The role of cognitive bias in financial decision-making under financial scarcity

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Abstract

Title: The role of cognitive bias in financial decision-making under financial scarcity

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Financial scarcity affects cognitive biases and financial decision-making. Moreover, cognitive biases impact the financial decision-making process. Therefore, the dissertation explores the mediating role of cognitive biases—present bias, optimism bias, and loss aversions—in financial decision-making under financial scarcity.

The dissertation is based on a quantitative correlational design. It uses an online survey to test different hypotheses. The survey gathered 123 valid responses and focused on financial scarcity, present bias, optimism bias, loss aversion, and financial decision-making. A mediating model was used to analyze how these cognitive biases mediate the impact of financial scarcity on financial decision-making.

The results show that optimism mediates the relationship between financial scarcity and financial decision-making. Financial scarcity has a negative relationship with optimism, which, in turn, is positively associated with financial decisions. Present bias and loss aversion do not show any mediating role between financial scarcity and financial decision-making. Additionally, financial literacy and gender significantly affect financial decision-making, with higher financial literacy leading to better decisions. Moreover, the dissertation highlights the importance of improving financial literacy and addressing gender differences to improve financial outcomes. Future research should include a wider spectrum of cognitive biases to further explore these relationships.

Keywords: Financial scarcity, Cognitive biases, Present bias, Optimism bias, Loss aversion, Behavioral Finance

Resumo

Título: O papel dos enviesamentos cognitivos na tomada de decisões financeiras em condições de escassez financeira

Autor: Adrian Suarez Gaitan

A escassez financeira afecta os enviesamentos cognitivos e as decisões financeiras. Além disso, os enviesamentos cognitivos têm impacto no processo de tomada de decisões financeiras. Consequentemente, a dissertação explora o papel mediador dos enviesamentos cognitivos - enviesamento do presente, enviesamento do otimismo e aversão à perda - nas decisões financeiras em situações de escassez financeira.

A dissertação baseia-se num desenho correlacional quantitativo. Utiliza um inquérito *online* para testar diferentes hipóteses. O inquérito recolheu 123 respostas válidas e incidiu sobre a escassez financeira, o enviesamento para o presente, o enviesamento para o otimismo, a aversão à perda e a tomada de decisões financeiras. Foi utilizado um modelo de mediação para analisar a forma como estes enviesamentos cognitivos medeiam o impacto da escassez financeira nas decisões financeiras.

Os resultados mostram que o otimismo medeia a relação entre a escassez financeira e as decisões financeiras. A escassez financeira tem uma relação negativa com o otimismo, que, por sua vez, tem uma associação positiva com as decisões financeiras. O enviesamento para o presente e a aversão à perda não revelam qualquer papel mediador entre a escassez financeira e as decisões financeiras. Além disso, a literacia financeira e o género afectam significativamente as decisões financeiras, sendo que uma maior literacia financeira conduz a melhores decisões. Ademais, a dissertação salienta a importância de melhorar a literacia financeira e de abordar as diferenças de género para melhorar os resultados financeiros. A investigação futura deve incluir um espetro mais alargado de enviesamentos cognitivos para explorar melhor estas relações.

Palavras-chave: Escassez financeira, enviesamentos cognitivos, enviesamento para o presente, enviesamento para o otimismo, aversão à perda, finanças comportamentais

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List of Abbreviations

&	And
b	Regression coefficient
DV	Dependent variable
H1	Hypothesis 1 (1-3 respectively)
IV	Independent variable
M	Mean
N	Total number of cases
p	p-value
R^2	Multiple correlation squared; measure of strength of association
SD	Standard deviation
SE	Standard error

Model 4 of Hayes PROCESS macro for SPSS

M1	Mediator 1 (1-3 respectively)
X	Independent variable
Y	Dependent variable
CI	Confidence Interval

1. Introduction

Humans make various choices throughout their lives, some of which are more significant than others. Some of these decisions are straightforward, while others are more challenging and need a more comprehensive decision-making procedure (Hallo et al., 2020). Among these, financial decisions are very important, as they are often considered complex and entail consequences (Lusardi & Mitchell, 2014). Financial scarcity, defined as a lack of adequate financial resources, can worsen the complexity of these types of decisions by adding external effects, such as pressure and urgency (Mullainathan & Shafir, 2013). Therefore, when individuals face financial constraints, their decision-making process can become negatively influenced, leading to irrational choices.

Humans make decisions based on their previous and own experiences instead of gathering information that empowers them to make good financial decisions (Shah et al., 2018). The modern portfolio theory, as mentioned in conventional finance literature, posits that individual investors are rational, exhibit risk aversion, and prefer investing in assets with lower levels of risk. This idea was introduced by Markowitz (1952). However, psychologists have discovered that human beings do not always act as rationally as economists had assumed (Bashir et al., 2013). The unusual characteristics can be explained by the area of behavioral finance, which is about understanding the various psychological traits that affect individuals in their financial decisions (Shefrin, 2002). This study field aims to understand the impact of emotions and cognitive biases (i.e., biases) on individual financial decision-making (Kengatharan, 2014).

Biases are "people's systematic but purportedly flawed patterns of responses to judgment and decision problems" (Wilke & Mata, 2012, p. 531). They impact the decision-making process by influencing the perception of information and the choices made by individuals (Tversky & Kahneman, 1974). These biases can lead to suboptimal decisions, especially in environments with limited financial resources (Carvalho et al., 2016). Sadly, humans are often influenced by biases, leading to poor decision-making due to inherent limitations in processing information (Hilbert, 2012).

This thesis explores the mediating role of cognitive biases, particularly present bias, optimism bias, and loss aversion, in the relationship between financial scarcity and financial decision-making.

1.1 Relevance of the topic

Understanding the mediating role of cognitive biases in the context of financial scarcity and financial decision-making is crucial due to its profound implications for economic behavior and policy design. Financial scarcity often restricts an individual's cognitive resources, which is reflected in a scarcity mindset (Goldsmith et al., 2020). This state of mind can result in cognitive biases, significantly influencing financial decisions (Huijsmans et al., 2019). Research by Mulainthan and Shafir (2013) illustrates how scarcity taxes mental bandwidth and leads to tunneling, where immediate need overshadows long-term considerations. By analyzing cognitive biases as mediators, we can better understand how and why individuals stick to decisions. These decisions, often made under scarcity, can be a risk to financial stability (Adamkovič & Martončik, 2017). Furthermore, previous research by Kahneman and Tversky (1979) found that biases such as loss aversion can lead individuals to evaluate risks and rewards irrationally. In turn, these significantly impact financial behavior, such as investing, spending, and saving.

In addition, it is crucial that humans are aware of cognitive biases and their impact on financial decision-making, which leads to irrational decisions. This awareness can help us take corrective action to make better financial decisions and help us escape the poverty trap (De Bruijn & Antonides, 2022) often present when humans face financial limitations. The poverty trap is defined as actions resulting from poverty that make it difficult for individuals to escape, ending in a cycle of poverty (Barrett et al., 2016).

Investing in the topic can lead to valuable insights and to an understanding of how financial scarcity impacts decision-making quality and presents viable tactics to reduce cognitive biases and enhance financial decision-making (Carvalho et al., 2016).

1.2 Problem statement and research question

In psychology and behavioral economics, the impact of financial limitations on financial decision-making has been a critical area of study (Elliehausen, 2019). Cognitive biases such as present bias, optimism bias, and loss aversion significantly distort financial decision-making (Barberis et al., 2001; Frederick & Loewenstein, 2002; Weinstein, 1980). Present bias causes a preference for immediate rewards, ignoring long-term benefits and amplifying impulsive

spending, which leads to repressing financial stability (Laibson, 1997; Thaler & Shefrin, 1981). Optimism bias exacerbates unrealistic expectations about the occurrence of future financial outcomes (Sharot, 2011). Loss aversions lead humans to weigh losses compared to gains disproportionally (Kahneman & Tversky, 1979). These cognitive biases altogether hinder rational financial decision-making, leading to challenges in managing resources effectively.

Existing literature has extensively shown the direct connection between financial scarcity and cognitive biases (de Almeida et al., 2024; Vinas et al., 2023), cognitive biases and financial decision-making (Zindel et al., 2014), and financial scarcity and financial decision-making (Cook & Sadeghein, 2018; De Bruijn & Antonides, 2022).

While it is known that financial scarcity can lead to more of a type of cognitive bias, and these biases, in turn, affect financial decision-making, this dissertation's novel contribution lies in examining how these biases mediate the impact within this relationship. Therefore, the following research question was developed to be answered:

> *RQ: Do cognitive biases mediate financial decision-making processes under conditions of financial scarcity?*

1.3 Overview of the dissertation's structure

The thesis follows a typical dissertation structure and consists of five chapters. Chapter 1 covers the topic presentation, research question, and problem statement. This is followed by providing an overview of existing literature and highlighting key findings about decision-making, financial scarcity, and cognitive biases in Chapter 2. Chapter 3 explains the methodology used to answer the research question. This will be followed by analyzing the collected data and presenting the results covered in Chapter 4. Chapter 5 discusses the main findings of the data analysis, connects the results to existing literature, and gives the academic and managerial implications and study limitations.

2. Literature Review

2.1 Decision-making

Decision-making is nothing other than making a choice (Beach, 1993). It aims to select the option that maximizes the personal outcome (Banks & Gamblin, 2022). This is one of the basic cognitive processes of human behavior (Wang & Ruhe, 2007), which is complex and not straightforward (Phillips et al., 2016). This fundamental process involves a combination of tasks, decision types, and cognitive functions (Phillips et al., 2016; Wang & Ruhe, 2007).

Every day, humans face an endless number of decisions that require them to select from what seems like an infinite number of options. The exact number of choices humans make is estimated to be around several thousand remotely conscious decisions per day (Sollisch, 2016).

In addition, humans' daily decisions vary from complex choices involving risks and uncertainties to apparently minor and routine choices (Banks & Gamblin, 2022; Jagoda et al., 2020). Relatedly, decisions can be trivial, such as deciding what to wear, while others may have significant implications for the future, like choosing a career path (Koçak et al., 2021). Depending on the complexity, making these types of decisions can be easy or difficult (Croskerry et al., 2014). Regardless of the type of decision, whether pivotal and complex or small and easy decisions, every decision shapes human life (Lerner et al., 2015; Levitt, 2021). Among these types of decisions humans face daily, financial decision-making attracts attention based on its impact on both personal well-being and financial stability (Brüggen et al., 2017).

