

Evaluating the Impact of
Commitment and Flexibility Preferences
on the Saving Behaviour of
Individuals who Perceive Financial Scarcity

BY

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This thesis is dedicated to Kara: may you always find big dreams to chase and enjoy your learnings along the way.

Abstract

This study tests and explains how the opposing preferences for commitment and flexibility impact the saving behaviour of individuals who perceive financial scarcity in South Africa. Those who perceive financial scarcity need to save to reduce the risk of unexpected financial burdens, for increased financial resilience and to accumulate assets. In this context, saving behaviour requires decision-making over time and under uncertainty. Prior research indicates that individuals are prone to present bias and certainty-effect bias under these conditions, which impact their saving behaviour adversely. Evidence also suggests that these biases drive opposing preferences for commitment to save, but also for flexibility to access savings under uncertain conditions.

The interaction between commitment and flexibility preferences in saving behaviour is not well understood and requires further research in different contexts and subgroups. Thus, this study primarily contributes to intertemporal choice under uncertainty literature as it relates to saving behaviour when financial scarcity is perceived. Additionally, the study informs practice on appropriate interventions and behavioural design elements for services and products offered specifically to this customer segment.

The impact of hard and soft, or more flexible, commitment treatments on saving intention (directly) and saving action (indirectly), were measured and compared between Intent and Low/No Intent subgroups. Participants' allocation to one of these subgroups were determined by their baseline saving intentions. The longitudinal experimental design of the study allowed for within-group heterogeneity analyses over time ($N = 405$). Both the hard and soft commitment treatments had immediate, positive effects on saving intention in both subgroups. These effects endured, and saving intention continued to increase in the Low/No Intent subgroup during the 30 days post-intervention. An intention-action gap was observed in both subgroups, moderated by the temporal stability of saving intention.

These results suggest that baseline saving intention should be a key consideration when selecting the most appropriate saving intervention for an individual. Further research is required to determine why the particular hard and soft treatments were effective in the study's context. In addition, the intervention and research methodology should be tested on other behaviours that also require decision-making over time and under uncertainty.

Keywords: Commitment; Flexibility; Saving intention; Saving behaviour; Scarcity.

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List of Abbreviations

| | |
|----------------|---|
| ANOVA | Analysis of Variances |
| ATE | Average Treatment Effect |
| BoP | Base of Pyramid |
| CLM | Central Limit Theorem |
| COVID-19 | Coronavirus 2019 |
| CSD | Commitment-Saving Device |
| DEU | Discounted Expected Utility |
| DU | Discounted Utility |
| EU | Expected Utility |
| GDP | Gross Domestic Product |
| GIBS | Gordon Institute of Business Science |
| H ₁ | Hypothesis 1 |
| H ₂ | Hypothesis 2 |
| H ₃ | Hypothesis 3 |
| H ₄ | Hypothesis 4 |
| IBM | International Business Machines Corporation |
| IMC | Instructional Manipulation Check |
| LL | Larger-Later |
| MDE | Minimum Detectable Effect |
| MLR | Multiple Linear Regression |
| OECD | Organisation of Economic Development |
| OLS | Ordinary Least Squares |
| PFL | Perceived Financial Literacy |
| RCT | Randomised Controlled Trial |
| SARB | South African Reserve Bank |
| SASSA | South African Social Service Association |
| SMarT | Save More Tomorrow™ |
| SPSS® | Statistical Package for the Social Sciences |
| SS | Smaller-Sooner |
| T ₁ | Treatment 1 |
| T ₂ | Treatment 2 |
| TPB | Theory of Planned Behaviour |

TRA

Theory of Reasoned Action

VIF

Variance Inflation Factor

WEF

World Economic Forum

Chapter 1: Introduction to the Research Problem

1.1 Background and context

Saving money for the future inherently requires an individual to make a series of financial decisions over time. Uncertainty is added to this intertemporal decision-making when an individual perceives financial scarcity while making saving decisions. Biases and preferences abound when making such intertemporal choices under uncertainty, but this study focuses on the opposing preferences for commitment and flexibility in the saving decisions of individuals who perceive financial scarcity.

The background and specific context of the study sets the scene for the research problem and purpose, which is discussed in the next sections. This is followed by the study's contributions to both literature and practice, and a summary of the research scope before the chapter concludes.

1.1.1 *The importance of saving*

The World Economic Forum (WEF) (2018) reports that shortfalls in individuals' long-term savings, for example retirement savings, are a worldwide phenomenon. These savings gaps are caused by a combination of factors, including increased longevity and ageing populations; increased responsibility placed on the individual to ensure sufficiency of retirement income (Cronqvist & Siegel, 2015); and low levels of savings by individuals in general (Dholakia, Tam, Yoon & Wong, 2016; WEF, 2018). These factors, coupled with the fact that financial systems in many countries are already overextended, mean that individuals should save more, in general, to avert welfare dependency later in life (WEF, 2017).

Individuals in South Africa are no exception and the poor saving culture is reflected in the Investec Gordon Institute of Business Science (GIBS) Savings Index, which measures the country's overall saving rate and saving behaviour. For example, a headline index figure of 60 points reported at the end of 2018 marks the lowest score in 28 years (tracked and reflected in Figure 1) (Saville & Macleod, 2019). A benchmark score of 100 points would have indicated that South Africa's savings are sufficient to support a Gross Domestic Product (GDP) target of 5.4% (Investec, 2019). Figure 1 thus illustrates a strong correlation between the index and economic (GDP) growth, which means that the country's growth targets may not be achievable if the low rate of saving persists. While this index reflects the trend in total national gross savings, savings from the household sector comprised a mere 1.4% of GDP in 2018, with the balance derived from the corporate sector (13% of GDP) (South African Reserve Bank [SARB], 2019).

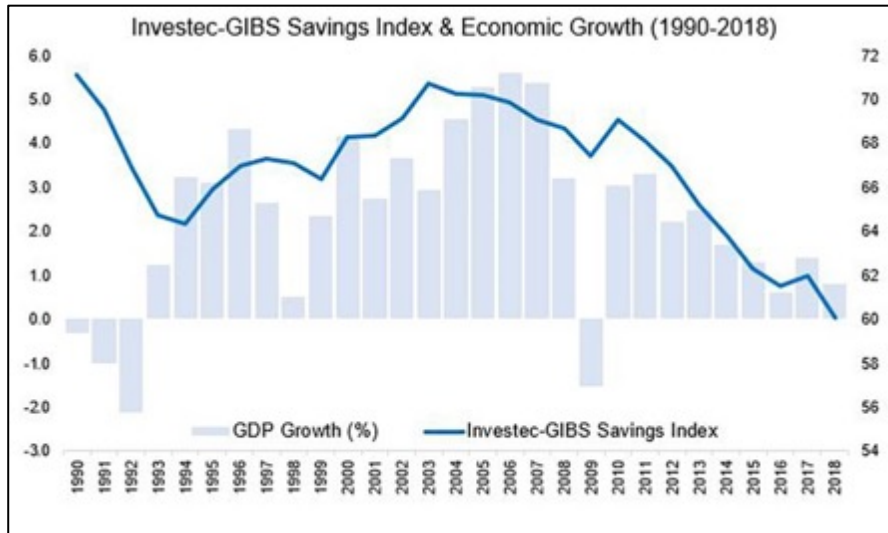


Figure 1: Investec GIBS Savings Index for the Period 1990 to 2018

Source: Saville & Macleod (2019)

According to the Organisation of Economic Development (OECD), household saving is a key source of finance for capital investments required for a country’s long-term economic growth. While the Coronavirus 2019 (COVID-19) pandemic was a temporary impetus to household savings during 2020 due to decreased consumption, the OECD household savings index measured until 2021 suggests a returning trend of declining saving rates across all countries measured (OECD, 2023). This trend was similar in South Africa, where household saving rates increased to 2.6% of GDP in 2020 – the strongest saving performance since 2004 (SARB, 2022) - but since declined to 2.4% of GDP, as inflation rose and household expenditure increased (SARB, 2023). Thus, individual savings in South Africa contributes very little to the country’s struggling economy, where GDP growth is forecasted by various institutions to be around 1% or even less for 2023.

The trend of low saving rates among individuals in South Africa is attributable to several persistent external factors, such as high levels of unemployment and inequality, low incomes and jobless economic growth (Investec, 2019). Despite this unfavourable saving environment, this study is motivated by the fundamental intuition that *internal* factors need to be addressed in parallel with *external* factors to effectively increase personal saving rates. Internal factors that drive personal saving rates, such as biases and preferences in decision-making, have been studied extensively (Cronqvist & Siegel, 2015; Dholakia et al., 2016; Karlan, McConnell, Mullainathan & Zinman, 2016). However, the underlying psychological decision-forming process regarding saving requires further empirical investigation (Ruefenacht, Schlager, Maas & Puustinen, 2015).

It is worth noting that savings indices, such as those discussed earlier, normally include only measurable savings from the formal financial sector. However, low-income groups in South Africa often save through informal saving mechanisms such as savings groups (African Response, 2020), which are difficult to measure and therefore are not reflected in national or global indices. While these informal savings mechanisms are important for precautionary purposes and subsistence, long-term saving is needed for asset accumulation and wealth building to reduce the risk of poverty over time (Bernheim, Ray & Yeltekin, 2015; Karlan, Ratan & Zinman, 2014). To conclude, individuals need to save money from a macroeconomic perspective since these savings indirectly support the economic growth in their country of residence. In addition, personal savings directly increase an individual's financial resilience and build wealth over time.

1.1.2 Saving behaviour under conditions of financial scarcity

For this particular study, financial scarcity is broadly understood as a lack of money which is a specific category of resource scarcity (Cannon, Goldsmith & Roux, 2019) and includes economic constraints generally experienced in poverty and low-income contexts (Goldsmith, Griskevicius & Hamilton, 2020). However, since an individual's *perception* of financial scarcity is highly subjective and not necessarily linked to a specific income group (Hamilton, Mittal, Shah, Thompson & Griskevicius, 2019; Shah, Shafir & Mullainathan, 2015), participants from higher income groups have not been excluded from the study.

