-making among different populations. Here the author uses published behavioral economics literature and existing international survey data. Four aspects of financial decision-making: savings, consumption, investment and financial resilience, will be analyzed. Indicators for these aspects include financial behavior and attitudes, reported financial behavior, Financial Knowledge, saving and investment behavior, and the ability to cope with unforeseen financial shocks.

The primary source is the OECD/INFE 2023 International Survey of Adult Financial Literacy, which was filled in by respondents from 39 countries/economies. Financial Knowledge, Financial Behavior, Financial Attitudes, and Digital Financial Literacy and Financial Well Being are the components of Financial Literacy. Some indicators are attitudes toward saving and spending, consideration of affordability, comparison shopping for financial products, seeking financial advice, and understanding the concept of inflation, compound interest, and risk. Additionally, the study uses the World Bank Global Findex Database 2021 to analyze financial inclusion and savings, borrowing, and financial resilience particularly the ability of individuals to acquire emergency funds and the different sources of financial support. Also, the study integrates findings from established behavioral economics studies to link the financial behaviors that have been observed to behavioral mechanisms.

The analysis is predominantly descriptive and comparative. Survey indicators from the OECD/INFE and Global Findex are compared along financial decision-making dimensions and are aligned with findings from behavioral economics. Since the datasets vary in their survey questions, sampled countries, and measurement methods, the study does not aim to provide a single percentage for each cognitive bias. Instead, it aims to evaluate whether trends in the secondary data are in line with the behavioral mechanisms described in the literature. The main limitations of the study are the reliance on self-reported behavior, disparities in survey methodologies across countries, and challenges in comparing survey data across different countries and behavioral experiments. As such, the findings are not interpreted as evidence of cognitive biases where specific financial outcomes are observed. Instead, the findings are interpreted as the presence of behavioral factors that influence financial decision-making.

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4. Discussion and Results

Following the existing research, the study defines cognitive biases as systematic differences between the predicted financial decisions based on rational-choice hypotheses and the actual decisions made by economic agents. The study explores biases affecting financial decisions involving intertemporal trade-offs, financial risk-taking, and investment decisions. Possible behavioral interventions to improve financial decisions are also examined. The hypotheses tested do not presume that people make irrational financial decisions. Instead, the hypotheses reflect that there are psychological and/or emotional reasons, as well as environmental and institutional constraints, that lead people to make financial decisions that are not fully captured by decisions made based on rationality.

The study explores the role of the decision environment in financial decision-making. There is behavioral evidence to suggest that saving behavior can be improved by changing the order of the forms employees fill out to make retirement savings contributions. Other behavioral evidence suggests that both saving and investment decisions are impacted by an individual's level of financial resilience. The impact of financial literacy on financial decision-making is also explored.

The results show that a number of trends in financial behavior are associated with behavioral economic theories. However, the first-hand accounts and survey data used in this report do not permit determination that a given cognitive bias affected a particular financial behavior. Other factors including personal income and financial conditions, level of education and financial literacy, availability and type of financial services, and society's and family's tradition and values may also affect the financial behavior of individuals. Therefore, the authors draw conclusions based on behavioral theories that describe the financial behavior of individuals, rather than prove the theories.

There is an important behavioral financial economy concept that includes the choice of some individuals to be financially discreet. Financial discipline often means that an individual prefers to consume financially liberating goods and services (goods and services that provide immediate financial relief) in the short run, but prefers to forgo their consumption in the long run. The OECD/INFE report states that the majority of adults in countries with developed financial markets prefer current (or short-term) consumption. Short-term or immediate consumption may provide a greater sense of psychological satisfaction compared to the consumption of equivalent long-term or future rewards. However, there may be situations where an individual prefers to consume in the long-term or future, but financially constrained (or income-restrained) conditions do not permit such consumption.

An individual may possess the knowledge of financial practices that enable them to attain a financially secured future, but may not be financially liberated to act. There are numerous behavioral financial economy theories that may explain this phenomenon. These theories may provide the foundation for modifying the choices of individuals to attain financially liberating outcomes.

Thaler and Benartzi (2004) introduced a 'commitment device' to employer-sponsored retirement savings programs, dubbed 'Save More Tomorrow'. This commitment device allowed employees to decide to voluntarily allocate part of their future salary increases to their retirement savings. The employees then submitted a series of 'binding' decisions regarding future increases to their retirement savings. The authors believe their intervention illustrates how the saving behavior of employees can be enhanced by altering the architecture of the saving 'system,' in addition to allowing employees to 'pre-commit' to a saving goal. The authors claim that adjusting the 'system' can 'nudge' employees to save more. They acknowledged that this saving 'intervention' does not confirm that 'present bias' or 'self control' issues fully account for insufficient saving behavior.