2.1.1 Financial decision-making

Humans make financial decisions in order to manage their resources and finances (Latané & Tuttle, 1966). The personal financial decision-making process involves activities such as how much to spend, choosing investments, managing debt, and retirement planning (Greenberg & Hershfield, 2019). Every financial choice has the potential for risk and can have an effect on a person's stability, financial security, and strategic direction (Myers, 1984). Making financial decisions is an essential part of living because it affects achieving short- and long-term goals, which results in financial security (Guzman et al., 2019). Viewed from a different angle, financial decisions not only have an influence on a personal level but also play a pivotal role in economic growth since individual financial behavior (spending and saving) impacts economic

demand, and investments by organizations determine economic expansion and job creation (Butkiewicz & Yanikkaya, 2011). In addition, how humans make financial decisions is influenced by psychological factors, such as cognitive biases and emotional responses (Hirshleifer, 2015). Thus, previous research conducted by Frydman & Camerer (2016) showed that biases and heuristics not only affect financial behavior but also lead to suboptimal financial decisions. The current dissertation aims to understand better financial behavior regarding spending, saving, and investment decisions under financial limitations and how cognitive biases exacerbate these types of behavior.

2.1.2 The underlying process of making decisions

To explore financial behavior extensively, looking at the underlying decision-making processes is essential. Analyzing the various dimensions of decision-making is crucial to understanding its complexity. The underlying cognitive processes that control the human decision-making process unconsciously, the array of decisions humans face, from simple to complex, and the diverse actions that require making decisions are crucial for this exploration (Fellows, 2004; Gold & Shadlen, 2007).

1.2.1.2 Intuition or analysis

When humans face decisions, they usually listen to their gut or analyze the task according to logical criteria. But what causes them to act in one way or the other? Two thinking styles, intuition, and rationality, significantly impact decision-making and are, therefore, known as the heart of cognitive processing (Wang et al., 2015).

Intuition in the human decision-making process is a cognitive process characterized by rapid, nonconscious associations that enable immediate judgment without deliberate reasoning (Sloman, 1996). Dane and Pratt (2007) describe intuition as judgments that efficiently summarize unclear information, usually avoiding analytical thought processes. Similarly, Hodgkinson et al. (2008) discuss how intuition is characterized by a complex interplay of unconscious cognition that integrates previous experiences and immediate perceptions. This process is described by Sadler-Smith & Shefy (2004) and often functions as a “gut feeling” or “sixth sense”.

On the contrary, rationality in human decision-making is characterized by systematic analysis, deliberate, logical reasoning, evaluation of options, and choice-making (Simon, 1979). Rational decision-making is rooted in computational complexity, aiming to achieve efficient and effective outcomes based on given inputs and logical processes (Bossaerts & Murawski, 2017).

Whether humans use intuition, rationality, or a combination of both to solve tasks or decisions is influenced by the task's characteristics (Hammond et al., 1987; Inbar et al., 2010). These characteristics can significantly impact the decision-maker (Phillips et al., 2016) and lead to either a more analytical or an intuitive approach based on how the task is framed, presented, and perceived (Allinson & Hayes, 1996; Inbar et al., 2010; Levin et al., 2002; McElroy & Seta, 2003). Research indicates that those characteristics impact the effectiveness of the decision-making process. These attributes include the task's complexity, whether the choice is made alone or in conjunction with other decisions, the decision's time constraints, the task's repetition based on observable patterns, and the accuracy with which the decision's result can be predicted (Inbar et al., 2010; Papadakis et al., 1998; Phillips et al., 2016).

Moreover, the decision maker's intuition is responsible for high levels of uncertainty and an absence of concrete information (Elbanna & Fadol, 2016). A clear and well-defined task with sufficient data is necessary for rational thinking (Simon, 1979). Intuitive thinking techniques are more effective than analytical techniques in solving complex problems under time pressure (Dane & Pratt, 2007; Witteman et al., 2009). However, when faced with no time constraints, reasonable individuals can employ analytical methods to objectively assess possibilities according to predetermined standards and criteria (Hogarth, 2010).

The dual-process theory of human information processing can distinguish between tasks and decisions led by analytical reasoning or intuitive judgment. According to this theory, which Kahneman covered in detail, information is processed via two different pathways, known as System 1 and System 2. The next section will examine this dual-process model in more detail and show how it advances our knowledge of the decision-making process.

2.2.1.2 Dual process theories

Research by different theorists posits that reasoning comprises two different systems that differ in their functionality (Epstein, 1973; Evans & Over, 2013; Kahneman et al., 2002; Sloman, 1996; Stanovich & West, 2000). These two systems, which are the basis for the human cognitive

process, derive from distinct neurological systems (Lieberman et al., 2002). The distinction between the two thinking styles was often made in ignorance of the corresponding writings of other theorists (Frankish & Evans, 2009), which is why they used different terminologies for the same systems. Table 1 summarizes the different terminologies concisely.

Table 1:

Overview of terminologies

Terminology	Research
Heuristic system and analytic system	Evans and Over (1996)
Associative process and logical rule-based process	Sloman (1996)
Type 1 process and Type 2 process	Evans (2011)
System 1 and System 2	Kahneman (2011)

The terminology used in this dissertation adheres to the widely recognized System 1 and System 2 terminology coined by Kahneman (2011). Since both systems are crucial for the decision-making process, it is important to understand how they work. The extent and the manner in which they operate depend on the task and the context (Kahneman, 2011). As already mentioned above, the two systems differ fundamentally in their functionality.

System 1 is described as a fast-thinking, permanent information processing system (Kahneman, 2012). It is defined as an associative (Sloman, 1996), intuitive (Kahneman, 2011), heuristic thinking system (Sanders & McHugh, 2021) that "operates automatically and quickly with little or no effort" (Kahneman, 2011, p. 20). Besides that, responses may be inexact (Inbar et al., 2010) and based on previous experience (Evans, 2008). System 1 is activated when the decision maker faces a familiar and recognizable situation from past experience. It does not require conscious thought, involves a quick decision, and occurs when the decision-maker is not interested in engaging deeply with the information or the potential outcome (Kahneman, 2011).

System 2, in turn, can be described as an effortful, rule-based decision-making process (Inbar et al., 2010), that is slow but conscious (Evans, 2008), reflective (Phillips et al., 2016), controlled (Evans & Stanovich, 2013), and requires deliberate attention (Kahneman, 2012). System 2 is engaged when the task requires more attention and analysis or when a decision is

not obvious (Carol-anne et al., 2007). Therefore, resource-intensive System 2 is only actively used when required for the task: for example, if the task is a complex, new, or unfamiliar situation that significantly impacts the decision-maker, requires a detailed evaluation of the information, and does not involve time constraints (Kahneman, 2011; Sanders & McHugh, 2021).

In addition, the degree to which System 1 and System 2 are favored depends on two personal attributes of the decision-maker. On the one hand, there is the willingness (having sufficient motivation) and, on the other hand, the ability (having sufficient capacity and capability) to perform or solve the task (Frankish, 2010; McElroy & Seta, 2003).

But what is the relationship between the two systems? Current research does not show how they are connected. Some theorists assume a parallel process, where both systems operate simultaneously (Kahneman, 2011), while other researchers are convinced that it is a sequential process, where one system activates after the other (Evans, 2008). Although researchers may differ in their views on the relationship between the systems, they all agree that they are not entirely separate and can influence each other in complex ways (Kahneman, 2011; Phillips et al., 2016).

Sometimes, System 1 and System 2 align in their decisions, leading to the execution of the proposed decisions (Shleifer, 2012). Nevertheless, there are situations where sometimes System 2 does not agree with System 1's judgment. Therefore, System 2 will overrule the suggested decision and take over the control (Osman, 2004). The process by which System 2 overrides the suggested decisions is crucial for reducing the probability of making mistakes: for example, if System 1 struggles with a task, the suggested decision is inadequate, or situations in which System 1 is susceptible to errors (Kahneman, 2011; Kahneman et al., 2002; Sanders & McHugh, 2021).

2.2 Heuristic thinking and biases

As mentioned above, System 1 works permanently to process information, so humans constantly apply heuristic thinking (Kahneman, 2011). Heuristics are cognitive shortcuts that simplify complex situations (Gigerenzer & Gaissmaier, 2011). They are based on the judgment

of previous experiences rather than on the conditions of the current task (Kahneman et al., 1982). For example, when selecting a restaurant, some individuals tend to stick with familiar choices, disregarding the possibility of discovering better new options.

Humans use a wide variety of heuristics. Tversky and Kahneman (1974) examined three main heuristics in human decision-making: availability, representativeness, and anchoring and adjustment. According to Frankish (2010), heuristics can be described as a rough and ready estimation procedure. However, these estimates do not always account for all the necessary information, leading to systematic errors known as bias (Feinleib, 1987).

The term bias was introduced to "describe people's systematic but purportedly flawed patterns of responses to judgment and decision problems" (Wilke & Mata, 2012, p. 531). Biases are a systematic deviation from rational judgment (Tversky & Kahneman, 1974). Past research has identified various human biases, which can be classified as motivational and cognitive (Montibeller & Von Winterfeldt, 2015). Both types of biases affect how information is perceived and processed and how decisions are made, but they are based on different cognitive and emotional bases. These biases arise when decision-makers' responses in an evaluation task deviate from a normative rule that specifies the "correct" answer (Von Winterfeldt & Edwards, 1993), meaning that incorrect mental processes "violate commonly accepted normative principles" (Montibeller & Von Winterfeldt, 2015, p. 1230).

Cognitive bias refers to systematic errors in thinking that occur when individuals process and interpret information. It results from the brain's attempt to simplify the information obtained and the respective information process (Tversky & Kahneman, 1974). The following subchapters will introduce the three cognitive biases the dissertation wants to analyze in financial decision-making under financial limitations.

2.2.1 Present bias

Present bias is a fundamental notion arising from the idea of self-control in behavioral economics, highlighting the tendency of individuals to overvalue immediate gratifications at the expense of future gains (Thaler & Shefrin, 1981). It is incorporated into several key economic theories, notably the behavioral life-cycle hypothesis (Shefrin & Thaler, 1988) and the hyperbolic model of consumption and saving (Laibson, 1997), which attempt to model and predict consumer behavior by acknowledging the impact of present bias.

This tendency to prioritize immediate gratification over future ones is economically modeled by quasi-hyperbolic discounting over time (Laibson, 1997). The core understanding of present bias is recognizing how it influences intertemporal decisions involving trade-offs between costs and benefits occurring at different times (Direr, 2020). Furthermore, present bias leads to difficulties in accurately anticipating and valuing future states of personal preferences (Laibson, 1997).

Present bias affects various economic behaviors related to finance, healthcare, education, and work (Wang & Sloan, 2018; Xiao & Porto, 2019). For example, present-biased individuals tend to show less engagement in beneficial health actions by choosing to eat unhealthy foods over long-term benefits (Mørkbak et al., 2017).