While dominant logic suggests that the poor do not have the economic means to save, observations from the South African context as discussed earlier and results from empirical studies offer contradictory evidence. Several studies on saving behaviour have found that the poor are willing and able to save over the short term, albeit through informal mechanisms or by storing cash amounts at home (Dupas & Robinson, 2013; Prina, 2015). According to Dalton, Chosal and Mani (2016), such short-term saving behaviour in low-income groups is generally due to economic circumstances and a survivalist mentality prevailing in this market. Low-income individuals are particularly sensitive to income shocks and therefore need to smooth consumption and build savings balances to cover unexpected expenses (Goldberg, 2014; Martin & Hill, 2015). Their financial needs are complicated and require a combination of diverse saving strategies (Goldberg, 2014) to reduce the risk of unexpected financial burdens, increase resilience and accumulate money (Bernheim et al., 2015; Karlan et al., 2014). Accumulation of savings allows one to invest in assets, build wealth (Dalton et al., 2016; Laajaj, 2017) and escape persistent poverty, otherwise known as the 'poverty trap' (Karlan et al., 2014).

In reality, accumulation of savings requires time, especially when the amounts saved are small or frequently withdrawn to cover unexpected expenses - which is often the case under conditions of scarcity such as poverty (Collins, Morduch, Rutherford & Ruthven, 2009; Martin & Hill, 2015). Thus, individuals may benefit from both behavioural interventions and appropriate, flexible saving devices that drive longer-term saving behaviour (Bryan, Karlan & Nelson, 2010).

1.1.3 Commitment and flexibility in saving behaviour

Commitment involves a restriction of future choice sets, while flexibility implies expanded choice options in contrast (Amador, Werning & Angeletos, 2006). While individuals who face scarcity may have a high demand for commitment to save (Galperti, 2015; Laibson, 2015; O'Donoghue & Rabin, 2015), their preference for flexibility is also elevated due to income uncertainty to cover future consumption needs (Afzal, d'Adda, Fafchamps, Quinn & Said, 2017). This preference for flexibility to access savings for liquidity (Bond & Sigurdsson, 2018; Carvalho, Meier & Wang, 2016) can be an obstacle to accumulating savings for increased wealth over the long term (Prina, 2015). Literature, therefore, suggests a tension between preferences for commitment and flexibility in saving behaviour, particularly under conditions of financial scarcity.

1.2 Research problem

The research problem centres around the low saving rates of individuals that result in inadequate savings, especially when these individuals perceive financial scarcity. The matter of low personal saving rates observed globally (WEF, 2018) has been a longstanding problem for researchers (Cronqvist & Siegel, 2015; Dholakia et al., 2016), even before the COVID-19 pandemic and the subsequent inflation increases experienced in most countries. While individuals' awareness of their inadequate precautionary savings for unforeseen events and saving rates increased during the pandemic, this effect did not last (OECD, 2023). If predictions of a worldwide recession in 2023 materialise, personal savings may erode where individuals experience income volatility or the cost of living reduces their disposable income available to spend or save (WEF, 2023). The broad question of how to improve the saving behaviour of individuals is therefore topical and important to answer for financial resilience at both individual- and macroeconomic levels in the current economic climate.

Low personal saving rates are especially prevalent when individuals frequently experience income shocks which negate their ability to save consistently over the long term (Martin & Hill, 2015; Prina, 2015). In this state of financial scarcity, both saving flexibility to ensure

subsistence in the present (Afzal et al., 2017; Karlan et al., 2014), and commitment to save for the future (Dalton et al., 2016), are needed.

Literature from various fields suggested future research to expand knowledge on how the opposing preferences for commitment and flexibility interact. For example, a better understanding of decision-makers' preferences, in general, is needed to construct more realistic economic models to predict behaviour (Baucells & Heukamp, 2012; Casari & Dragone, 2015; Ferecatu & Öngüler, 2016; Pejsachowicz & Toussaert, 2017), and to design mechanisms and devices to improve an individual's ability to save (Amador, et al., 2017; Galperti, 2017; Janssens, Kramer & Swart, 2017; John, 2019). Apart from the economic- and saving behaviour literature, social psychology studies also called for further research on the commitment versus flexibility trade-off. For example, to explore the specific conditions under which flexibility or commitment (in terms of tenacity, rigidity, granularity) prevails in goal pursuit (Legrand, Bieleke, Gollwitzer & Mignon, 2017; Sheeran, 2002), and in different types of goal contexts (Rai, Sharif, Chang, Milkman & Duckworth, 2022). Thus, this research broadly relates to the literature on the tension between commitment and flexibility preferences (Amador, et al., 2017; Bond & Sigurdsson, 2018; Casari, 2009; Galperti, 2017; Legrand et al., 2017), however, with a specific focus on saving decisions by individuals who perceive financial scarcity.

In summary, the study addresses the problem of low personal saving rates by gaining a better understanding of commitment and flexibility preferences in saving decision-making. This is done by experimenting with behavioural interventions to measure and compare the impact of individuals' commitment and flexibility preferences on their saving behaviour.

1.3 Research purpose

The purpose of the study is to answer the following overarching research question: *How do commitment and flexibility preferences impact the saving behaviour of individuals who perceive financial scarcity?* Consistent with literature that values both commitment and flexibility when saving, this study tests how these opposing preferences operate together in saving behaviour. In the first instance, this research aims to expand literature on intertemporal choice under uncertainty when making saving decisions in the context of financial scarcity. Secondly, the results inform financial advisors and saving product developers in practice on appropriate behavioural interventions to improve saving behaviour under conditions of scarcity. Specific contributions to both theory and practice are discussed in the next sections.

1.4 Contribution of research to theory

Individuals often 'over-value' an immediate smaller award compared to a delayed greater award, which points to instant gratification, myopia and an excessive focus on the short term (Strotz, 1955). Present bias theory originates from this phenomenon and has been developed from the seminal theories of time-inconsistent preferences (Strotz, 1955) and quasi-hyperbolic discounting (Laibson, 1997). Since highly desired consumption (money spent) at present can have limited utility in future (Bond & Sigurdsson, 2018), individuals need to recognise their present bias. In present bias literature, 'sophisticated' individuals are aware of their bias and may want to deliberately restrict their future economic opportunities to prevent self-damaging activities and to improve future decisions (Ashraf, Karlan & Yin, 2006; Giné, Goldberg, Silverman & Yang, 2018; Laibson, 2015). Present bias, therefore, has the potential to drive a preference for commitment (a restriction of future choices) when an individual wishes to avoid self-harming decisions or to improve behaviour, such as to increase savings (Exley & Naecker, 2016).

Present bias, as a short-term discounting model, has also been recognised as imperfect with improvements suggested to explain some of the heterogenous behaviour between individuals and across different contexts (O'Donoghue & Rabin, 2015). Thus, recent studies have begun to test present bias behaviours experimentally (Jackson & Yariv, 2014; Janssens et al., 2017; Sprenger, 2015) as opposed to the methodological norm of predictive modelling. While present bias occurs when decisions are made over time (intertemporal choices), uncertainty also plays a significant role in individuals' decision-making in general. For example, uncertainty may lead individuals to place a disproportionate weight on certain options, otherwise known as the certainty effect (Kahneman & Tversky, 1979). Furthermore, individuals who experience uncertainty about the future in terms of risk, changing preferences or consumption needs, may choose not to commit to a course of future action at present, and therefore, prefer flexibility (Krishna & Sadowski, 2014). Literature suggests that uncertainty not only drives these preferences for certainty and flexibility but also hyperbolic discounting and present bias (Andreoni & Sprenger; Epper, Fehr-Duda & Bruhin, 2011; Halevy, 2008). This interconnectivity between time and uncertainty in decision-making is the foundation of this study's design, as illustrated in Figure 2.

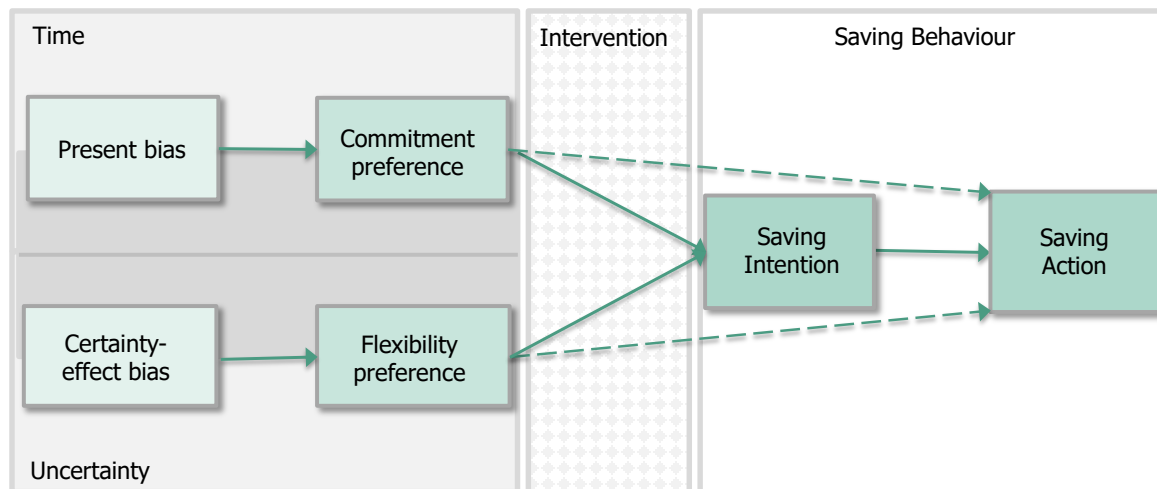


Figure 2: Simplified Conceptual Framework

Source: Author's own

A growing body of literature is combining time and uncertainty in decision-making analyses because they are correlated (Ferecatu & Önçüler, 2016; Halevy, 2008; Keren & Roelofsma, 1995; Weber & Chapman, 2005) even though their exact relationship is still not clearly understood and require further research (Liu, Heath & Onculer, 2020; Luckman, Donkin & Newell, 2017). While intertemporal choice, present bias and commitment preferences have been studied extensively in the saving behaviour literature, uncertainty and flexibility preferences have comparatively been under-researched in this milieu. To date, even fewer studies have empirically tested both commitment and flexibility preferences, especially as they relate to saving behaviour.

This study tests intertemporal saving decisions in a longitudinal study over 30 days, and in the context of perceived financial scarcity where the need for economic trade-offs is heightened (Shah et al., 2015; Schilbach, Schofield & Mullainathan, 2016). The primary theoretical contribution of this study is to extend the Behavioural Economic literature on intertemporal choice under uncertainty in saving behaviour. This is in response to general calls for a better model to describe intertemporal choices through preference-based and uncertainty-based explanations (Baucells & Heukamp, 2012; Casari, 2009; Casari & Dragone, 2015; Keren & Roelofsma, 1995; Luckman et al., 2017). More specifically, the study also responds to the need for a better understanding of how time and uncertainty-related biases and preferences operate together and in different contexts (Ferecatu & Önçüler, 2016; O'Donoghue & Rabin, 2015). This has been done empirically, by determining how present bias and commitment preferences (Hypothesis 1 [H₁]), and certainty-effect bias and flexibility preferences (Hypothesis 2 [H₂]) operate together to design an intervention (Hypothesis 3 [H₃]) that would increase saving behaviour (H₃ and Hypothesis 4 [H₄]). The study has been conducted over a

period of time and in the context of perceived financial scarcity, where individuals are likely to experience resource uncertainty at a minimum.