Additionally, the authors claim that behavioral explanations can be used to analyze excessive levels of trading (i.e. 'Overconfidence'). It is posited that individuals may trade excessively due to 'Overconfidence' in their investing ability. Frequent trading, however, does not necessarily imply 'Overconfidence' in the trading decision. Other possible factors may include differences in trading objectives and strategies, as well as different levels of transaction costs.

Barber and Odean (2000) evaluated trading behavior for 66,465 households. They found the most active traders had returns that were below the market. Barber and Odean posited that traders cross the trading threshold (i.e. buy/sell) due to excessive confidence in their own information, hence, trading too often. This research adds behaviorally to why some active traders underperform the market. It does not imply that all active traders are overconfident. It also does not exclude overconfidence as the only reason for differences in investment performance (Barber & Odean, 2000).

Another possible behavioral factor to explain differences in investment performance is loss aversion. Losses are generally viewed as more negative than equivalent gains. This strong loss orientation may increase the perceived risk of a given investment. Because losses are more strongly felt than equivalent gains, investors may be more hesitant to realize an investment loss. It is important to note that an investor may not be trying to sell a loser. There may be other reasons why he/she/they is retaining the investment including, expected appreciation in the investment's price, cost of transacting in the investment, tax implications, risk/return objectives of the overall portfolio, and/or other information.

Studies of myopic loss aversion show that a focus on the mechanics of behavior rather than the behavior itself can provide valuable insight. Studies analyze the effect of evaluating financial outcomes on investors' sensitivity to loss. Although these studies help interpret investors' behavior in financial markets, they do not suggest that loss aversion is similar for different investors or in different markets (Kahneman et al., 1991; Iqbal et al., 2021).

Thus, the evidence evaluated in this study supports that H3 is valid in the context of loss-aversion theory. The intensity of these effects may depend on the characteristics of the investor, the amount of money being invested, and the condition of the market.

Trading behavior can also be attributed to overconfidence. Investors may believe they are more skilled or knowledgeable than the average person and are thus more able to predict future market movements. Barber and Odean's research supports this theory. Other behavioral finance research built on this foundation and analyzed the role of overconfidence and other behavioral effects in finance and the market (Daniel & Hirshleifer, 2015).

While many researchers draw the causal relationship between overconfidence and excessive trading, there is little evidence to support this. It is more accurate to say that overconfidence is one of many behavioral causes of this trading activity.

These results, taken as a whole, support Hypothesis 4. Overconfidence may not be the sole determinant factor for excess trading, but these results support that the relationship between trading and investment performance may be explained by theories and concepts related to investor overconfidence.

This research supports that the design of financial choice architectures may impact financial decisions. The Save More Tomorrow program is an important example, as it utilized the design features of pre-commitment and gradual increases in savings to alter the default financial choice architecture. As a result, 78% of the employees of the organization adopted the default savings increase, and the average savings rate of participants increased from 3.5% to 13.6%.

The results of this research are in line with Hypothesis 5 and indicate behavioral nudges impact the savings choice architecture to increase savings. This research supports that designers and architects of

financial policy, through use of commitment devices, may influence the savings behavior of individuals to achieve positive financial outcomes and improve financial choice architectures.

It is important to acknowledge the limits of extending the Save More Tomorrow program to other scenarios. While commitment devices may positively influence savings behavior, the conditions under which commitment devices would be useful must be analyzed on a case to case basis. The Save More Tomorrow program demonstrates positive influence of behavioral design in one context.

The study of the intersection of financial literacy and behavioral finance is fairly new. The OECD/INFE has produced a body of work showing that the level of financial literacy within a population can differ greatly. Simply put, knowledge of a financial concept does not always mean it will be implemented. Many respondents to a financial literacy survey may be able to explain a financial concept but may be unable to incorporate the concept in their financial decision making.

Just because a person makes a financially suboptimal choice given their knowledge, it does not mean a behavioral finance explanations is necessary. Making such a choice could be influenced by financial constraints, social environment, and personal preferences. Understanding the financial services industry may also influence the individual's choice.

Given what has been studied on the subject, more useful financial services industry choices may be encouraged with integration of behavioral finance into financial literacy education. Behavioral finance recognizes that people may be aware of a financially optimal choice but may need additional motivation to make that choice.