In addition, previous empirical research has examined the potential effects of present bias on financial decisions. Hence, the presence of present bias can impact spending patterns, particularly among tourists who exhibit high levels of loss aversion and present bias, leading to a greater likelihood of excessive expenditure (Nguyen, 2016). Present bias may also impact the borrowing behavior of individuals, for example, individuals who are present-biased tend to borrow more from credit cards than those who are not present-biased (Meier & Sprenger, 2010). Furthermore, it has been shown in the United States that present-biased individuals do not conform to the expectation of saving for their retirement despite the instability of the social security system (Brown & Previtero, 2014).

Besides, focusing on the current situation tends to cause people to lose sight of their debt repayment plans and fail them. This was corroborated by the empirical research done by Kuchler and Pagel (2021) which demonstrated that present-biased people, especially those who were aware of their biases as opposed to those who were not, exhibited distinct financial management habits.

2.2.2 Optimism bias

According to popular belief, people often have a tendency to think that they are invincible (Weinstein, 1980). This invincibility suggests not just an optimistic view of life but also a mistake in judgment that may be referred to as unrealistic optimism (Sharot et al., 2007). In fact, one of the most well-documented biases in psychology and behavioral economics is the optimism bias, which is consistent and prevalent (Sharot, 2011).

Optimism bias is characterized by people's propensity to claim that they are more likely than others to encounter favorable experiences and less likely than others to encounter unfavorable ones (Helweg-Larsen & Shepperd, 2001). Thus, when it comes to predicting what will happen tomorrow, the next week, or five years from now, individuals who experience optimism bias tend to overestimate the likelihood of positive events and underestimate the likelihood of negative events (Sharot, 2011). Previous research suggests people underestimate their likelihood of experiencing car accidents (McKenna, 1993), crimes (Perloff & Fetzer, 1986), and cancer (Harris & Guten, 1979). Furthermore, individuals tend to overestimate their life expectancy, job success, and children's talents (Sharot, 2011).

The optimism bias not only contributes to an overly positive perception of the future but also significantly impacts human decisions. The presence of optimism bias can alter an individual's perception of risk, leading to decisions that may not accurately reflect actual probabilities (Tversky & Kahneman, 1974). In terms of financial decision-making, individuals are optimistic, while risks are undervalued, which influences decisions on investment, saving, and borrowing (Benartzi & Thaler, 2007). For example, investors may overestimate their returns, and households may not save sufficiently for future needs (Benartzi & Thaler, 2007; Riaz & Iqbal, 2015).

2.2.3 Loss aversion

Loss aversion is a cornerstone concept in behavioral economics and one of the most robust human biases in decision-making (Inesi, 2010). According to prospect theory, loss aversion describes individuals exhibiting a significantly stronger negative reaction to losses than a positive reaction to equivalent gains (Tversky & Kahneman, 1974, 1992). Figure 1 illustrates this principle in a simple and easy-to-understand manner. Gaining 0.05$ does not hold the same worth for an individual as losing 0.05$.

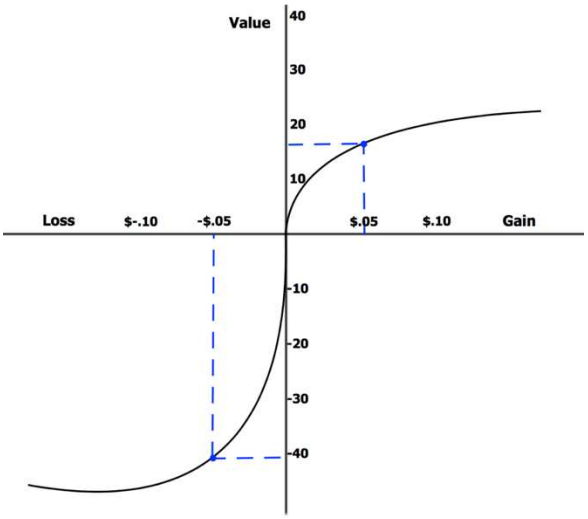

***Figure 1**: Adapted Prospect Theory by Tversky and Kahneman (1992)*

The asymmetry between the impact of gains and losses on emotions affects various decision-making processes (Zeif & Yechiam, 2022). Loss aversion is not a uniform, personal trait and can vary significantly, depending on the environment and the stakes involved, complicating its understanding (Mukherjee et al., 2017).

Previous research on behavioral economics, especially in loss aversion, has confirmed its pervasive influence across different fields, ranging from finance and consumer behavior to decision-making in general (Berkelaar et al., 2004; Gal & Rucker, 2018; Tom et al., 2007). Loss aversion can impact political beliefs, policy preferences, and daily decisions, resulting in less-than-ideal choices (Passarelli & Del Ponte, 2020). For example, a preference for the status quo versus advantageous changes may arise from the fears of possible losses (Alesina & Passarelli, 2019).

A wide variety of recent papers studied the effect of loss aversion in financial economics (Barberis et al., 2001; Benartzi & Thaler, 1995; Gomes, 2005). Benartzi and Thaler (1995) demonstrate that loss aversion can explain why individuals avoid investing in stocks. They argue that people avoid investing in stocks due to loss aversion and short-term planning. Negative returns overshadow the benefits of positive returns in the short run. This behavior leads to overestimating the negative impact of potential losses, which is attributed to an affective forecasting error (Novemsky & Kahneman, 2005).

2.3 Scarcity

Scarcity has been a fundamental part of economics for decades (Daoud, 2018). Indeed, it is a part of the definition of economics (Verhallen, 1982). Besides, interest in scarcity has increased in the last two decades, possibly unleashed by the 2008 financial crisis or the not-too-long-ago COVID-19 pandemic (Goldsmith et al., 2020). These were two fundamental historical events in which humans faced great scarcity.

Based on multiple research lines examining financial constraints, four different perspectives were created. These perspectives are rooted in the literature about resource scarcity, environmental uncertainty, social comparison, and choice restrictions (Hamilton et al., 2019). This dissertation will focus on resource scarcity, which represents the problem of having infinite desires and needs but limited resources to satisfy them.

Resource scarcity can take different forms, such as time scarcity, which refers to not having enough time to complete a task (Jabs & Devine, 2006), or financial scarcity, which not only means not having enough money but also feeling like one does not have as much money as one needs (Cook & Sadeghein, 2018). The most well-known cause of experiencing financial scarcity is poverty (De Bruijn & Antonides, 2022). However, personal perception of financial situation, as mentioned earlier, has a significant impact on mindset (i.e., leading to a scarcity mindset) and the choices humans make (Mani et al., 2013; Mullainathan & Shafir, 2013; Shah et al., 2012). External economic factors, such as job loss or unexpected financial emergencies, can exacerbate financial scarcity (Barrell, 2009).

Scarcity impacts various aspects of daily life, such as consumer behavior, resource management, etc (Lynn, 1991). Trends have shown that today's society experiences increased time pressures (Menzies, 2013), whereby time is a critical factor in influencing spending behavior (Hornik & Zakay, 1996). In addition, scarcity has a crucial impact on consumer behavior, leading to preference reversals. This means that consumers change their preferences when they perceive a good as scarce, which implies understanding how scarcity can alter economic behaviors in everyday situations (Mittone & Savadori, 2009). To summarize, it can be said that consumption targets are not achieved due to a lack of resources such as time and/or money (Goldsmith et al., 2020). As the dissertation aims to investigate the link between financial scarcity and cognitive processes, I will now concentrate on this specific scarcity.

2.3.1 Impact of financial scarcity on human behavior

A shortage on a day-to-day basis (e.g., limited financial resources, shortage of resources, limited products, etc.) is a problem not only in resource-poor societies but also in resource-rich societies (Cialdini, 2009; Dadzie, 1989; Gierl & Huettl, 2010).

Financial scarcity is a matter of insufficient resources to meet basic needs and leads to cognitive load influencing decision-making, attention, and overall cognitive performance (Mani et al., 2013). In psychology, the process of determining how to perceive and react to resource availability is called the scarcity mindset (Huijsmans et al., 2019). The scarcity mindset affects cognitive capacity, also called fluid intelligence, which is crucial in planning, decision-making, and problem-solving (Madrian et al., 2017; Sarial-Abi et al., 2023). Individuals with limited resources exhibited higher brain activity in areas related to immediate resource assessment and lower brain activity in areas related to goal-directed planning (Huijsmans et al., 2019). The scarcity mindset is a different way of thinking and functioning due to the limitations of resources (Mullainathan & Shafir, 2013, 2014).

Studies suggest that financial scarcity reduces cognitive function, increases trade-off thinking, and leads to an additional focus on scarcity-related information due to using cognitive resources (De Bruijn & Antonides, 2022; Mani et al., 2013; Mullainathan & Shafir, 2013). In addition, dealing with financial constraints that require mental resources distracts from the ability to perform other cognitive tasks (Mani et al., 2013). It shifts human attention to scarce resources, which can have both positive and negative effects. On the one hand, the resource (e.g., money) is used more efficiently, but on the other hand, it can lead to tunneling (Mullainathan & Shafir, 2014). This means that focusing on one scarce resource impacts the cognition process in a way that neglects other resources or obligations (Goldsmith et al., 2020). Information neglect was confirmed by Zhao and Tomm (2017), who showed that low-budget participants tended to focus more on meal prices than high-budget participants, neglecting a peripheral indication of a discount. Thus, it can be concluded that, with attentional prioritization on prices, the low-budget group is more likely to remember and recall information about their scarce resources. Haushofer and Fehr (2014) also called this phenomenon an attentional bias because selective and guided attention leads to missed opportunities and errors in judgement. Mani et al. (2013) demonstrated in two experiments that financial scarcity or dealing with a shortage of resources limits cognitive abilities, leading to a narrowing of mental bandwidth. In the first laboratory experiment, participants faced a hypothetically financially challenging scenario. The study

found that financial concerns significantly reduced cognitive performance among low-income participants but not among those with high incomes. The same results were confirmed by the field study, which analyzed the cognitive behavior of sugarcane farmers in times of scarcity (before harvest) compared with financially more stable times (after harvest). The results showed that cognitive performance significantly improved post-harvest (Mani et al., 2013). In addition, poor people are less able to make "good" financial decisions, as poverty-related issues exert stress and survival pressure, completely exhausting their mental resources (Haushofer & Fehr, 2014).