Furthermore, the economic literature on preference for flexibility mainly predicts this preference in decision-making through econometric models (Ahn & Sarver, 2013; Jones & Ostroy, 1984; Krishna & Sadowski, 2014; Saito, 2015) and very limited experimental studies have been conducted to empirically test this construct (Casari, 2009). This study, therefore, makes a methodological contribution to experimental economics literature by *experimentally* testing individuals' preferences for flexibility in the context of saving behaviour. The second methodological contribution relates to Behavioural Economic literature on saving behaviour. Saving behaviour, as the main construct of interest for this study, is separated into Saving *Intention* and Saving *Action* variables to measure both the direct impact of the intervention on saving intention and the indirect impact on taking saving action. While intention has received a lot of attention in consumer behaviour studies driven by the Theory of Planned Behaviour (TPB), most behavioural economic studies have not separated intention from behaviour in studies on saving behaviour. Furthermore, the self-reflection intervention is designed from social psychology literature on 'Wise Interventions' (Chen, Chavez, Ong & Gunderson, 2017; Hall, Zhao & Shafir, 2014; Walton & Wilson, 2018) and implementation intentions (Hulland & Houston, 2021; Legrand et al., 2017). This has been done purposefully, in an attempt to increase the temporal stability of saving intentions to enhance its impact on saving action as suggested by Webb and Sheeran (2006). To the best of the researcher's knowledge, this intervention design is a novel approach to specifically address the problem of inadequate saving behaviour in Behavioural Economic literature.

1.5 Significance of research for practice

Study participants were selected based on their subjective state of perceived financial scarcity, which can be observed across all income groups (Hamilton et al., 2019; Mullainathan & Shafir, 2013; Shah et al., 2015). However, financial scarcity in particular is most often researched in the poverty domain and among low-income groups (Blocker, Zhang, Hill, Roux Corus, Hutton, Dorsey & Minton, 2022; Hall et al., 2014; Hamilton et al., 2019). Similarly, much saving research has been conducted in wealthier nations, however too little is known about saving behaviour at the 'Base of Pyramid' (BoP) which includes those individuals with income of less than USD2.50 per day (Martin & Hill, 2015). Savings products and other commitment-saving devices (CSDs) that are tailored to this market can be valuable to generate income and reduce poverty (Dupas & Robinson, 2013) while potentially increasing financial institutions' client pool (Prina, 2015).

Conventional wisdom dictates that profit margins of organisations in developing countries are low and driven by volumes of customers in low-income groups. Thus, profit-maximising institutions may benefit from attracting and retaining low-income customers who build wealth over the long term, even though lower fees need to be charged (Basu, 2014). Numerous financial inclusion and economic development studies have tested ways to increase and sustain the uptake of a variety of CSDs designed for the unbanked and under-banked in developing countries (Afzal et al., 2017; De Mel, McIntosh & Woodruff, 2013; Dupas & Robinson, 2013; Prina, 2015). CSDs can take the form of informal behavioural interventions added to existing saving products' design to improve saving behaviour (Giné et al.; 2018). This study is designed with this approach in mind - to provide empirical evidence on how savings products and advice offered to individuals can be improved cost-effectively to increase saving behaviour.

Cost-effective interventions are particularly important in the low-income market segment where customers prefer saving products with low transaction costs in terms of proximity to a trusted financial services provider, with low fees (Allen, Demirguc-Kunt, Klapper & Martinez Peria, 2016; Prina, 2015). While financial inclusion has improved to 91% in South Africa over the past few decades, bank fees on transactions still comprise a disproportionately high percentage of monthly income, especially for low-income customers (Solidarity, 2022; World Bank, 2022). This is despite market competition by recent new entrants offering lower-cost and technological solutions to this market segment (World Bank, 2022). Following the general principle of behavioural economics that “the simpler a task, the more likely it is to be done” (Karlan et al., 2014, p.72), this study aims to firstly, design and test a simple saving intervention that would increase its likelihood of implementation and efficacy in practice. Secondly, since transaction fees can be a deterrent to saving via a CSD such as a saving product (Dupas, Keats & Robinson, 2017), the saving intervention is designed to be implemented at a low cost to avoid fee escalations to customers already experiencing financial scarcity.

The findings of this study reveal broad contextual insights to define customer profiles for individuals who perceive financial scarcity. This, together with specific evidence on their preferences during saving decision-making and the positive impact of the study's tailored behavioural interventions, offer suggestions to explore in practice. Financial institutions, development organisations and financial advisors may benefit by testing these behavioural elements in their service and product offerings to improve the saving behaviour of customers who perceive financial scarcity.

1.6 Research scope

Many behavioural economic studies on saving behaviour have conducted randomised controlled trials (RCTs) in the field to test the impact of developmental savings programmes (Dupas et al., 2017; Dupas & Robinson, 2013; Giné et al., 2018). Similarly, this study experiments with a behavioural intervention to improve saving behaviour among individuals who perceive financial scarcity. The results provide specific insights on how the tension between commitment and flexibility preferences in saving decisions could potentially be leveraged to improve saving intentions directly, and actions indirectly.

The research is conducted in two phases. During the first phase, data are collected before, during and directly after conducting an intervention on participants' saving intentions, while follow-up data on saving intentions and saving actions are collected during Phase Two. More specifically, collected data specifies participants' demographics, present bias, certainty-effect bias, and commitment and flexibility preferences through a baseline survey in Phase One. Following this, commitment and flexibility preferences are manipulated to measure their direct impact on individuals' saving intentions immediately after the intervention. The second phase is commenced after 30 days, to measure the durability of saving intentions and whether it translated into improved saving activity. Results are then statistically analysed to determine if causality can be inferred, for example, that the manipulation of commitment and flexibility preferences improved saving intentions directly and saving actions indirectly.

1.7 Conclusion

The study commenced with a review of theory and extant literature that motivated the formulation of the main research question (Chapter 2). The behavioural intervention was subsequently designed and executed according to the research methodology in Chapter 3. Data collected before, during and after the intervention was quantitatively analysed and the results are presented in Chapter 4 with supplementary information in the appendices. These results are discussed and interpreted in Chapter 5 with regards to existing evidence that either supported or contradicted the findings. Finally, the study concludes in Chapter 6 with a summary of the study's key findings, followed by a discussion of its contributions, limitations and suggestions for future research.

Chapter 2: Literature review

2.1 Introduction

In this chapter, the extant literature on intertemporal choice under uncertainty is discussed with a specific focus on the theory and prior research that led to the *Commitment Preference*, *Flexibility Preference*, *Saving Intention* and *Saving Action* constructs. Research opportunities to expand existing knowledge on these variables of interest are highlighted and used to frame the hypotheses for the intended study. Most importantly, this literature review is grounded in the context of financial scarcity which is essentially the departure point for the main research question and the overall study.

2.2 Context of financial scarcity

Scarcity, defined as “having less than you feel you need” (Mullainathan & Shafir, 2013, p. 4), is an economic reality that most individuals face at some point in time. This concept of scarcity is highly subjective but broadly assumed to be a condition regularly experienced by individuals with low income. ‘Low income’ suggests that individuals have at least some source of income, even though they can be best described as the ‘working poor’. On the other hand, an individual’s perception of financial scarcity is not limited to those who earn no or low income, but has been found across all income groups (Hamilton et al., 2019). For this study, the term financial scarcity included conditions of economic constraints such as poverty and low-income contexts. The exact parameters of individuals who perceived financial scarcity and participated in this study are defined in Chapter 3.

Scarcity or economic constraints can be the result of internal or external (environmental) factors (Dalton et al., 2016). As the main research question revolves around the saving behaviour of individuals who perceive financial scarcity, a behavioural lens was applied to focus on internal, subjective constraints in decision-making within this context. Under conditions of scarcity, individuals have pressing needs and a heightened awareness of the trade-offs that must be made to fulfil those needs (Shah et al., 2015). It is important to understand this trade-off thinking, as it can frame consistent preferences in decision-making more so than irrelevant contextual influences (Shah et al., 2015). One school of thought supports the notion that internal constraints perpetuate poverty traps through behavioural biases such as myopia, lack of willpower and lack of aspirations - which are often cited as traits that the poor are likely to suffer from (Dalton et al., 2016). On the contrary, Bertrand, Mullainathan, and Shafir (2004) offer the view that the poor display the same behavioural weaknesses and biases as individuals from other income groups. However, in poverty with its narrow margins for error, those same behavioural patterns can manifest in more pronounced

ways and result in worse economic outcomes (Bertrand et al., 2004). It is, therefore, evident that contrasting views exist around the influences on the general decision-making of individuals who experience scarcity. The next section demonstrates that these contradictions extend to the literature on saving decisions and behaviour in the context of financial scarcity.

2.2.1 Saving behaviour in the context of financial scarcity

A comprehensive review of the literature revealed several concepts that influence individuals' saving behaviour in the context of financial scarcity. An understanding of these influences is key to developing interventions and saving devices which can negate negative influences or enhance positive influences, towards increased savings outcomes (Afzal et al., 2017; Karlan et al., 2014). Table 1 below presents those influences most relevant to this study.

Table 1: Influences on saving behaviour in the context of financial scarcity

| | Concept | Direction of Influences: | | Reference |
|---|---|--------------------------|----------|--|
| | | Positive | Negative | |
| 1 | Poverty with income uncertainty and scarce resources | X | X | Carvalho et al., 2016; Kaboski, Lipscomb & Midrigan, 2014; Karlan, et al., 2014; Martin & Hill, 2015 |
| 2 | Anticipation of income shocks/ exceptional expenses | X | | Dholakia et al., 2016; Karlan et al., 2014 |
| 3 | Commitment | X | | Galperti, 2015; Laibson, 2015; O'Donoghue & Rabin, 2015 |
| 4 | Commitment devices/ basic saving accounts | X | X | Afzal et al., 2017; De Mel et al., 2013; Dupas & Robinson, 2013; Prina, 2015 |
| 5 | Future orientation | X | | Carvalho et al., 2016; Laajaj, 2017 |
| 6 | High personal discount rates (hyperbolic discounting) | | X | Cronqvist & Siegel, 2015; Janssens et al., 2017 |
| 7 | Time inconsistent preferences | | X | Bernheim et al., 2015; Cronqvist & Siegel, 2015 |
| 8 | Present bias | | X | Jackson & Yariv, 2014; Laibson & List, 2015; O'Donoghue & Rabin, 2015 |
| 9 | Complexity of savings products | | X | Prina, 2015; Thaler, 2016 |

Source: Author's own

Notes:

Keywords for concepts were used in conjunction with "saving behaviour" in the literature search strategy.