Financial companies can also benefit from behavioral economics. Different types of banks and firms can adapt choice architectures to align with their clients' best interests. For example, clients can be automatically enrolled in savings programs or be saved from themselves with pre-commitment to savings. Other choice architectures can incorporate reminders or provide easier-to-understand methods of comparing financial products. Yet, the effectiveness of all these initiatives hinges on the specific personality of the client and the skills of the financial employee architecting the choice environment.

Harms committed by choice architectures must also be considered. Policymakers should regulate architectures only if they cause harm or infringe on individual freedom. This is especially true if a client chooses a financial product against the recommendations of the financial employee. Mobility and flexibility in financial systems must be protected.

Policy can and should be designed using behavioral economics, but not all policy should be designed to bring all economic behavior in line with classical economic models. Rational choice models should be integrated with behavioral economics to paint a fuller picture of economic systems. The role of psychology should also be expanded, and the field should focus more on organizing and classifying existing economic phenomenons.

The evidence in this study generally supports behavioral mechanisms described in H1-H5. Evidence in support of H1 indicates financially rational choices are not automatically made by individuals with a high level of financial literacy and awareness, and hence financial literacy alone is not enough to foster positive financial behaviors. Some of the support for H2 indicates present-bias is largely driven by individuals' self-control failures, and hence, individuals are able to rationalize their behaviors to some extent. The support for H3 and H4 indicates individuals' behavioral biases are highly context-dependent and investors exhibit loss aversion when selling stocks; and overconfidence when choosing an unfair lottery with a positive expected utility. Lastly, the support for H5 indicates saving behaviors can be positively nudged by default. None of the above behavioral mechanisms of financial decision-making were directly confirmed by the observed evidence.

5. Conclusion

This research provides a behavioral finance framework and analyzes financial decisions including saving, consuming, borrowing, and investing. It incorporates various behavioral and psychological factors. The evidence analyzed in the context of the five hypotheses pointed to various behavioral effects. While the evidence was not sufficient to unambiguously conclude the operation of the behavioral effects, it was sufficient to rule out their absence.

Results indicate that individuals may exhibit present bias when choosing to consume rather than save, particularly if individuals perceive that saving is preferable in the long-run. However, in the short-run, individuals may find it difficult to delay the gratification associated with saving. Various other economic conditions may account for the preference for consumption over saving. Reasons may include, for example, limited financial resources. Likewise, results do not necessary indicate that a given individual is loss averse. It is possible that other factors may explain the overall investment behavior.

Trading may be explained by overconfidence. Moreover, individuals may exhibit a particular bias associated with belief in their ability to foresee the future. Mental accounting indicates that individuals may engage in financial decisions in a manner that is contrary to predictions based on classic economic theory. Nonetheless, the behavior may be rational and beneficial to the management of the household economy. The results suggest that behavioral economics and financial economics can be integrated. Save More Tomorrow provides evidence that physical and temporal changes to employee savings options changed employees' savings behavior. Because behavioral biases exist, financial services and other allied professions can create products and services, as well as design systems and offer financial education, based on behavioral research. Whether a behavioral financial product or service would be successful is an empirical question.

This research also suggests that there is a behavioral financial literacy dividend. Being financially literate can help people make better financial choices, but financial literate people may not always make financially prudent choices. Many other behavioral factors including self control and social norms, may determine whether a person behaves in a financially prudent manner.

Behaviors are more complex than some rational choice models suggest. Behavioral economics helps to explain many of these deviations. Deviations from the rational model do not always result in bad economic outcomes. Rational choice and behavioral models of the economy are not contradictory. Behavioral economics can help explain some rationale choices. More integrative models of the economy may provide better normative frameworks for economic policy.

Further research may be able to corroborate these results by more directly observing the behavioral mechanisms. Research looking at Central Asia may be able to show variability in financial irrationality with changes in banking structures, income equality and social norms. Comparative research looking at financial irrationality in Europe may also be able to show variability with changes in social and banking structures.

Variability in financial irrationality may also be explained by changes in differences in loss aversion and overconfidence as well as other behavioral biases. These biases may depend on educational levels and varying social and normative structures. Although financial irrationality may seem illogical in the context of economic theory, these behaviors may be financially rational in the context of a family or cultural unit. Further, financial irrationality may play an important social role in a family or cultural unit. Financial irrationality should be regarded as financial rationality unless proven otherwise.

Gaps in models of financial behavior may be caused by behavioral biases and other psychological

factors. Understanding these constraints and integrating them into models of financial behavior may improve the integration of behavioral and theoretical financial models.

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