Considering the above facts, it can be concluded that a scarcity mindset triggered by financial limitations significantly impacts cognitive performance by focusing on present problems or needs rather than long-term goals, leading to suboptimal decisions (González et al., 2024). As the mindset causes a vicious circle, a scarcity trap is created, also referred to as a poverty trap in literature (Mullainathan & Shafir, 2013). The scarcity trap is a situation where individuals prioritize pressing needs over future planning and investment due to their limited financial situation (Gennetian & Shafir, 2015). This short-term focus results in poor decision-making, which in turn maintains financial difficulties. Financial scarcity is associated with an increased risk of depression, anxiety, overborrowing, financial avoidance, and discounting future payoffs (Haushofer & Fehr, 2014; Hilbert et al., 2022a, 2022b; Shah et al., 2019). These are all causes of the poverty trap, which leads to ongoing poverty (Mani et al., 2013; Mullainathan & Shafir, 2013, 2014; Shah et al., 2012).

Different approaches have been used in the past to examine financial scarcity. For example, as mentioned above, researchers have compared people before and after payday (Mani et al., 2013). This method enables the identification of changes in spending, risk-taking, or financial behavior based on resource availability. Moreover, some researchers (e.g., Mani et al. (2013)) used the approach of a scarcity simulation, where participants had to make decisions in different scenarios. This method is good for isolating the effects of scarcity and seeing changes in prioritizing needs and desires (Shah et al., 2015). Another possibility that researchers have used in the past is field studies to observe the spending habits in low-income neighborhoods or how financial decisions were made (Miller & Soo, 2018). My study analyzes financial scarcity through the “Perceived Economic Scarcity Scale” developed by Auger, Sommet, and Normand (2024). The scale captures the feeling of having insufficient resources to meet one’s needs, which measures the subjective evaluation and experience of economic scarcity. As mentioned

above, financial scarcity impacts cognitive resources and decisions made under financial scarcity. The following subsection deals with this topic.

2.3.2 Relationship between financial scarcity and cognitive biases

When faced with financial scarcity, people are more prone to displaying cognitive biases. This subsection will examine the relationship between financial scarcity and the three biases under study in the current dissertation: the present bias, optimism bias, and loss aversion.

Present bias

Financial scarcity, where an individual's financial resources are restricted, exacerbates the effects of present bias (Kremer et al., 2019). As noted in a previous section, scarcity, in general, not only leads to tunnel vision (Mullainathan & Shafir, 2014) but can also lead to a cycle of poor financial decisions that always prioritize immediate needs over future security. Additionally, scarcity leads to cognitive load, which further impairs financial decision-making, making it difficult for individuals to engage in future-oriented financial planning (Mani et al., 2013). The urgency of addressing current financial situations leads to low-income individuals taking out short-term, high-interest loans, which can be explained by the neglect of important future information (Bair, 2005; Bhutta et al., 2016). Choosing these loans may solve current problems, but their long-term costs make future expenses difficult to meet. This suggests that financial hardship can lead to a tendency to borrow, which may be reasonable in the short term but also overlooks the potential consequences in the future.

There is substantial evidence that financial scarcity exacerbates present bias (Brown & Previtero, 2014; Meier & Sprenger, 2010; Nguyen, 2016). For example, Brown and Previtero (2014) revealed that individuals with financial constraints tend to discount the future more heavily, showing a clear connection between financial scarcity and present bias. Furthermore, Meier & Sprenger (2010) indicate that individuals with a higher degree of present bias are more likely to make financial decisions, favoring immediate gratification over long-term benefits. Moreover, Nguyen (2016) shows that present-biased individuals often engage in actions like excessive borrowing and under-saving, which indicates poor financial decision-making.
Thus, given evidence that financial scarcity leads to more present bias and that present bias affects financial decision-making negatively, I predict that:

H1: Financial scarcity positively influences the degree of present bias, which in turn negatively impacts decision-making quality, indicating that present bias mediates the relationship between financial scarcity and decision-making.

Optimism bias

Previous evidence has shown that humans with scarce financial resources exhibit paradoxical behaviors (Sarial-Abi et al., 2023). They revealed that financial scarcity leads people to spend more on non-essential items instead of prioritizing essential ones. They have also found that individuals experiencing financial scarcity may take on debt for non-essential expenditures. Furthermore, Sarial-Abi et al (2023). concluded that individuals with limited resources are willing to engage in discretionary investing. Hence, according to these authors, these counterintuitive actions are only performed due to the optimistic future perception of financially restricted humans.

Nevertheless, it is important to consider a broader context of financial scarcity. The poverty trap literature shows that people in poverty often experience more depression, higher levels of anxiety, and negative emotions (Bennett & Corcoran, 2010; Mullainathan & Shafir, 2013). These factors reduce optimism and lead to more conservative financial decisions. This was also approved by Mani et al. (2013), who showed that financial limitations raise cognitive load and impair optimistic future-oriented thinking.

Despite this, optimism can still be present in times of financial scarcity. Usually, when System 2 (the reflective part of the mind) is loaded with limited resources, individuals automatically rely more on System 1 (the heuristic-driven part), leading to being more prone to biases, including optimism bias (Kahneman, 2011). This idea is also supported by the evidence Sarial-Abi et al. (2023) showed that individuals who experience financial scarcity could have a more optimistic future perception, leading to paradoxical financial behaviors.

In the realm of financial scarcity, where resources are limited, and the stakes of each decision are magnified, it is crucial to understand the impact of optimistic bias (Mullainathan & Shafir, 2013). I therefore derive the following hypothesis:

H2: Financial scarcity positively influences the degree of optimism bias, which in turn negatively impacts decision-making quality, indicating that optimism bias mediates the relationship between financial scarcity and decision-making.

Loss aversion

Tversky and Kahneman (1992) found that individuals facing financial limitations are more sensitive to potential losses, according to prospect theory. According to the theory, people tend to assign more significance to losses than gains. This principle becomes even more crucial in situations of financial scarcity, and individuals become averse to risk (Mullainathan & Shafir, 2013). Therefore, individuals facing financial limitations are more likely to exhibit loss aversion. They avoid decisions that could exacerbate their financial stress, even if those decisions also carry the possibility of improving their financial status (Li et al., 2012).

Existing literature supports the relationship between financial scarcity and loss aversion. For example, Shah, Mullainathan, and Shafir (2012) showed that financial scarcity intensives focus on immediate losses, leading individuals to become more loss-averse. This increased sensitivity to losses under financial scarcity makes individuals more risk-averse in their financial decisions.

Moreover, loss aversion impacts financial decision-making. Individuals who experience a high level of loss aversion are prone to avoiding potentially beneficial opportunities due to the fear of losses. Kahneman and Tversky (1979) pointed out that loss-averse individuals tend to make more suboptimal financial decisions by avoiding risks that could lead to potential long-term benefits. Therefore, given the facts that financial scarcity increases loss aversions and that loss aversions negatively impact financial decision-making, I predict that:

> *H3: Financial scarcity positively influences the degree of loss aversion, which in turn negatively impacts decision-making quality, indicating that loss aversion mediates the relationship between financial scarcity and decision-making.*

3. Methodology

This chapter presents the research methodology and starts by explaining the research design. Then, the participants are described. Afterward, the procedure and the measures used in the study are specified.

3.1 Research design

The primary aim of my thesis was to study the impact of financial scarcity on financial decision-making by investigating the mediating influence of cognitive biases. Thus, a correlational design was chosen to investigate whether participants exhibited increased cognitive biases and made different financial decisions when faced with financial scarcity. The correlation design follows a quantitative approach, which creates robust scientific knowledge (Babbie, 2020) and explores relationships within variables (Creswell, 2003). Therefore, the study was conducted through an online questionnaire created with Qualtrics, a widely recognized survey platform (Carpenter et al., 2019). The survey included five components: financial scarcity, present bias, optimism bias, loss aversion, and financial decision-making.

3.2 Participants

My study was distributed via various social media channels. I used Instagram, WhatsApp, and LinkedIn to reach my personal and professional network. In addition to these, I also used SurveyCircle and SurveySwap to extend the outreach of my personal network and recruit more participants. Participation in the survey was voluntary and anonymous, with no restrictions. To ensure the internal validity and clarity of the survey questions, a pre-test with a few (N = 5) family, friends, and colleagues was run before the survey was published on social media. The survey was online between April 24 and May 5 and gathered 174 responses. Participants had the chance to provide feedback after completing the survey. The total valid sample size was 123 out of the 150 completed surveys. The 27 missing surveys were excluded based on the failure of the attention check and identification of bot usage.

3.3 Procedure

The study consisted of five sections, each covering a different topic relevant to the study. First, participants were shown a welcome text and an informed consent form. After giving their informed consent, they were confronted with basic demographic questions. However, in the first section, they were also asked how financially literate they considered themselves to be. This served to self-assess their knowledge of the financial sector.

The order of the following blocks was randomly presented to participants. The randomization was used to reduce the influence of previous questions on the answers to subsequent questions. One block of the survey aimed to measure participants' perceived economic scarcity and included an attention check. Three further modules each dealt with a cognitive bias (present bias, loss aversion, and optimism bias). Additionally, one block focused on the participants' financial decision-making. The last section of the survey asked for feedback on the questionnaire or the study in general. The survey ended with a debriefing of the study and a thank-you text.

3.4 Variable measurement

The subsequent section details each variable that was studied, providing a description and explanation of its measurement.

3.4.1 Independent variable

Financial scarcity was the only independent variable in my study, which also represents a continuous variable. To differentiate between people who perceive financial constraints and those who do not, this independent variable has been used. For this reason, I relied on the Perceived Economic Scarcity Scale (PESS) developed by Auger, Sommet, and Normand (2024). This instrument is novel and, unlike other scales, explicitly focuses on subjective experiences rather than objective clues such as income. The PESS has high internal consistency and exceptional test-retest reliability (in the original study, Cronbach's $\alpha = .95$). Moreover, it provides a more significant predictive utility than income, indicating incremental validity beyond income (Auger et al., 2024). The PESS consists of nine items that measure the experience of subjective economic scarcity. Each item is scored on a 7-point Likert scale (1 = Strongly disagree; 7 = Strongly agree). For example, one item reads, "My income is not sufficient to make a decent living."

3.4.2 Dependent variable

Financial decision-making was the only dependent variable in my study, and it was continuous. The scale developed by the OECD (2023) was used to measure financial behavior. The study's general objective, conducted in 14 countries, was to understand financial education better. The study by the OECD focused on financial knowledge, behavior, and attitude across countries. I

decided to rely on the part about financial behavior and added 7 of the 8 items used by the OECD to my survey. I deleted one, "I tend to live for today and let tomorrow take care of itself," which had redundant phrasing with the present bias item. The remaining items dealt with a set of financial behaviors in various domains, including day-to-day situations related to spending, borrowing, saving, and money management (OECD, 2023). In terms of consistency, I adapted the 5-point Likert scale used by the OECD (2023) to a 7-point Likert scale (1 = *Strongly disagree*; 7 = *Strongly agree*). For example, one item reads, “I set long-term financial goals and strive to achieve them”.