While this overview is by no means exhaustive, it demonstrates the complexity of saving behaviour as it is open to a variety of internal and external influences (and combinations

thereof), often with opposing effects. This is evident from the literature on poverty (refer to Table 1, Item 1), which states that this condition could either drive saving to smooth income (Karlan et al., 2014; Martin & Hill, 2015) or impede saving due to income uncertainty and liquidity constraints (Carvalho et al., 2016). Similarly, CSDs (refer to Table 1, Item 4) such as savings accounts could drive saving through regular, small deposits (Afzal et al., 2017), or impede saving due to a lack of liquidity from restricted access (Prina, 2015). Low-income individuals face more constraints in their saving behaviour than those with higher income security but they also have a greater need for short-term precautionary savings for subsistence (Kaboski et al., 2014) and longer-term savings to escape the poverty trap (Dalton et al., 2016).

An intuition that emerged from this literature review is that recent studies focussed mostly on either predicting or experimentally testing, ways to increase commitment to save (refer Table 1, Items 3 and 4) by addressing intertemporal choice and present biased behaviour (refer Table 1, Items 6 to 8). Comparatively, much less research focussed on the influence of uncertainty (refer to Table 1, Item 1) on saving behaviour. The relevance of uncertainty in the context of financial scarcity is discussed next.

2.2.2 Time and uncertainty in the context of financial scarcity

The main research question is built on the intuition that individuals' saving decisions are generally influenced by their sensitivities to time and uncertainty during decision-making. According to Deck and Jahedi (2015), economic decision-making is best understood by identifying how individuals make choices over time and under uncertainty, and the extent to which these judgments are influenced by context. While predictive economic models and empirical studies to date have largely focussed on the effect of either time (Meier & Sprenger, 2015; Sprenger, 2015) or uncertainty (Saito, 2015; Shmaya & Yariv, 2016) on decision-making, this study contributes to a smaller body of literature that *jointly* evaluated decision-making in both domains (Andreoni & Sprenger, 2012; Sutter, Kocher, Rützler & Trautmann, 2013). To the best of the researcher's knowledge, joint analyses of time and uncertainty in the decision-making of individuals who perceive financial scarcity in developing markets are even more limited, which offered the opportunity for a contribution to literature in this respect.

Individuals frequently make decisions in the present with consequences that reveal over some time. Laajaj (2017, p.187) describes an individual's time horizon as "the extent to which she identifies with her future selves [sic]" and this horizon is shortened significantly to reduce distress when future poverty or hardship is anticipated. This anticipation makes a long-term planning horizon costly and therefore results in short-sighted decision-making (Laajaj, 2017). The mental consequence of poverty is akin to a high cognitive load (low mental bandwidth)

caused by the taxing thought processes involved in difficult trade-off decisions when resource-constrained (Schilbach et al., 2016). In turn, this limited bandwidth leads to more impatient decisions about money when resources are lower than needed (Deck & Jahedi, 2015; Schilbach et al., 2016). Mullainathan and Shafir (2013) labelled this condition a 'scarcity mindset' which impacts how individuals view problems and make decisions.

Uncertainty as a second decision domain of interest, means different things depending on the context in which it is applied, resulting in fragmented economic literature. To illustrate, this term refers mostly to general economic uncertainty at the macro-economic level, while it is also regularly used in decision-making under uncertainty at the micro-economic level. For the purposes of this micro-economic study on financial decision-making, uncertainty mainly refers to financial uncertainty experienced at the individual level. It is worth noting that decisions under uncertainty specifically occur when the probability of an expected outcome is subjective and *not known* – and is distinct from decisions under risk, where the probability of an expected outcome is objective and *known* (Sutter et al., 2013). The future is inherently uncertain for all (Andreoni & Sprenger, 2012; Epper et al., 2011; Halevy, 2008); however, under conditions of financial scarcity, individuals also experience uncertainty around their future income and livelihoods (Martin & Hill, 2015). Consequently, the context of financial scarcity is considered fitting for an empirical study intending to test decisions under uncertainty.

When faced with uncertainty, individuals prefer an earlier resolution to a later one (Kreps & Porteus, 1978) and therefore tend to make immediate, certain choices about gains and losses (Hardisty & Pfeiffer, 2017). Thus, it is clear that time and uncertainty should not be separated in decision-making. A small but growing body of literature is combining the time and uncertainty domains in decision-making analyses as they are correlated (Ferecatu & Öncüler, 2016; Halevy, 2008; Prelec & Loewenstein, 1991), even though the interaction effects are still unclear and require further research (Liu et al., 2020; Luckman et al., 2017). Furthermore, time and uncertainty affect choice via the common underlying dimension of delay (Frederick, Loewenstein & O'Donoghue, 2002; Weber & Chapman, 2005). For example, delaying an outcome is making that outcome uncertain but also reduces the preference for instant gratification at the same time (Weber & Chapman, 2005). According to Halevy (2008), omitting one of these domains in decision analyses might lead to incorrect attributions of behavioural effects and consequences. To avoid this, the combined role of time and uncertainty in the decision-making of individuals who perceive financial scarcity was investigated.

Theory and literature from the time and uncertainty decision domains gave rise to the constructs of interest specific to the study, *commitment preference*, *flexibility preference* and two elements of saving behaviour namely *saving intention* and *saving action*. The intertemporal choice under an uncertainty framework within decision theory provides the

theoretical foundation for these constructs, as is demonstrated in the remainder of the chapter according to the literature review summary presented in Figure 3.

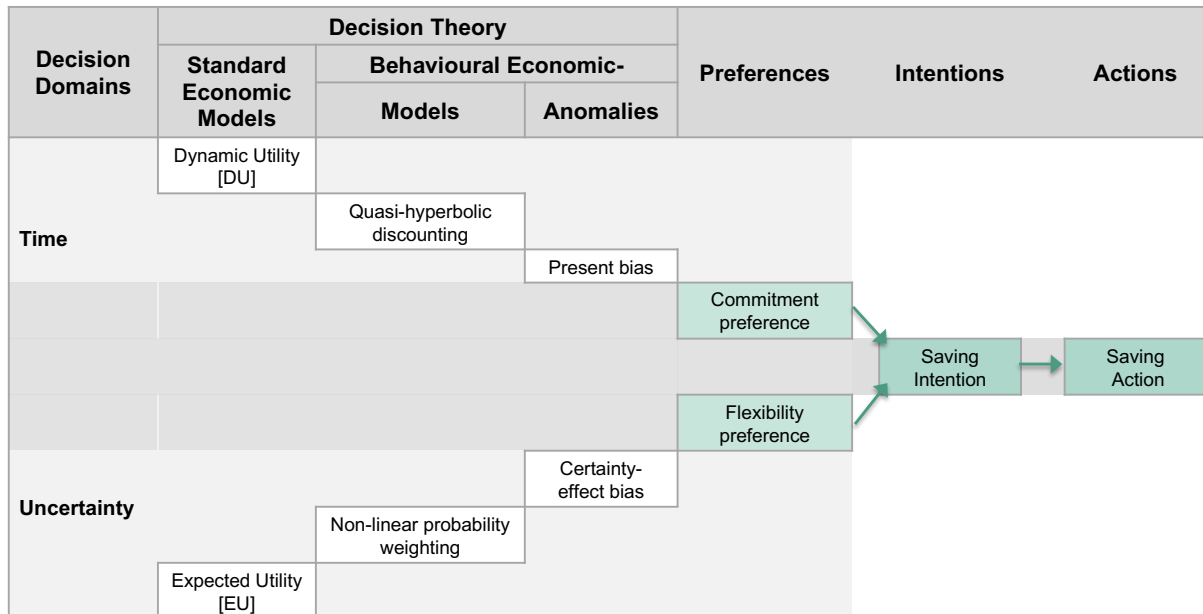


Figure 3: Literature review summary

Source: Author's own

Notes:

The propositions displayed in this figure are sequentially discussed in the remainder of the chapter.

2.3 Theoretical framework: Intertemporal choice under uncertainty

Decision Theory within the time and uncertainty domains forms the theoretical foundation of this study. The evolution of relevant standard economic models to behavioural economic models and decision anomalies within these decision domains (per Figure 3) are discussed in the sub-sections to follow.

2.3.1 Standard economic model related to time: Discounted utility

Standard economic theory is, in general, based on the key assumption that individuals always make rational decisions in line with their well-defined preferences which remain constant over time (Loewenstein & Thaler, 1989). Rational decisions involve the ability to rank alternatives according to preferences and then choose the highest-ranking item amongst all the alternatives (Ok, Ortoleva & Riella, 2015). Economic participants, therefore, optimise by always choosing the best alternative from a choice set (Thaler, 2017). Furthermore, Shah et al. (2015) posit that low-income individuals have a scarcity mindset due to constant trade-off thinking between limited resources. This mindset changes how these individuals make optimal

decisions and align them more closely with standard economic predictions based on the principle that individuals treat all resources as limited.

Based on these fundamental standard economic principles, the intertemporal choice framework includes all decisions involving optimal trade-offs between costs and benefits arising at different points in time (Frederick et al., 2002). To make optimal decisions, it may be necessary to weigh immediate gratification (utility) against foregoing delayed gratification at some point in the future, for example. These intertemporal trade-offs are problematic for individuals who need to make choices in the present that will harbour delayed future consequences (Loewenstein & Prelec, 1992), which is why they are the most frequently used unit of analysis in the intertemporal choice literature. Intertemporal choice operated through the discounted utility (DU) model as developed by Ramsey (1928) and Samuelson (1937) for most of the twentieth century. The core assumption of this theory is that preferences for intertemporal choice can be characterised and predicted by a single parameter, namely the discount rate (Koopmans, 1960). An early formal analysis conducted by Koopmans (1960) expanded the underlying assumptions of DU theory through a series of axiomatic derivations, which were widely accepted as accurate and representative of intertemporal choice. As a result, this decision-making model has been applied in diverse fields such as savings behaviour, education decisions and criminal behaviour (Loewenstein & Prelec, 1992).