3.4.3 Mediators

Present bias. Based on the study conducted by Pinger (2017), which relied on the 2006 measure elicited as part of the German Socio-Economic Panel Study (SOEP) time preference module, I used their single item to gauge participants’ importance of the present versus the future. The item contained a question asking to what extent the participants agreed to the following statement: “I live for today and do not worry about tomorrow.” Answers were given on a 7-point Likert scale, with 1 referring to complete disagreement and 7 to complete agreement. The variable acted as a mediator in this study.

Optimism bias. The study included an optimism scale with the aim of measuring participant's optimism. Scheier and Carver's (1985) Life Orientation Test (LOT) is widely used to assess optimism and pessimism. The tool measures individual differences in general expectancies for positive and negative outcomes. Since the tool was refined over the years, I relied on the LOT-Revised (LOT-R), which had improved psychometric properties. The original study provided a Cronbach’s α coefficient of reliability of .70 (optimism), .74 (pessimism), and .68 (total score). The LOT-R is a useful tool to study optimism bias since it provides a structured approach to examine the degree to which people hold a positive outlook toward future outcomes, which is crucial to understanding the bias. The participants were faced with three optimism and three pessimism-framed questions. Six items were measured by a 7-point Likert scale (1 = *Strongly disagree*; 7 = *Strongly agree*). For example, one item reads as follows “I’m always optimistic about my future”.

Loss aversion. This study included loss aversion to measure how participants weigh potential losses compared to equivalent gains. Therefore, I relied on the prospect theory developed by Kahneman and Tversky (1979) and used a simple lottery choice task from Gächter et al. (2022),

which pointed in the same direction. The participants could decide whether they wanted to accept (play) or reject (receive nothing) each of the six lotteries. The winning price in each lottery was fixed at 6€, and the losing price varied from 2€ to 7€. The change in the losing price with a constant winning price makes the lottery vary in its attractiveness.

3.4.4 Control variables

I included some control variables to provide more accurate estimates and conclusions from the analysis. Based on previous literature (Strömbäck et al., 2017), I used sociodemographic information as a control variable for my study. I considered the following information: gender, age, nationality, educational background, and employment status. Additionally, I considered self-assessed financial literacy as a further control variable, given the potential effect of financial knowledge on financial behavior (Lusardi & Mitchell, 2014). Participants were asked to provide their gender through a single-choice question with the option to self-describe. Age was queried by a blank field, and nationality was used as a drop-down. Educational background and employment status were checked using a single-choice question with the option to respond in a blank field. Whether participants had a high level of financial knowledge was analyzed using a 7-point Likert scale (1 = *Very low*; 7 = *Very high*).

4. Results

4.1 Descriptive statistics

The survey showed 174 filled-out surveys. I had to exclude 4 responses because they did not consent to participate. Furthermore, 39 responses were excluded either by not passing my attentional check ($N = 15$) or not finishing the survey ($N = 24$). In addition, the exclusion of the one completed survey via a bot was done by scanning all answers and identifying that all included answers within this specific survey were the same. Besides that, the lottery game included an attention check from previous research, resulting in the exclusion of seven participants. The exclusion was based on the answer from lottery 6, as this had a negative expectation value and should, therefore, logically be rejected by all participants.

The 123 surveys showed that 55.3% ($N = 68$) were male, 43.9% ($N = 54$) were female, and 0.8% ($N = 1$) did not want to state their gender. The age range of the participants was 19 to 57, with an average of 27 years old. A total of 33 countries took part in the survey. Most responses

came from Germany, with a share of 46.3% ($N = 57$), followed by Portugal with 7.3% ($N = 9$), and the United States of America with 5.7% ($N = 7$). Most participants were full-time workers, with $N = 56$ responses (45.5%), followed by students who counted 48 responses (39.0%). Forty-nine participants reported having a Bachelor's degree, 46 indicated having a Master's degree, and 17 had a high school degree. In addition, on average, the participants rated their level of financial literacy as moderately good ($M = 4.4$, $SD = 1.29$). For more detailed information, please see Appendix 2.

4.2 Scale reliability

Despite the fact that the reliability was tested in previous research (Auger et al., 2024; OECD, 2023; Schweizer et al., 1999), a reliability analysis was conducted to obtain Cronbach's α. The variables of perceived scarcity, optimism bias, and financial decision-making were measured on a multi-item scale. Before running the analysis, the scales were checked for reverse-coded items. The variable measuring optimism bias had three reverse-coded items (pessimism items) that had to be inverted to fit the optimism scale, as recommended in previous research (Schweizer et al., 1999). The reliability analysis for the financial scarcity scale provided a Cronbach's α of .89, and the optimism bias scale showed a Cronbach's α of .82. Meaning that both showed a high internal consistency between the items. Thus, it can be concluded that these two scales can be considered highly reliable (Vale et al., 1997). The scale of financial decision-making initially consisted of seven items. Running the reliability analysis with the original seven items, a Cronbach's α coefficient of 0.25 was obtained. This indicated that the scale with seven items was not reliable. For this reason, I excluded Item 5 from the scale, based on the inter-item-correlation matrix, which shows a low correlation between Item 5 and the other items. After deleting Item 5, Cronbach's α increased to .46. Since this coefficient is still unreliable enough, the whole process was repeated. After analyzing the Inter-Item-Correlation Matrix, I found that Item 7 had the lowest correlation and was eliminated, resulting in an α of.64. Therefore, this scale may likewise be regarded as reliable (Raharjanti et al., 2022). For more details on the inter-item correlation table and scale reliability, see Appendix 3.

4.3 Bivariate correlation

I constructed some dummy variables before running the bivariate correlations. Dummy variables were created for gender, nationality, educational background, and employment status. For gender, males were allocated a value equal to 1, and females had an indication of 0. The person who did not want to state their gender was excluded from the measure. The majority of responses came from Germany; therefore, I decided to allocate them to 1; the rest was merged to 0 since all other nationalities had less than 10 responses. Two dummy variables were created to represent employment status: one for full-time employees, coded as 1, and the other for students, coded as 1. All other employment statuses were coded as 0. The same was done for education: one dummy allocated participants who held a bachelor's degree to the value of 1, and the rest were merged to the value of 0. The same was done for the Master's degree. I checked some of the crucial variables for normal distribution to decide which bivariate correlation to use. Since the variables of financial decision-making, optimism bias, and the loss aversion scale indicated that they were not normally distributed (Appendix 4), I used the Spearman correlation in SPSS for all variables to determine the correlation between each variable, as shown in. The primary interest of the correlation was to get a first initial idea of the relationship between all variables. According to the correlations, the present bias did not indicate any correlation with any other biases, but it has a significant correlation with financial decision-making and the self-assessed financial knowledge of each participant. It seems that present bias and financial scarcity were unrelated. Optimism bias, in contrast, is related to both financial scarcity and financial decision-making but is not significantly correlated to one of the other biases. Loss aversion showed no correlation at all with other variables. In addition, what stands out in the correlation matrix is that financial literacy significantly correlates with various variables, such as gender, employment status, educational level, present bias, financial scarcity, and financial decision-making (see Table 2).

Table 2:

Bivariate Spearman correlation of all variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Age	--													
2. Gender_Dummy	-.01	--												
3. Germany_Dummy	.07	.14	--											
4. Fulltime_Dummy	.39**	.13	.20*	--										
5. Student_Dummy	-.35**	-.21*	-.21*	-.73**	--									
6. Bachelor_Dummy	-.13	-.13	.01	-.38**	.30**	--								
7. Master_Dummy	.18*	.11	.09	.41**	-.31**	-.63**	--							
8. Presen Bias	.04	-.11	.03	-.05	.15	.12	-.28**	--						
9. Present Bias_Dummy	.05	-.04	.06	.03	.01	.00	-.10	.72**	--					
10. Financial Scarcity	-.01	-.14	-.21*	-.33**	.20*	.16	-.16	.03	.04	--				
11. Financial Decision-Making	-.05	.29**	.18*	.08	-.16	-.03	.21*	-.45**	-.28**	-.11	--			
12. Optimism Bias	-.08	.16	.17	.04	-.03	-.07	.12	-.03	-.07	-.33**	.22*	--		
13. Loss aversion	.04	-.22*	-.09	-.08	.04	-.06	-.03	.00	.01	.11	-.01	-.06	--	
14. How would you rate your level of financial literacy?	.05	.28**	.05	.29**	-.29**	-.123	.27**	-.27**	-.09	-.33**	.32**	.12	-.01	--

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

4.4 Hypothesis testing

4.4.1 Model specification

This section is dedicated to hypothesis testing. To test H1-H3, I utilized the PROCESS macro for SPSS, developed by Hayes. I selected Model 4 of the macro as it enabled me to conduct a mediation analysis (Refer to Figure 2).

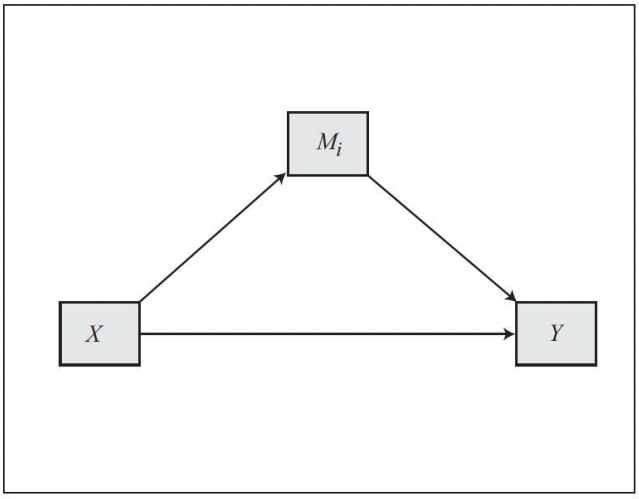

Figure 2: *Model 4 of Hayes PROCESS macro (Hayes, 2018)*

Hayes' Model 4 examines the indirect effect of X on Y, which is mediated by the mediator M. I added two more mediators to Model 4 for my dissertation, resulting in a parallel mediator model. In this dissertation, X represents financial scarcity, and the dependent variable Y has been replaced by financial decision-making. Furthermore, the mediators M were represented by the three biases: present bias, optimistic bias, and loss aversion (Figure 3). Moreover, I added gender, financial literacy, the nationality dummy (0 = Rest, 1 = Germany), and the educational dummy for the master's degree (0 = Rest, 1 = Master's degree), as covariates.

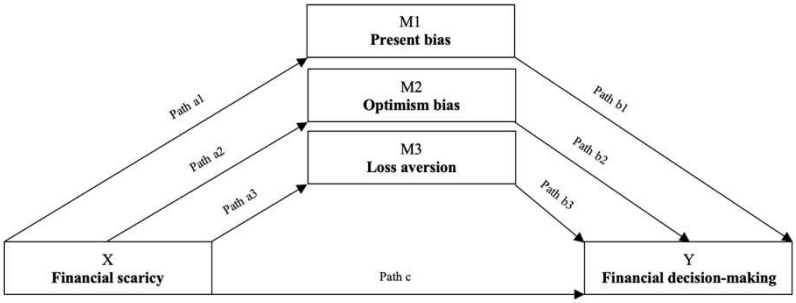

Figure 3*: Adapted model 4, including the variables of this study*

4.4.2 Model results

I divided the model into sub-models to test if the biases mediate the relationship between X and Y. First, I analyzed the effect of X on M1/M2/M3 (i.e., paths a1/a2/a3). These paths treated the biases as the outcome variable. The results showed that financial scarcity neither significantly affects the present bias, b = -0.68, SE = 0.11, p = .535, nor the loss aversion variable, b = 0.09, SE = 0.11, p = .430. In contrast, optimism bias is significantly related to financial scarcity, which leads to less optimism bias, b = -0.27, SE = 0.08, p < .001. This means that individuals who perceive financial limitations will be less susceptible to optimism bias. Moreover, no significant impact of any covariate in the relationship between financial scarcity and optimism bias was detected.

Secondly, I analyzed the second sub-model, which refers to the paths b1, b2, and b3 and describes the effect of the three biases on financial decision-making. In addition, this sub-model examined the relationship between financial scarcity and financial decision-making, which corresponds to path c and defines the direct effect. Starting with the direct effect (path c), the results showed that financial scarcity has a small positive but insignificant impact on financial decisions, b = 0.24, SE = 0.06, p = .696. In terms of the relationship between the biases and the financial decision-making, two biases significantly impacted the financial decisions. Optimism bias significantly affects financial decision-making positively with the parameters: b = 0.18, SE = 0.07, p < .001. This means that people who experience more optimism, resulting in a higher optimism bias, tend to score better in financial decision-making, meaning that they make better financial decisions. Furthermore, present bias also connects with financial decision-making in a statistically significant way. The negative correlation (b = -0.21, SE = 0.05, p < .001) indicates that present-biased individuals tend to make suboptimal financial decisions. The last bias, loss aversion, does not significantly impact financial decisions, b = 0.03, SE = 0.05, p < .483.

However, to directly test the mediating role of biases in linking financial scarcity with financial decision-making, the indirect effect of X and Y mediated by M is crucial for the analysis. The model shows that only one bias has a mediating role., optimism bias, with b = -.05, SE = 0.02, 95% CI = [-0.10, -0.01]. Present bias counts for b = 0.01, SE = 0.02, 95% CI = [-0.03, 0.06] and loss aversion, b = 0.00, SE = 0.01, 95% CI = [-0.01, 0.02], which implies that these two biases have no mediating role in this model as their effects' confidence intervals include zero.

Additionally, the results of the model show that the covariate financial literacy has a significant impact on financial decision-making, $b = 0.15$, $SE = 0.06$, $p < .01$ and present bias, $b = -0.29$, $SE = 0.11$, $p < .01$. This implies that individuals who perceive themselves as having better financial literacy make better financial decisions and are less susceptible to being presently biased. Gender also significantly affects financial decision-making, $b = 0.29$, $SE = 0.15$, $p = .05$. Considering the dummy and that being a man accounts for a value equal to 1, it can be determined that being a man positively influences making financial decisions.

In conclusion, financial scarcity influences financial decision-making indirectly, primarily through the optimism bias variable, with optimism bias positively affecting financial decision-making. Present bias also has a crucial impact on financial decision-making, but its mediation role is insignificant. The loss aversion variable does not significantly mediate any effect. Therefore, H1 and H3 are not supported. Moreover, as stated above, financial scarcity has a negative effect on financial decision-making mediated by optimism bias, which is in accordance with the prediction of H2, but the relationship between these variables is the reverse of what H2 predicted: financial scarcity has a negative impact on optimism bias which then has a positive impact on financial decision-making. Thus, H2 is rejected since the predicted effect was the opposite of what I found.

Covariates such as gender and financial knowledge play a notable role in directly affecting some mediators and financial decision-making. See Appendix 5 for the full results of the mediating model.

5. Discussion

After running the analysis, I will first summarize the statistical model's results. This chapter will also cover the academic and managerial implications, limitations, and potential future research.

5.1 Results overview

The field of behavioral finance has gained importance in the last couple of years, especially in investigating cognitive biases in the context of financial scarcity and financial decision-making

(Van der Veer et al., 2024). Previous research analyzed the direct effect of cognitive biases on financial decision-making or looked closely at the relationship between cognitive biases and financial decision-making (Mani et al., 2013; Sarial-Abi et al., 2023). Therefore, the objective of this dissertation was to close a research gap by analyzing the mediating role of three cognitive biases, particularly present bias, optimism bias, and loss aversion, in the relationship between financial scarcity and financial decision-making. This led me to three different hypotheses, which were tested using a quantitative correlational design.

Using a parallel mediation model, I aimed to analyze the mediating role of present bias, optimism bias, and loss aversion to answering the previously established hypotheses. The results of the model showed that financial scarcity did not affect present bias in a significant way, which was in contrast to some theoretical predictions, which were of the idea that scarcity exacerbates present bias (Laibson, 1997; Thaler & Shefrin, 1981). In addition, financial scarcity and loss aversion results also diverge from previous research since the results did not show increased sensitivity to potential losses, as Haushofer and Fehr (2014) observed. Moreover, the study showed that financial scarcity affected optimism bias significantly negatively, which aligns with the previous theory by De Bruijn and Antonides (2022), who pointed to the poverty trap. In addition, the study found that financial scarcity had a small positive effect on financial decisions, but the effect was insignificant. This means that the impact of scarcity alone did not worsen the quality of financial decision-making. This finding does not align with predictions from previous research, which pointed out that the cognitive load imposed by scarcity impairs people's ability to think clearly and make adequate decisions (Mullainathan & Shafir, 2013).

Based on previous studies, I predicted in H1 that individuals who perceive financial scarcity will be more present biased, which in turn negatively affects the financial decision-making process. Contrary to these expectations, the study found that individuals do not focus on immediate gratification, which then ignores long-term opportunities. Therefore, the study did not support H1.

Next, I looked for the mediating effect of optimism bias. H2 predicted that optimism bias would mediate the effect of financial scarcity on financial decision-making, meaning that a higher level of optimism would decrease financial decision-making. Based on the results, H2 was rejected even though the model showed a significant negative mediating effect because the predicted relationships between the variables contrasted with the findings. Even though the

results showed the opposite of what H2 predicted, some existing literature aligns with this study's findings. Previous research has shown that poverty and, therefore, financial scarcity are associated with negative emotions, such as anxiety and depression (Haushofer & Fehr, 2014; Hilbert et al., 2022a, 2022b; Shah et al., 2019). It was also found that optimism is negatively associated with depression and stress (Kleiman & Alloy, 2017). Moreover, studies from Bennett and Corcoran, (2010) and Vázquez (1987) strengthen the finding of the negative relationship between these two variables since they found that individuals who experience depression, anxiety, etc. (provoked by poverty) act in a more rational way and, therefore they are unlikely to be optimistic. Thus, it makes sense that financial scarcity is related to a lower, not higher, optimism bias. Furthermore, previous research by Puri and Robinson (2007) also supports the positive link between optimism bias and financial decision-making. The study highlights that optimism bias, whether in a private or business environment, individuals perceive positive future financial stability outcomes, which encourages them to make financial decisions that are in accordance with long-term financial health. Thus, it also makes sense that optimism bias is related to better, not worse, financial decision-making.

Based on the results, H3 could not be accepted because loss aversion was insignificant as a mediator. Although no previous studies support this mediation, the hypothesis was based on the direct relationship between financial scarcity and loss aversion (Tversky & Kahneman, 1992). The findings did not emphasize that loss aversion plays a crucial mediating role, possibly due to the hypothetical gamble the participants were exposed to. Losing money in a fictive world is not comparable to real-world circumstances.

Furthermore, the covariate of financial literacy significantly impacted financial decision-making, which in turn means that higher financial knowledge contributes to better financial decisions, which aligns with the findings of Lusardi and Mitchell (2014). Additionally, the effect of gender, as a covariate on financial decision-making was likewise significant, which in turn means that being a man ends in better financial decisions compared to a woman. This, in turn, is attributed again to financial literacy, which aligns with the paper by Bucher-Koenen et al. (2017), which found that women display lower financial literacy and confidence than men, leading to worse financial decisions.

5.2 Academic and managerial implications

Although the study results are limited and insignificant, they provide valuable insights from an academic and practical perspective. The area of behavioral finance, which connects cognitive psychology, economics, and finance, is an ongoing topic that explains irrational decision-making (Ricciardi, 2008). For this reason, future research is recommended, as cognitive psychology is a complex and broad subject. The dissertation highlights the impact of financial scarcity on cognitive biases and decision-making and builds a bridge between cognitive psychology and economic behavior. The study underlies the often counterintuitive way in which humans tend to make decisions, which is all based on financial limitations and challenges traditional economic models that rely on rational decision-making. This, in turn, shows how real-world financial restrictions change normal financial behavior. Furthermore, an approach could be used to develop a more detailed model that accounts for more biases, maximizing the model's overall effectiveness. In addition, the study contributes to the existing literature that not only cognitive biases play a crucial role in the interplay between financial scarcity and decision-making but also control variables such as financial literacy and gender, which are big factors in explaining the relationship. This could be kept in mind to develop a more sophisticated model.

Even if the study's findings diverge from the predicted outcomes, it brings managerial implications. First, the lack of a significant relationship between financial scarcity and present bias challenges existing studies, which assumed that scarcity exacerbated immediate gratification tendencies (Thaler & Shefrin, 1981). This suggests that financial scarcity does not always lead to poorer financial decisions via increased present bias. It suggests that it is a more complex process, which also must consider personal conditions and contextual factors that might influence the decision-making (Sachdeva & Lehal, 2023). Moreover, the absence of a link between financial scarcity and loss aversion implies that individuals facing financial limitations are not necessarily more sensitive to potential losses. This implies that not only the fact of financial constraints plays a role but also the fact of personal risk tolerance (Tom et al., 2007). Additionally, the significant finding is the mediating role of optimism bias, whereby financial scarcity reduces optimism bias, positively affecting financial decision-making. This insight underscores the importance of strengthening the balance between optimism and realism, which helps individuals make better financial decisions. Furthermore, the results of the study highlight the importance of addressing gender differences in financial decision-making. Since men and women show different levels of financial literacy and confidence, personalized

financial training that considers this can be beneficial. For example, targeted educational initiatives that aim to improve financial literacy among women could help close the gap, leading to more informed, effective, and rational financial decisions.