The most relevant assumptions to the intended study centre around the dimensions of *time preferences* and *time discounting*. Frederick et al. (2002, p.352) defined *time preference* as “the preference for immediate utility over delayed utility” and *time discounting* as “any factors that diminish the expected utility [EU] generated by a future consequence, such as uncertainty or changing tastes”. These definitions are adopted for this study as they are considered to be sufficiently descriptive and in agreement with the large body of literature on intertemporal choice. The DU model further claims that rational economic agents have *time-consistent preferences* which can be measured by a discount rate (Loewenstein & Thaler, 1989). Future preferences that simply confirm present preferences are time-consistent and suggest an even-handedness in the way individuals consider time (Frederick et al., 2002). This constant discounting, therefore, permits the use of a single, exponential discount rate to summarise time-consistent preferences.

Despite its simplicity and continued use as the model of choice for analysing intertemporal decisions, the descriptive validity of the DU model was never claimed by its developers (Koopmans, 1960; Ramsey, 1928; Samuelson, 1937). The DU model has never been empirically validated as the most appropriate model for intertemporal choice. Furthermore, almost every underlying assumption of this model has now been questioned since Loewenstein and Prelec (1992) first exposed a set of DU anomalies. Most importantly, the

literature failed to establish a single, consistent discount rate as a reliable measure of time preferences across all types of goods and all categories of intertemporal choices (Loewenstein & Thaler, 1989). However, DU anomalies do not necessarily violate any standard to uphold or are considered to be mistakes but should rather be viewed as contradictions to a model whose descriptive validity was never validated.

2.3.2 Standard economic models related to uncertainty: Expected utility

Similarly to intertemporal choice, decisions made in the uncertainty domain operate through a standard economic utility model. The normative model for decision-making under conditions of risk and uncertainty is the Von Neumann and Morgenstern EU model. According to this model, rational decision-makers choose between alternatives based on a weighted sum of utilities – with the weights being probabilities of an event or outcome occurring in the future (Prelec & Loewenstein, 1991). It is worth noting that probability weights are subjective, and it is also possible that probabilities of certain choices may be truly uncertain and unknown - not merely risky (Sutter et al., 2013). Thus, there is a clear distinction between risk and uncertainty in decision theory, with the latter being the specific focus of this study.

As with the DU model discussed previously, this model's appeal rested in its simplicity and similarity compared to standard financial formulas. A fundamental assumption of this model is that decision-makers have *time-consistent preferences* and *linear probability weightings* (Weber & Camerer, 1987) – which indicates some similarity to key assumptions of the DU model. However, almost from the onset, doubts were raised about the descriptive validity of the EU model (Loewenstein & Prelec, 1992) and researchers such as Kahneman and Tversky (1979) discovered several anomalies which violate its underlying assumptions.

The intertemporal choice framework developed over the years includes several alternative models that challenge the DU and EU models' inadequacies. However, recent models that combine the time and uncertainty decision domains are particularly relevant to this study.

2.3.3 Combining time and uncertainty: Discounted expected utility

Researchers have discovered that the time and uncertainty decision domains are interconnected as the DU and EU models have parallel structures and similar anomalies (Prelec & Loewenstein, 1991; Weber & Chapman, 2005). Combining intertemporal choice and uncertainty into a single, predictive economic model has gained increased research attention over the past 20 years (Andreoni & Sprenger, 2012; Epper et al., 2011; Halevy, 2008; Luckman et al., 2017; Sutter et al., 2013; Weber & Chapman, 2005). The premise that time and uncertainty influence choice through *delay* as a common underlying factor, has gained considerable traction (Weber & Chapman, 2005). This is plausible, as delayed outcomes are

almost by definition uncertain and since uncertainty often takes time to resolve, uncertain outcomes are also delayed.

Thus, Andreoni and Sprenger's (2012) intertemporal choice experiment to manipulate uncertainty through a discounted expected utility (DEU) model delivered interesting results. Based on their findings, namely that individuals have a disproportionate preference for present certainty over future uncertainty, they speculated that certainty may drive present bias. Hardisty and Pfeffer (2017) confirmed this uncertainty avoidance in intertemporal choice through their experiments and argued that most predictive models that combine time and uncertainty reveal anomalies when tested empirically. Therefore, this study made a methodological contribution to the intertemporal choice under uncertainty literature by empirically testing saving decision-making over time by individuals who experienced uncertainty due to financial scarcity, among other reasons.

Steinert, Zenker, Filipiak, Movsisyan, Cluver, and Shenderovich (2018) argued that while the standard economic paradigm may apply to medium- and high-income societies, it is less so for poor communities where saving behaviour is much more complex and meets with unique constraints. For example, liquidity constraints experienced by the poor affect monetary intertemporal choices which can lead to irrational economic decision-making (Carvalho et al., 2016). The anomalies found in the seminal DU and EU intertemporal choice models are also difficult to 'rationalise', or implausible assumptions are necessary to explain them within the standard economic paradigm (Loewenstein & Thaler, 1989). Consequently, behavioural economic theory related to time and uncertainty was considered to be more appropriate to explain irrationality in the saving behaviour of those who perceive financial scarcity.

2.3.4 Behavioural economic theory related to time

A consistent theme running through the intertemporal choice literature suggests that individuals are more likely to prefer options that give priority to the present in the form of immediate experienced utility, over options for the future. For this reason, multiple present-focussed models developed as variations of the seminal DU model, to examine empirical evidence on present-focussed preferences (Ericson & Laibson, 2019). It is worth noting that the *present biased* theoretical model is a type of *present-focussed* model that refers specifically to situations where it would supposedly be a mistake to base choices on immediately experienced utility (gratification). For example, individuals often plan to behave in a certain way in future but proceed to act differently by succumbing to temptations for immediate gratification (Laibson & List, 2015; O'Donoghue & Rabin, 2015).

The fields of psychology and economics merge in the field of Behavioural Economics which developed from the basis that individuals make errors in their intertemporal choices because

they are not always rational agents, as standard economic theory suggests. Behavioural economic models help to explain these errors to avoid making the same mistakes in future (Thaler, 2016) and expand economic assumptions on intertemporal choice (Laibson & List, 2015). This study investigated erroneous decision-making resulting from individuals who discount the value of future events, have time-inconsistent preferences and are generally biased towards the present (Alan & Ertac, 2015; Jackson & Yariv, 2014), amongst other decision anomalies.

More specifically, in the field of Behavioural Economics, the present bias theoretical model originates from *time-inconsistent preferences* (Strotz, 1955) and *quasi-hyperbolic discounting* (Laibson, 1997). Present bias as a short-term discounting model operates on the timing of utility; in fact, it requires a trade-off between present and future values (O'Donoghue & Rabin, 2015). Individuals discount the utility of their savings, for example, at different rates due to inconsistencies in their time preferences (Jackson & Yariv, 2014). Present biased individuals, in particular, exemplify high personal discount rates in the present, which gradually decreases in the future (Ashraf et al., 2006; O'Donoghue & Rabin, 2015). This decreasing discount rate can be quantitatively predicted through the beta-delta (β , δ) formulation (*quasi-hyperbolic discounting model*) under set conditions, as developed by Laibson (1997).

However, no model is perfect, and it has been recognised that this model can be improved in two areas. According to O'Donoghue and Rabin (2015), the model could be expanded to explain some of the heterogenous behaviour between individuals and across different contexts. For this reason, more recent studies have started to test present bias behaviours experimentally (Jackson & Yariv, 2014; Janssens et al., 2017; Sprenger, 2015). The notion that hyperbolic discounting (present bias) is influenced by, or even generated by uncertainty (Epper et al., 2011; Hardisty & Pfeffer, 2017), is also starting to emerge in the literature on decision theory. This new research avenue is relevant to answering the overall research question and is further explored in the next section.

2.3.5 Behavioural economic theory related to uncertainty

The certainty effect was first introduced by Kahneman and Tversky (1979) in their seminal study on prospect theory. It described decision-makers' tendency to place disproportionate weight on *certain* outcomes relative to very likely, yet uncertain outcomes (Halevy, 2008; Weber & Chapman, 2005). This effect is descriptively explained by a non-linear probability weighting function (alternatively, the π function) as a variant of the classical EU model (Kahneman & Tversky, 1979). The π function is concave in shape, with the curve steepest very near certainty, which means that decision biases are most prominent when one of the choices involves certainty, hence the certainty-effect bias (Weber & Chapman, 2005). As a

result, the certainty-effect bias behaves similarly to diminishing impatience when comparing the present to the future, where the willingness to sacrifice later choice options for earlier options is highest in the present (Halevy, 2008). Chakraborty, Halevy and Saito (2020) also stated that the normative models of present bias and the certainty effect share similar shortcomings. In the risk domain, preferences are disproportionately sensitive to certainty (certainty effect) and overly sensitive to the present in the time decision domain (present bias) (Chakraborty et al., 2020). It is therefore evident that the certainty effect shares some commonalities with how present bias operates.

In summary, Figure 3 (refer to Section 2.2.2) illustrates the development of present bias and the certainty-effect bias from earlier standard economic theory in the time and uncertainty decision domains, respectively. A lot is still unclear about the interaction between these two domains in decision-making (Liu et al., 2020; Luckman et al., 2017); yet several commonalities exist between the source theories (Prelec & Loewenstein, 1991; Weber & Chapman, 2005) that led to the development of present bias and certainty-effect bias. This study responded to the need for clarification by testing these biases and their relation to two independent variables of interest: *Commitment Preference* and *Flexibility Preference*, which are discussed next.

2.4 Preference for commitment

Commitment is first defined, then deliberated in respect of its drivers and the heterogeneity in individual preferences for commitment in the sub-sections that follow. This discussion leads the way to conclude with the first formulated hypothesis of this study.

2.4.1 General definitions of commitment

One of the earliest definitions of commitment in decision-making described it as a “deliberate regimenting of one’s future economic behaviour” (Strotz, 1955, p.155). Individuals making plans today, such as to save for retirement, may recognise that their future selves will want to deviate from these plans and they may therefore want to constrain the actions of their future selves (Karlán, et al., 2014). Laibson (2015) subsequently defined commitment as placing a ‘pure’ limitation on one’s choice-set without consideration of confusing external advantages, for example, tax benefits on saving options. Exley and Naecker (2016) also explained that an individual needs commitment when they recognise their time-inconsistent preferences, wishes to restrict future options to avoid self-harming decisions, or improves behaviour such as to increase savings.

The abovementioned definitions all imply that a need for commitment originates from a recognition of possible decision-making errors in future. They suggest that too many options may cause these errors and suggest placing limitations on future choices as a precautionary

measure. Whereas the seminal work of Strotz (1955) referred to commitment in economic behaviour in general, the more recent definitions offered were explained in the context of saving behaviour. Whilst all three definitions for commitment presented here are similar, only Exley and Naecker (2016) referred to the intertemporal choice framework of time-inconsistent preferences as a possible explanation for commitment preference. For this reason, this particular definition was adopted as it was considered to be the most relevant for this study.