5.3 Limitations

The study contributed to understanding cognitive biases in the context of financial scarcity and financial decision-making. Nevertheless, besides providing valuable insights, it also revealed some limitations that must also be addressed.

The first limitation to mention was the sample size and diversity of responses collected by the survey due to financial and time constraints. The sample size may not capture all important information about financial behavior through different demographics (Babbie, 2020). Furthermore, the majority of the sample came from Germany, which limits the degree of generalizability of the results to other cultural background contexts (Hofstede, 2001). Moreover, using a survey only recruited participants from my personal network. All of these mentioned points limited the depth of data collection and affected the findings (Fowler Jr, 2013).

The second limitation of my study was the measurement of the variables, particularly the composition of the cognitive biases. On the one hand, present bias and optimism bias were captured through a simple self-assessed item, which may not fully capture the complexity of the bias per se (Robinson et al., 2013). Furthermore, the responses given by the participants could have been biased from the beginning since they wanted to fit in specific criteria (e.g., participants might report lower levels of present bias to appear more self-disciplined and forward-thinking than they actually are) or had an inaccurate self-assessment (Furnham, 1986; Schwarz, 1999). Moreover, the present bias was only measured by one item, limiting the quality of measuring the bias.

In addition, the third possible limitation was that the study only captured a snapshot in the limited time frame influenced by the survey. It did not capture how financial scarcity and decision-making might evolve over different periods. For instance, financial scarcity might impact cognitive biases differently in different periods of economic stability. Furthermore, the study controlled for variables like financial literacy but did not include other disruptive factors

such as previous financial education or personal income, which could significantly impact financial decision-making behavior (Hastings et al., 2013).

The last limitation I want to raise, which could impact the results and might negatively impact the study's accuracy, is the measurement of financial scarcity. Financial scarcity was measured via a perceived subjective self-assessment scale. The self-assessment, as with the present bias, leads to possible biases and may not reflect the actual financial scarcity of the participants. This leads to the problem or limitation that financial scarcity was not measured objectively based on real financial conditions such as salary, debt ratios, etc., leading to lack of accuracy.

5.4 Future research

As stated in the previous chapter, the study had some limitations that can be avoided in future research. I suggest extending the sample size for this type of topic by sharing it not only through personal networks. This, in turn, would guarantee better generalizability of the findings by including a wider variety of countries and cultural backgrounds (Gustavson et al., 2012). Building up on that, longitudinal research would also help in understanding the dynamics of how financial scarcity impacts cognitive biases and financial decision-making over time (Teague et al., 2018). This would generate a better comprehension of the relationship between the variables. Another interesting point I would like to raise is that future research could integrate a qualitative approach besides the survey. This could provide a deeper understanding of the cognitive processes underlying financial decision-making under scarcity instead of relying only on self-assessment scales (Polit & Beck, 2010). Moreover, the study could be expanded in the future by including more cognitive biases. Adding more biases could provide a deeper understanding of the psychological impacts of financial scarcity. Addressing these possibilities for future research purposes can help the field of behavioral finance develop a more robust understanding, which in turn could support better financial decisions in the future.

6. Conclusion

As decision-making and particularly financial behavior are integrated into our lives, it is crucial to understand why humans make several irrational decisions. This dissertation has contributed to the relevant research of connecting financial behavior with cognitive psychology. The study's

findings showed that financial scarcity changes cognitive biases, conversely leading to suboptimal financial decisions. Furthermore, traditional theories were challenged which relied on rational decision-making. Nevertheless, the limitations of the study make it essential to investigate further if perhaps the combination of cognitive biases or including more biases mediates the impact on decision-making.

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Appendix

Appendix 1: Research Survey

Q1 Informed consent

WELCOME AND THANK YOU FOR PARTICIPATING!

Welcome, and thank you for participating in this survey on how people make decisions about their finances and what may predict these decisions. I, Adrian Suarez Gaitan, am conducting this survey as part of my master's thesis at Católica Lisbon School of Business and Economics under the supervision of Prof. Cristina Mendonça. It will take around 5 minutes to complete. Your participation will contribute to understand financial decision making. Please answer as honestly as possible. There are no "right" or "wrong" answers. Your responses will be anonymous and confidential and only be used for research purposes. The participation in this survey is voluntary and can be stopped by you anytime by closing the web page.

If you have concerns or questions about this study, please contact me: Adrian Suarez Gaitan (s-agaitan@ucp.pt)

Q1 Do you consent to participate in this study?

- ○ I consent (1)
- ○ I do no consent (2)

Q2 Gender What is your gender?

- ○ Male (1)
- ○ Female (2)
- ○ Prefer to self-describe (5) _____
- ○ Prefer not to say (4)

Q3 Age How old are you?

_____

Q4 Nationality What is your nationality?

▼ Afghanistan (1) ... Zimbabwe (1357)

Q5 What is the highest level of education you have completed or the highest degree you have received?

- ○ Less than high school degree (1)
- ○ High school degree (2)
- ○ Associate degree (3)
- ○ Professional degree (4)
- ○ Bachelor's degree (5)
- ○ Master's degree (6)
- ○ Doctoral degree (7)
- ○ Other, please specify (8) _____

Q6 What best describes your employment status?

- ○ Working full-time (1)
- ○ Working part-time (2)
- ○ Unemployed and looking for work (3)
- ○ A homemaker or stay-at-home parent (4)
- ○ Student (5)
- ○ Retired (6)
- ○ Other, please specify (7)

Q7 How would you rate your level of financial literacy?

- ○ Very low (1)
- ○ Low (2)
- ○ Somewhat low (3)
- ○ Moderate (4)
- ○ Somewhat high (5)
- ○ High (6)
- ○ Very High (7)

For the main part of this survey, we will now ask you a series of questions related to decision making. Please answer them as honestly as possible.

Q8 Please indicate to what extent you agree with the following sentences:

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
I do not have enough money to cover monthly expenses (1)	○	○	○	○	○	○	○
My income is not sufficient to make a decent living (2)	○	○	○	○	○	○	○
I am struggling to pay my bills and other essentials (3)	○	○	○	○	○	○	○
I have less money than I feel I need (4)	○	○	○	○	○	○	○
I feel the burden of missed or late payments weighing down on me (5)	○	○	○	○	○	○	○
My income is scarce compared to others (6)	○	○	○	○	○	○	○
I worry about not having enough money (7)	○	○	○	○	○	○	○
Please select "somewhat agree" to show you paying attention to this question (8)	○	○	○	○	○	○	○
I cannot help but think about lack of money (9)	○	○	○	○	○	○	○
Having limited income and saving makes me unsure about my future (10)	○	○	○	○	○	○	○

60 **Q9 Please indicate to what extent you agree with the following statement:**

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
I live for today and do not think about tomorrow (2)	○	○	○	○	○	○	○

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62 **Q10 Please indicate to what extent you agree with the following sentences:**

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
I'm always optimistic about my future (1)	○	○	○	○	○	○	○
In uncertain times, I usually expect the best (2)	○	○	○	○	○	○	○
If something can go wrong for me, it will (3)	○	○	○	○	○	○	○
I hardly ever expect things to go my way (4)	○	○	○	○	○	○	○
I rarely count on good things happening to me (5)	○	○	○	○	○	○	○
Overall I expect more good things to happen to me than bad (6)	○	○	○	○	○	○	○

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Q11 In the following table you find a list of coin tosses with different payoffs. The payoffs differ in how much you lose if the coin turns up heads. For each row you need to indicate whether you want to toss the coin or not.

1. If the coin turns up heads, then you lose €2; if the coin turns up tails, you win €6. (1)	○ I don't want to toss the coin (1)	○ I do want to toss the coin (2)
2. If the coin turns up heads, then you lose €3; if the coin turns up tails, you win €6. (2)	○ I don't want to toss the coin (1)	○ I do want to toss the coin (2)
3. If the coin turns up heads, then you lose €4; if the coin turns up tails, you win €6. (3)	○ I don't want to toss the coin (1)	○ I do want to toss the coin (2)
4. If the coin turns up heads, then you lose €5; if the coin turns up tails, you win €6. (4)	○ I don't want to toss the coin (1)	○ I do want to toss the coin (2)
5. If the coin turns up heads, then you lose €6; if the coin turns up tails, you win €6. (5)	○ I don't want to toss the coin (1)	○ I do want to toss the coin (2)
6. If the coin turns up heads, then you lose €7; if the coin turns up tails, you win €6. (6)	○ I don't want to toss the coin (1)	○ I do want to toss the coin (2)

Q12 Please indicate to what extent you agree with the following sentences:

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (8)	Neither agree nor disagree (3)	Somewhat agree (4)	Agree (5)	Strongly agree (6)
Before I buy something I carefully consider whether I can afford it (5)	○	○	○	○	○	○	○
I pay my bills on time (6)	○	○	○	○	○	○	○
I keep a close personal watch on my financial affairs (1)	○	○	○	○	○	○	○
I set long term financial goals and strive to achieve them (4)	○	○	○	○	○	○	○
I find it more satisfying to spend money than to save it for the long term (7)	○	○	○	○	○	○	○
I am prepared to risk some of my own money when saving or making an investment (12)	○	○	○	○	○	○	○
Money is there to be spent (13)	○	○	○	○	○	○	○

Q13 Do you have any comments you would like to share with the researcher? If so, please write them in the box below. Otherwise, leave it blank.

_____

Appendix 2: Demographics

Descriptive statistics for age

	N	Minimum	Maximum	Mean	Std. Deviation
Age	123	19	57	26.68	5.679
Valid N (listwise)	123				

Descriptive Statistics for financial literacy

	N	Minimum	Maximum	Mean	Std. Deviation
How would you rate your level of financial literacy?	123	1.00	7.00	4.3659	1.288463
Valid N (listwise)	123				

Frequency table for education

	N	%
Associate degree	1	0.8%
Bachelor's degree	49	39.8%
Doctoral degree	2	1.6%
High school degree	17	13.8%
Master's degree	46	37.4%
Other, please specify	5	4.1%
Professional degree	3	2.4%

Frequency table for employment status

	N	%
Other	5	4.1%
Student	48	39.0%
Unemployed	6	4.9%
Working full-time	56	45.5%
Working part-time	8	6.5%

Frequency table for gender

	N	%
Female	54	43.9%
Male	68	55.3%
Prefer not to say	1	0.8%

Frequency table of nationality

	N	%
Australia	1	0.8%
Austria	2	1.6%

Bosnia and Herzegovina	1	0.8%
Canada	2	1.6%
China	1	0.8%
Croatia	4	3.3%
Denmark	1	0.8%
Egypt	1	0.8%
El Salvador	2	1.6%
Finland	1	0.8%
France	2	1.6%
Germany	57	46.3%
Greece	1	0.8%
Guatemala	3	2.4%
Honduras	1	0.8%
Hungary	1	0.8%
India	2	1.6%
Italy	4	3.3%
Malaysia	1	0.8%
Netherlands	1	0.8%
Nigeria	1	0.8%
Norway	2	1.6%
Pakistan	2	1.6%
Peru	1	0.8%
Philippines	2	1.6%
Poland	2	1.6%
Portugal	9	7.3%
Romania	1	0.8%
Spain	1	0.8%
Sweden	2	1.6%
Turkey	1	0.8%
United Kingdom of Great Britain and Northern Ireland	3	2.4%
United States of America	7	5.7%

Appendix 3: Scale reliability

As stated in the main text, I used Cronbach's alpha to measure the scale reliability for financial scarcity, optimism bias, and financial decision making as these variables were the only scales within my study.

Cronbach's alpha: Financial Scarcity

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.89	.89	9

Cronbach's alpha: Optimism bias

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.82	.82	6

Cronbach's alpha: Financial decision-making

The scale of financial decision-making was initially unreliable, as evidenced by the table below. After reviewing the inter-item correlation matrix, I removed item 5 due to its weak correlation with all variables.

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.25	.28	7

Inter-Item Correlation Matrix

	FDM_1_num	FDM_2_num	FDM_3_num	FDM_4_num	FDM_5_num	FDM_6_num	FDM_7_num
FDM_1_num	1.00	.28	.38	.29	-.37	.05	-.27
FDM_2_num	.28	1.00	.40	.15	-.24	.24	-.10
FDM_3_num	.38	.40	1.00	.53	-.33	.07	-.25
FDM_4_num	.29	.15	.53	1.00	-.25	.24	-.20
FDM_5_num	-.37	-.24	-.33	-.245	1.00	-.03	.53
FDM_6_num	.05	.24	.07	.24	-.03	1.00	-.00
FDM_7_num	-.27	-.10	-.25	-.20	.53	-.00	1.00

Cronbach's alpha: Financial decision making

Since the reliability was still weak, I decided to repeat the procedure. This identified that item 7 needed to be excluded to achieve higher reliability..

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.46	.45	6

Inter-Item Correlation Matrix

	FDM_1_num	FDM_2_num	FDM_3_num	FDM_4_num	FDM_6_num	FDM_7_num
FDM_1_num	1.00	.28	.38	.29	.05	-.27
FDM_2_num	.28	1.00	.40	.15	.24	-.10
FDM_3_num	.38	.40	1.00	.53	.07	-.25
FDM_4_num	.29	.15	.53	1.00	.24	-.20
FDM_6_num	.05	.24	.07	.24	1.00	-.00
FDM_7_num	-.27	-.10	-.25	-.20	-.00	1.00

Cronbach's alpha: Financial decision making

After deleting item 5 and item 7 the scale showed reliability.

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.64	.64	5

Appendix 4: Check for normal distribution

As stated before, I checked the four different variables (FS = Financial Scarcity, FDM = Financial decision-making, OP = Optimism bias, LA_Scale = Loss aversion) for normal distribution. Therefore, I used the Skewness and Kurtosis values, which indicate whether a variable is normally distributed. For a perfect normal distributed variable, Skewness and Kurtosis would have the value of zero. As can be seen, the values of the tested variables diverge from zero. Thus, it can be assumed that the variables are not normally distributed.

Statistics

		FS	FDM	OP	LA_Scale
N	Valid	123	123	123	123
	Missing	0	0	0	0
Skewness		.35	-.77	-.60	.00
Std. Error of Skewness		.22	.22	.21	.21
Kurtosis		-.29	.85	.23	-.68
Std. Error of Kurtosis		.43	.43	.43	.43

In addition, I tested the normal distribution through the Kolmogorov Smirnov and Shapiro Wilk test. Both tests test with the null hypothesis that there is a normal distribution. The variables are normally distributed if the significance is above .05. As can be observed in the table below, all of the variable's values are below .05, except financial scarcity.

In conclusion it can be said, that the variables are not normally distributed, therefore I chose the Spearman Correlation.

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
FS	.081	123	.048	.982	123	.100
FDM	.128	123	<.001	.960	123	.001
OP	.098	123	.006	.970	123	.008
LA_Scale	.194	123	<.001	.928	123	<.001

a. Lilliefors Significance Correction

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Appendix 5: Testing hypothesis H1-H3 with Hayes PROCESS macro (Model 4 – Parallel mediation model)

```
Run MATRIX procedure:
***************** PROCESS Procedure for SPSS Version 4.2 *****************

          Written by Andrew F. Hayes, Ph.D.       www.afhayes.com
    Documentation available in Hayes (2022). www.guilford.com/p/hayes3

**************************************************************************
Model  : 4
    Y  : FDM
    X  : FS
   M1  : OP
   M2  : PB_num
   M3  : LA_Scale
Covariates:
 GER_bin  Gender_d MA_d     FL_num
Sample
Size:  122
**************************************************************************
OUTCOME VARIABLE:
 OP
Model Summary
```

```
          R       R-sq        MSE          F        df1        df2          p
      .3988       .1590     1.0126     4.3869     5.0000   116.0000       .0011

Model
             coeff         se          t          p       LLCI       ULCI
constant    5.4187       .5099    10.6277       .0000     4.4088     6.4285
FS          -.2712       .0798    -3.3961       .0009     -.4293     -.1130
GER_bin      .2245       .1889     1.1879       .2373     -.1498      .5987
Gender_d     .2771       .1949     1.4221       .1577     -.1088      .6631
MA_d         .0982       .1952      .5032       .6158     -.2884      .4848
FL_num      -.0167       .0802     -.2082       .8355     -.1755      .1422

************************************************************************
OUTCOME VARIABLE:
 PB_num

Model Summary
          R       R-sq        MSE          F        df1        df2          p
      .3578       .1280     1.9139     3.4052     5.0000   116.0000       .0066

Model
             coeff         se          t          p       LLCI       ULCI
constant    4.7237       .7010     6.7389       .0000     3.3353     6.1120
FS          -.0683       .1098     -.6218       .5353     -.2857      .1492
GER_bin      .1844       .2598      .7097       .4793     -.3301      .6988
```

```
Gender_d     -.0413      .2679     -.1540      .8779     -.5719      .4894
MA_d         -.6058      .2684    -2.2575      .0258    -1.1373     -.0743
FL_num       -.2920      .1103    -2.6484      .0092     -.5104     -.0736

*************************************************************************
OUTCOME VARIABLE:
 LA_Scale

Model Summary
          R       R-sq        MSE          F        df1        df2          p
      .2275      .0518     1.9252     1.2662     5.0000   116.0000      .2833

Model
              coeff         se          t          p       LLCI       ULCI
constant     2.2234      .7030     3.1627      .0020      .8310     3.6158
FS            .0871      .1101      .7911      .4305     -.1310      .3052
GER_bin      -.1572      .2605     -.6034      .5474     -.6732      .3588
Gender_d     -.5604      .2687    -2.0855      .0392    -1.0926     -.0282
MA_d         -.0268      .2691     -.0995      .9209     -.5599      .5063
FL_num        .0681      .1106      .6157      .5393     -.1509      .2871

*************************************************************************
OUTCOME VARIABLE:
 FDM
```

```
Model Summary
          R       R-sq        MSE          F        df1        df2          p
      .6090      .3708      .5414     8.3254     8.0000   113.0000      .0000

Model
              coeff         se          t          p       LLCI       ULCI
constant     3.8743      .5905     6.5607      .0000     2.7044     5.0443
FS            .0241      .0615      .3918      .6959     -.0977      .1458
OP            .1798      .0679     2.6466      .0093      .0452      .3144
PB_num       -.2101      .0494    -4.2524      .0000     -.3080     -.1122
LA_Scale      .0346      .0493      .7032      .4834     -.0630      .1322
GER_bin       .2610      .1395     1.8707      .0640     -.0154      .5373
Gender_d      .2878      .1463     1.9673      .0516     -.0020      .5776
MA_d          .0273      .1460      .1872      .8518     -.2618      .3165
FL_num        .1500      .0605     2.4799      .0146      .0302      .2698

************************** TOTAL EFFECT MODEL ****************************
OUTCOME VARIABLE:
 FDM

Model Summary
          R       R-sq        MSE          F        df1        df2          p
      .4738      .2245      .6501     6.7156     5.0000   116.0000      .0000

Model
```

	coeff	se	t	p	LLCI	ULCI
constant	3.9330	.4085	9.6272	.0000	3.1238	4.7421
FS	-.0073	.0640	-.1143	.9092	-.1340	.1194
GER_bin	.2571	.1514	1.6985	.0921	-.0427	.5570
Gender_d	.3269	.1561	2.0935	.0385	.0176	.6361
MA_d	.1714	.1564	1.0957	.2755	-.1384	.4811
FL_num	.2107	.0643	3.2790	.0014	.0834	.3380

********** TOTAL, DIRECT, AND INDIRECT EFFECTS OF X ON Y **********

Total effect of X on Y

Effect	se	t	p	LLCI	ULCI
-.0073	.0640	-.1143	.9092	-.1340	.1194

Direct effect of X on Y

Effect	se	t	p	LLCI	ULCI
.0241	.0615	.3918	.6959	-.0977	.1458

Indirect effect(s) of X on Y:

	Effect	BootSE	BootLLCI	BootULCI
TOTAL	-.0314	.0339	-.1008	.0336
OP	-.0488	.0245	-.1037	-.0082
PB_num	.0143	.0224	-.0266	.0618
LA_Scale	.0030	.0083	-.0118	.0236

```
(C1)         -.0631      .0331     -.1346     -.0038
(C2)         -.0518      .0262     -.1097     -.0071
(C3)          .0113      .0242     -.0350      .0624

Specific indirect effect contrast definition(s):
(C1)          OP        minus   PB_num
(C2)          OP        minus   LA_Scale
(C3)          PB_num    minus   LA_Scale

************************ ANALYSIS NOTES AND ERRORS ************************

Level of confidence for all confidence intervals in output:
  95.0000

Number of bootstrap samples for percentile bootstrap confidence intervals:
  5000

------ END MATRIX -----
```

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