2.4.2 Present-focused preferences and commitment preference

Numerous intertemporal choice models prioritise present utility over future utility to explain behavioural anomalies in decision-making. Despite this commonality, models of present-focused preferences can be distinguished along two dimensions, namely *commitment preference* and *dynamic consistency* of preferences. Ericson and Laibson (2019) proposed this categorisation, as illustrated in Table 2.

Table 2: Present-focused intertemporal choice models categorised

| | Dynamically consistent preferences | Dynamically inconsistent preferences |
|---------------------------------|--|--|
| Commitment preference | <ul style="list-style-type: none"> • Unitary-self temptation models • Long-term self in multiple self-models | <ul style="list-style-type: none"> • Present bias with partial sophistication • Other forms of hyperbolic discounting |
| No commitment preference | <ul style="list-style-type: none"> • Exponential discounting • Objective risks (non-exponential discounting) • Myopia | <ul style="list-style-type: none"> • Present bias with perfect naivety • Psychometric distortions (i.e. perception of time, certainty-effect bias) • Myopia |

Source: Adapted from Figure 1 (Ericson & Laibson, 2019, p.18)

It can be observed from this categorisation that multiple models have the ability to explain commitment preference or a lack thereof. This study aimed to test present bias as a form of dynamically inconsistent time preference which may, or may not, drive commitment preference, depending on an individual's level of sophistication. In the present bias literature, sophisticated individuals are aware of their bias, which they may want to mitigate to improve future decisions (Ashraf et al., 2006; Giné et al., 2018; Laibson, 2015).

2.4.3 Present bias as a driver of commitment preference

Individuals often 'over-value' an immediate smaller award as opposed to a delayed greater award, which points to instant gratification, myopia and an excessive focus on the short term (Strotz, 1955). Since highly desired consumption at present can have limited utility in future and affect savings negatively (Bond & Sigurdsson, 2018), it is important for individuals to recognise their present bias. Empirical evidence suggests that a lack of self-control over present bias can create a preference for commitment to saving when individuals are aware of

their biases (Ashraf et al., 2006; Galperti, 2015; Giné et al., 2018). Observed commitments are therefore often regarded by economists as a prediction of present bias in behaviour (O'Donoghue & Rabin, 2015).

2.4.4 Heterogeneity in present bias

Individuals that are aware of their present bias may want to deliberately restrict their future economic opportunities to prevent self-damaging activities and to improve future choices (Laibson, 2015). Prior studies have identified three types of present biased individuals, namely those that are sophisticated, partially sophisticated or naïve (Alan & Ertac, 2015; Ashraf et al., 2006; O'Donoghue & Rabin, 2015). Sophisticated individuals are aware of their present bias and demand commitment to save, even though commitment is needed at a reduced level compared to the other two types of individuals (Alan & Ertac, 2015; Laibson, 1997). On the other hand, the naïve are unaware of their present bias and do not consider the need for either commitment or CSDs to save (Giné et al., 2018; O'Donoghue & Rabin, 2015). The partially sophisticated are sophisticated enough to realise the benefit of a CSD but not sophisticated enough to use it effectively (Ashraf et al., 2006) since they underestimate their level of present bias. In the latter instance, John (2019) argues that commitment may fail and reduce the welfare of the partially sophisticated when they adopt weak commitments and eventually default. Consistent with the literature discussed here, the first hypothesis assumes that individuals who perceive financial scarcity prefer commitment, which can be linked to their present bias:

H₁: There is a difference in the commitment preferences of individuals with perceived financial scarcity who are present biased, compared to those who are not present biased.

Commitment to save is challenging because it carries costs in the form of loss of flexibility as well as direct commitment product costs, which often exceed its benefits (Karlan & Zinman, 2018; Laibson, 2015; Peysakhovich, 2014). Since a preference for flexibility may impede commitment to saving, this variable of interest is considered in the next section.

2.5 Preference for flexibility

Conventional wisdom suggests that a preference for flexibility in decision-making is a partiality towards adaptation of choices to new, different or changing conditions. Kreps (1979, p.565) instigated the term “preference for flexibility” and explained that this preference is natural in circumstances with explicit uncertainty where sequential decisions need to be made. A simple sequential decision model proposed by Jones and Ostroy (1984), predicts that the more uncertain an individual’s beliefs about the future are, the more they will prefer to choose flexible positions as it allows for a larger pool of options. In the context of saving

behaviour, a preference for flexibility also includes a demand for liquidity (Jones & Ostroy, 1984), which is the ability to dissave when the individual is faced with uncertainty or time-inconsistent preferences (Casari, 2009). Preference for flexibility is defined and discussed in terms of its components and drivers in the sub-sections that follow.

2.5.1 Definitions of flexibility

Since the origin of the “preference for flexibility” construct (Kreps, 1979, p.565), it was generally left open to interpretation in the literature as no explicit definition was offered at the time. According to Jones and Ostroy (1984, p.13), “one position is more flexible than another if it leaves available a larger set of future positions at any given level of cost”. Flexibility is also the *freedom of choice* in what, when and how savings goals are attained or desired behaviour is adopted (Amador et al., 2006). While these examples offer descriptions of flexibility, a preference for flexibility also indicates the expectancy of uncertain future circumstances according to more recent literature (Ahn & Sarver, 2013, p.341). This was also observed in a study by Sadowski (2013), where decision-makers revealed preferences for menus with alternative future options. In other words, decision-makers prefer to leave some options open, rather than choosing a restricted or set plan (Higashi, Hyogo & Takeoka, 2014). For this study, the term flexibility refers to a larger pool of options and freedom of choice between these options.

In contrast, commitment preference was defined as the need to limit one’s choice sets and is considered costly as it comes at a loss of flexibility (Laibson, 2015). This suggests that trade-offs need to be made between decision-makers’ flexibility preferences and commitment preferences. To determine the optimal trade-off, extant literature offers three benefits of flexibility to consider, namely *enlarged choice sets*, *liquidity* and *choice changes or reversals*. As demonstrated from the definitions offered earlier, enlarged choice sets are consistently associated with flexibility (Jones & Ostroy, 1984) and preference for flexibility (Sadowski, 2013; Higashi et al., 2014). A benefit of enlarged choice sets is that it allows the decision-maker to re-optimize their plans, especially when these plans are subject to constraints, such as poverty (Karlan et al., 2014). In that instance, flexibility offers a buffer against the demotivating effects of failure in goal pursuits (Rai et al., 2022). Secondly, liquidity is a financial term that is generally understood as the ability to access cash or funding, which is also key to maintaining the flexibility to respond to income shocks when financially constrained (Bond & Sigurdsson, 2018). Lastly, consumption choices made today may have limited utility in the future and flexibility allows for reversal of choices at a later time (Bond & Sigurdsson, 2018; Karlan et al., 2014). While the benefits of flexibility in decision-making are evident, the drivers of individuals’ flexibility preferences are of specific interest to this study, as discussed next.

2.5.2 Drivers of flexibility preference

To date, the economic literature on preference for flexibility has largely focussed on extensions of the standard EU functions (EU model) in a choice setting. Parameters added to the original model introduced by Kreps (1979) to predict preference for flexibility include choice deferral (Pejsachowicz & Toussaert, 2017); dynamic preferences (Krishna & Sadowski, 2014); consistency of preferences (Janssens et al., 2017; Riella, 2013); and random uncertainty (Saito, 2015). These models extended choice theory by identifying drivers of flexibility preference which can be classified into two main groups, specifically dynamic *time preferences* and *uncertainty* as reflected in Figure 3. Thus, both inconsistent time preferences and uncertainty about future events (Casari, 2009; Giné et al., 2018) may result in choice reversals over time which flexibility allows.

Uncertainty often results in flexibility preferences to such an extent that individuals are willing to incur a cost to enlarge the choice sets available to them in the future (Casari, 2009; Krishna & Sadowski, 2014). For example, decision-makers are influenced by uncertainty around future consumption utilities, future risks or changing tastes (taste shocks) and therefore prefer not to commit to a course of future action today (Casari & Dragone, 2015; Krishna & Sadowski, 2014).

2.5.3 Heterogeneity in flexibility preference

When individuals expect new information on their preferences or other variables (income shocks, for example) to arrive in the future, they prefer the flexibility to act on that new, relevant information (Amador et al., 2006; Casari, 2009). In the absence of temptation for higher present consumption, individuals will prefer full flexibility over full commitment (Amador et al., 2006; Ambrus & Egorov, 2013; John, 2019).

For individuals to maximise their welfare through savings, they need to make optimal choices in terms of their flexibility preferences. Sophisticated individuals are aware of their degree of inconsistency in decision-making and can be assumed to make the optimal choice, whilst a lack of personal information will lead the naïve to an adverse selection problem (Galperti, 2015). Individuals are heterogeneous in their degree of inconsistency which is not always easily observable (Galperti, 2015) but preferences are revealed through the decisions they make, including saving decisions, for example (Pejsachowicz & Toussaert, 2017). Individuals' flexibility preferences in financial decision-making were therefore elicited through appropriate hypothetical choice scenarios as discussed in detail in Chapter 3.

2.5.4 Flexibility preference under conditions of financial scarcity

Saving behaviour is complex and meets with unique constraints in poor communities such as high levels of uncertainty about future conditions (Steinert et al., 2018). Flexible saving devices that allow for small, frequent deposits that match the income variability of the poor are therefore particularly suitable in developing countries (Afzal et al., 2017). Flexibility to access their savings in the event of income shocks (Bond & Sigurdsson, 2018), while allowing them to safely store their money during better times is also highly valued (Prina, 2015). The liquidity constraints experienced in poverty (Dupas & Robinson, 2013) lead to this flexibility preference which is one of the main constraints to saving (Carvalho et al., 2016). For these reasons, this study specifically tested interventions among individuals who perceive financial scarcity to explain the trade-off between preferences for flexibility and commitment towards increased saving outcomes.

According to the literature discussed here, the preference for flexibility originates from time-inconsistent preferences and high levels of uncertainty about the future. Thus, the second hypothesis tested if flexibility preferences differed based on a participant's measure of certainty-effect bias:

H₂: There is a difference between the flexibility preferences of individuals with perceived financial scarcity who are certainty-effect biased, compared to those who are not certainty-effect biased.

In summary, it is evident from extant literature that commitment involves a restriction of future choice sets, while flexibility implies a preference for expanded choice options (Amador et al., 2006). An individual that experiences a consumption-saving problem has a preference for commitment to save but uncertainty about future consumption also creates a preference for flexibility to access amounts saved (Bond & Sigurdsson, 2018). Commitment generally implies a long-term time horizon, yet flexibility to access savings over the short term seems to be a key requirement for individuals who perceive financial scarcity to continue saving. A preference for flexibility could therefore be an obstacle to accumulating savings to increase wealth over the long term (Prina, 2015). Due to the lack of clarity in the literature on how the two constructs operate together in saving decisions, this study experimentally manipulated both through behavioural intervention.

2.6 Interventions to improve saving behaviour

Behavioural interventions operate on the assumption that economic participants act irrationally and behaviour, such as inadequate saving behaviour as an example, can be corrected. An example of a successful saving promotion intervention can be found in the Save More Tomorrow™ (SMarT) plan by Thaler and Benartzi (2004). This intervention was effective because it addressed present bias by delaying saving increases to the future; mitigated loss

aversion by linking savings to salary increases; while leveraging off status quo biases by making the default option the option to remain in the plan (Thaler & Benartzi, 2004). In other words, the plan was designed to target a combination of employees' behavioural constraints to saving and managed to change their behaviour towards increased savings outcomes over time. Empirical studies that experimented with various interventions to encourage saving behaviour change became popular as a result. Interventions that involved CSDs in particular have been tested in various fields and often in the low-income context (Ashraf et al., 2006; Dupas & Robinson, 2013; John, 2019).

Individuals enter into CSDs intending to achieve a goal for future behaviour that would otherwise be difficult due to a lack of self-control, for example. A *formal* CSD such as a goal-based savings bank account requires either a committed amount to be saved by a set deadline, or regular deposits of a selected amount until the commitment period ends (Allen, et al., 2016; Karlan et al., 2016). Bernheim et al. (2015) state that these devices are effective because they require a savings goal and restrict access to funds until the particular goal is achieved.

In the opinion of Giné et al. (2018), *informal* CSDs as cost-effective solutions to drive saving behaviour, provide opportunities to improve the lives of the poor in developing countries. For example, unsophisticated, easily accessible saving devices such as lock boxes are better suited for small, frequent savings in this market (Dupas & Robinson, 2013). CSDs do not necessarily have to operate in a physical form. They can also operate cognitively through reminders to form saving habits (Karlan et al., 2016), budgeting to increase mental accounting towards saving (Dholakia et al., 2016), or information to raise awareness and salience to save (Crossley, Bresser, Delaney & Winter, 2017; Karlan et al., 2016).

Another research avenue related to CSDs makes a distinction between 'hard' and 'soft' commitment interventions, and tests which type of intervention is more effective to improve saving behaviour. These studies seek to determine the usefulness of CSDs, and specifically the optimal trade-off between commitment and flexibility offered by the devices (Beshears, Choi, Harris, Laibson, Madrian & Sakong, 2020). Devices with weak commitments may not help individuals to overcome present bias or self-control problems, thus several studies found that hard CSDs can be effective at increasing savings (Ashraf et al., 2006; Dupas & Robinson, 2013; John, 2019). On the other hand, overly restrictive CSDs may result in low uptake in uncertain environments (Amador et al., 2006; Laibson, 2015), for instance when incomes or expenditures are highly volatile and more flexibility is required to smooth consumption (Dupas & Robinson, 2013; Janssens et al., 2017). Hard commitment interventions may involve restrictions and economic penalties for failure or rewards for success, while soft commitment interventions may have intangible psychological effects such as guilt or loss of self-esteem

(Bryan et al., 2010; Dupas & Robinson, 2013; Karlan et al., 2014). For the intervention conducted in this study, the hard commitment treatment featured strict constraints, while the soft commitment treatment allowed for flexibility, as suggested by Janssens et al. (2017).

Further research on interventions to improve saving behaviour is, however, needed in terms of how to match different people and households with different types of saving devices (Karlan et al., 2014). This is important because commitment can be harmful if individuals select inappropriate CSDs, which are either too hard or too soft for their level of present bias awareness (sophistication) (John, 2019). In this study, participants' commitment and flexibility preferences were manipulated through hard and soft treatments respectively, to evaluate the effects on saving intention (directly) and saving action (indirectly).

2.7 Intention and action in saving behaviour

“Saving” is the action of consistently spending less money than income received, thereby accumulating funds for future consumption or for building personal wealth (Dholakia et al., 2016). According to Cronqvist and Siegel (2015), ‘savings’ is the change in the net worth of an individual’s assets over a period of time. ‘Saving behaviour’ encompasses more than just the financial dimensions of saving; it also includes psychological dimensions such as intentions and habits (Ranyard, 2017) and is instigated when a person steadily increases their saving activity, in different contexts and on different occasions (Dholakia et al., 2016). Saving behaviour, therefore, requires both an intention to save and taking action to save over a period of time.

2.7.1 Saving intention

Behavioural Economic literature generally refers to saving behaviour and does not explicitly separate saving intention from saving activity or behaviour. Most empirical studies on intention emanate from social psychology theories such as the action control theory (Kuhl, 1984) and the TPB (Ajzen, 1991). For this reason, this study looked to social psychology literature for extant research on intention and its relationship with behaviour. A definition for saving intention from the field of psychology states that saving intention is the degree to which a person formulates conscious plans to perform or not perform a specified future behaviour (Warshaw & Davis, 1985). The definition of Cane, O’Connor and Michie, (2012) was adapted for this study and describes saving intention as a *conscious decision* to perform a saving behaviour or to resolve a saving action in a certain way, according to choices or preferences.

The third hypothesis of this study relates to the manipulation of commitment and flexibility preferences through two treatments to promote saving intention, and ultimately to gain a better

understanding of the heterogeneity in their saving behaviour. The third and main hypothesis consists of three parts to compare the effect of the two treatments, formulated as:

H_{3(a)}: A strict (hard) commitment intervention has a positive impact on the saving intentions of individuals who perceived financial scarcity (Treatment 1 [T₁]).

H_{3(b)}: A flexible (soft) commitment intervention has a positive impact on the saving intentions of individuals who perceived financial scarcity (Treatment 2 [T₂]).

H_{3(c)}: A flexible (soft) commitment intervention has a stronger positive impact on the saving intentions of individuals who perceived financial scarcity compared to a strict (hard) commitment intervention.

2.7.2 From saving intention to saving action

Saving activity is an *observable saving action* that is performed in a particular time and place (Fishbein & Ajzen, 2010). This construct is therefore distinct from a mere intention or conscious decision to take action as discussed in the previous sections. Several correlation studies from the field of social psychology found that intention better predicts behaviour compared to other cognitions such as risk perceptions, attitudes, norms and self-efficacy (Sheeran, 2002; Sheeran, Harris & Epton, 2014; Sheeran, Klein & Rothman, 2017). Despite this, predicting behaviour is still no indication of how much behavioural change can be attributed to manipulating the intention variable (Sheeran et al., 2017). This is based on the findings of a meta-analysis of experiments that manipulated intention, which showed that a medium-to-large-sized change in intentions only led to a small-to-medium-sized change in behaviour (Webb & Sheeran, 2006). This lack of consistency between intention and action is mostly driven by individuals labelled as ‘inclined abstainers’, who indicate an intention to act but fail to follow through (Sheeran, 2002, p.6). According to Hulland and Houston (2021), prior research has not found a consistently strong relationship between intention and behaviour, which has become known as the ‘intention-behaviour gap’.

Sheeran (2002) performed a meta-analysis of meta-analyses on intention-behaviour correlational studies with two objectives. The first objective was to quantify the intention-behaviour gap, resulting in the finding that intention predicts, on average, around 28% of the variance in future behaviour. Secondly, this study aimed to identify intention characteristics that may affect its predictive validity to offer insights on how to bridge the intention-behaviour gap. These characteristics were found to be temporal stability; degree of intention formation (strength); attitudinal versus normative control; and intention certainty and accessibility (Sheeran, 2002). Of these, temporal stability was found to be the most important moderator of the intention-behaviour relationship, meaning that stable intentions are more likely to translate into action compared to unstable intentions (Cooke & Sheeran, 2013; Sheeran,

Orbell & Trafimow, 1999). A fundamental study by Sheeran et al. (1999), offered evidence that the temporal stability of intentions not only moderates the intention-behaviour relationship but also the past behaviour-future behaviour relationship. More specifically, when intentions are stable, past behaviour is not related to future behaviour. On the contrary, when intentions are unstable, past behaviour is the best predictor of future behaviour (Sheeran et al., 1999). It is also important to consider any events causing a change in intention after measurement and before the observation of behaviour which may lessen the stability and predictive accuracy of the measured intention (Fishbein & Ajzen, 2010). Literature on the temporal stability of intentions seemed relevant to this particular study that measured saving intention at three time periods and evaluated how it impacted saving action.

A second characteristic of intention relevant to this study and mentioned earlier is the strength of intention (Sheeran, 2002). According to Connor and Norman (2022), stronger intentions are better predictors of behaviour, more stable over time, less easily influenced by interventions to change them and have more impact on individuals' processing of intention-relevant information. In summary, intention stability and strength are key moderators of the intention-behaviour relationship and are important to consider - either in predicting future behaviour or in the interpretation of subsequent behaviour. Thus, both these moderators may offer insights into the saving action observed post-saving intention intervention performed as per H₃.

Various lines of research have emerged over the years to challenge and explain intention as the most immediate predictor of behaviour as stipulated by the Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 2010). For example, studies on the past behaviour-future behaviour relationship offered contradictory evidence on the role of experience or past behaviour on the intention-behaviour relationship. Prior studies either found that past behaviour strengthens this relationship by stabilising intentions or found that it weakens the relationship due to habit formation (Sheeran, Godin, Conner & Germain, 2017). Sheeran et al. (2017) studied this paradox and clarified that past behaviour may strengthen the intention-behaviour relationship at first but as experience in the behaviour increases, habits are formed and further experience starts to weaken this relationship again.

Considering the potential influence of moderators and past behaviour on the intention-behaviour relationship as discussed here, this study did not automatically assume that an individual's saving intention would result in saving activity. Instead, the study was designed to experiment with commitment and flexibility treatments to improve saving intentions and to measure its secondary effects on saving action. The treatments chosen to achieve this outcome required the formation of saving implementation-intention plans, which are considered to be one of the best-validated tools for the translation of intention into action (Gollwitzer, 1999; Sheeran & Webb, 2016). Evaluation of the behavioural outcome involved

testing the relationship between saving intention and saving action 30 days post the intervention, to determine if improved saving intention led to improved saving activity (H₄). Without an intention-change intervention to facilitate this (as per H₃), a saving intention alone will most likely not result in significantly improved saving activity or behaviour (Webb & Sheeran, 2006). Following this, the fourth hypothesis was formulated:

H₄: There is a positive relationship between saving intention and saving action among individuals who perceived financial scarcity.

2.8 Conclusion

The purpose of this chapter was to explain the theoretical foundation of the study and to formulate the hypotheses to be tested. As a starting point, the commitment and flexibility preferences of individuals with perceived financial scarcity were discussed to formulate the first two hypotheses (refer to Table 3, H₁ and H₂). It is important to test these constructs for a better understanding of the underlying forces which might influence the effects of the subsequent treatments to improve saving intention (H₃). The main hypothesis (H₃) was subsequently formulated to compare two experimental treatments which differed in the level of commitment and flexibility offered, as an intervention to improve saving intention. The last hypothesis was then formed to test the effect of this saving intention intervention on saving activity and to determine the relationship between these two constructs of saving behaviour (H₄).

Table 3: Hypotheses

| Number | Hypothesis |
|-------------------|---|
| H ₁ | There is a difference in the commitment preferences of individuals with perceived financial scarcity who are present biased, compared to those who are not present biased. |
| H ₂ | There is a difference between the flexibility preferences of individuals with perceived financial scarcity who are certainty-effect biased, compared to those who are not certainty-effect biased. |
| H _{3(a)} | A strict (hard) commitment intervention has a positive impact on the saving intentions of individuals who perceived financial scarcity (T_1). |
| H _{3(b)} | A flexible (soft) commitment intervention has a positive impact on the saving intentions of individuals who perceived financial scarcity (T_2). |
| H _{3(c)} | A flexible (soft) commitment intervention has a stronger positive impact on the saving intentions of individuals who perceive financial scarcity compared to a strict (hard) commitment intervention. |
| H ₄ | There is a positive relationship between saving intention and saving action among individuals who perceived financial scarcity. |

Source: Author's own

The hypotheses summarised in Table 3 were formulated from the literature review discussed in this chapter in order to answer the main research question. A conceptual framework as

illustrated in Figure 4, guided the overall study and is discussed in the upcoming chapter. The research methodology followed to test the hypotheses are also described and motivated in the next chapter.

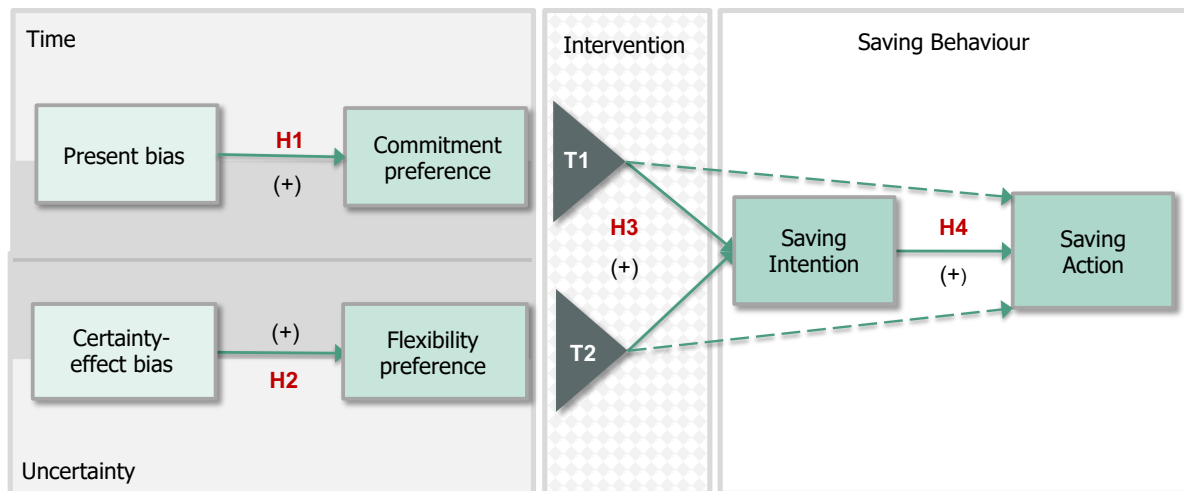


Figure 4: Conceptual framework

Source: Author's own

Chapter 3: Research Methodology

3.1 Introduction

The study aims to explain how the opposing preferences for commitment and flexibility impact the saving behaviour of individuals who perceive financial scarcity. The overarching research question and hypotheses were derived from extant literature as discussed in the previous chapters. The purpose of this chapter is to explain how the study was designed and conducted to test the hypotheses and to answer the research question.

The validity and reliability of data were considered in all the research design elements discussed in this chapter (refer to Section 3.7). Strategies to mitigate these concerns were applied and refined throughout the research process, considering available time and resources. All research design choices are discussed in Sections 3.2 to 3.6, followed by validity and reliability considerations (Section 3.7) and the methodological limitations of the study (Section 3.8), before closing the chapter with a concluding summary (Section 3.9).

3.2 Choice of research methodology and design

The main research question was answered by analysing *if* and *how* behavioural interventions can improve saving behaviour among individuals who experience financial resource scarcity. According to Chetty (2015), incorporating behavioural factors into the analysis of core economic questions, for example, how to increase saving rates, should be viewed as a pragmatic choice. A philosophy of pragmatism emphasises actionable knowledge, recognises the interconnectedness between experience, knowing and acting, and regard inquiry as an experiential process (Kelly & Cordeiro, 2020; Morgan, 2014). Following these key methodological principles of pragmatism, the researcher aimed to execute practical, actionable and applied research that worked best to answer the main research question (Wahyuni, 2012).

Considering the abovementioned paradigm and based on the specific nature of the main research question, explanatory research was conducted. A deductive research approach was followed from the onset to formulate the research question, derive the hypotheses and define the key variables from extant, peer-reviewed literature. The key, measurable variables of this study are Preference for Commitment (Exley & Naecker, 2016); Preference for Flexibility (Casari, 2009; Jones & Ostroy, 1984); Saving Intention (Cane et al., 2012; Warshaw & Davis, 1985) and Saving Action (Dholakia et al., 2016; Fishbein & Ajzen, 2010; Ranyard, 2017).

A strategy of experimentation was followed to collect primary data, test the hypotheses, and analyse the impact of behavioural interventions quantitatively. This strategy was chosen in line with the prevailing trend in behavioural economic research to test saving behaviour

interventions either through RCTs in the field (Afzal, d'Adda, Fafchamps, Quinn & Said, 2017; Dupas, Keats & Robinson, 2017; Giné, Goldberg, Silverman & Yang, 2018) or by way of laboratory experiments (Exley & Naecker, 2016; Houser, Schunk, Winter & Xiao, 2018; Jackson & Yariv, 2014). The former (field experiments) are particularly appropriate for behavioural research that aims to understand “how people behave, what influences their preferences and choices, how initial behaviours shape future behaviours” (Gneezy, 2017, p.140). Thus, ‘real-life’ data were collected from participants through an online survey experiment in a natural environment, as opposed to testing the saving behaviour of students in person at a university. The latter is considered to be a laboratory setting, which is a convenient and popular setting often used for behavioural science experiments (List, 2011). The specific experimental design choices are discussed and motivated in detail in the sub-sections that follow.

3.2.1 *The power of an experimental design*

The power of an experimental research design lies in the possibility to make cause-and-effect inferences (Imai, Tingley & Yamamoto, 2013). According to Imai et al. (2013), experiments should be designed to reveal not only the effect but also the underlying causal mechanisms of an intervention’s singular effect on an outcome of interest. During the experimental design, a mental checklist proposed by List (2011) was followed as a reminder to enhance rigour, reduce bias and increase the internal validity of the study to allow for possible causal inferences from the evidence. More specifically, the key independent variables (Commitment and Flexibility Preferences) were manipulated through an intervention to observe its direct impact on *saving intention* and indirect impact on *saving action*. Furthermore, an experimental manipulation that can produce a statistically significant increase in saving intention, should also produce a significant increase in subsequent saving behaviour if there is a causal relationship between intention and behaviour (Webb & Sheeran, 2006). To infer these causal relationships based on the findings, a robust experiment had to be designed from the onset.

3.2.2 *Overview of the specific experimental design*

Empirical evidence suggests that present biased behaviour drives demand for a commitment to save (Ashraf, Karlan & Yin, 2006; Giné et al., 2018), while a certainty-effect bias leads to a preference for flexibility (Casari, 2009; Krishna & Sadowski, 2014) in saving decisions. Despite financial constraints, low-income individuals save out of the necessity to smooth income and therefore prefer both commitment and flexibility features in saving devices (Amador et al., 2006; Bond & Sigurdsson, 2018; Galperti, 2015; Prina, 2015). This study posits that individuals with perceived financial scarcity, also known as ‘scarcity mindsets’, have the same commitment and flexibility preferences as low-income individuals when saving.

Several prior studies have tested interventions related to a demand for a commitment to save (Giné et al., 2018; Karlan, McConnell, Mullainathan & Zinman, 2016; Peysakhovich, 2014), while preferences for flexibility in decision-making have mostly been predicted with econometric models (Ahn & Sarver, 2013; Pejsachowicz & Toussaert, 2017; Saito, 2015). To the best of the researcher's knowledge, very few prior studies have experimentally tested flexibility preferences on their own, or their interaction with commitment preference in saving behaviour. Consequently, this study aimed to make a methodological contribution by manipulating these independent variables to evaluate their impact on the saving intentions of individuals with perceived financial scarcity.

To accomplish this aim, each participant was randomly assigned to either a control group or one of the experimental conditions (T_1 or T_2) according to the randomisation process explicated in Section 3.4.2. Causal estimates were attained by comparing the behaviour of individuals in one treatment group, with the behaviour of those in the second treatment group, as well as those in the control group. This 'between-subject' design - where each participant (subject) was exposed to only one treatment at most - was specifically chosen because it is a conservative experimental design which reduces the risk of multiple confounds and spurious associations (Charness, Gneezy & Kuhn, 2012). Furthermore, it is often the preferred design choice for testing real-world problems about whether to make a particular decision or not (Charness et al., 2012); in this case, to save money or not.

The research was conducted according to a pre-determined experimental protocol to ensure that valid causal inferences would eventually be possible based on the research findings. Appendix 2 offers a summary of this protocol that was followed to ensure transparency; data quality, -accuracy and -security; experimental integrity and ethical practices throughout the study. Figure 5 presents the conceptual framework of how the study was conducted, showing the variables of interest and the relationships which were tested to answer the overall research question. The main data collection phases for the respective variables of interest are also illustrated to provide a roadmap for the discussion of the measurement instruments that follow in Section 3.5.

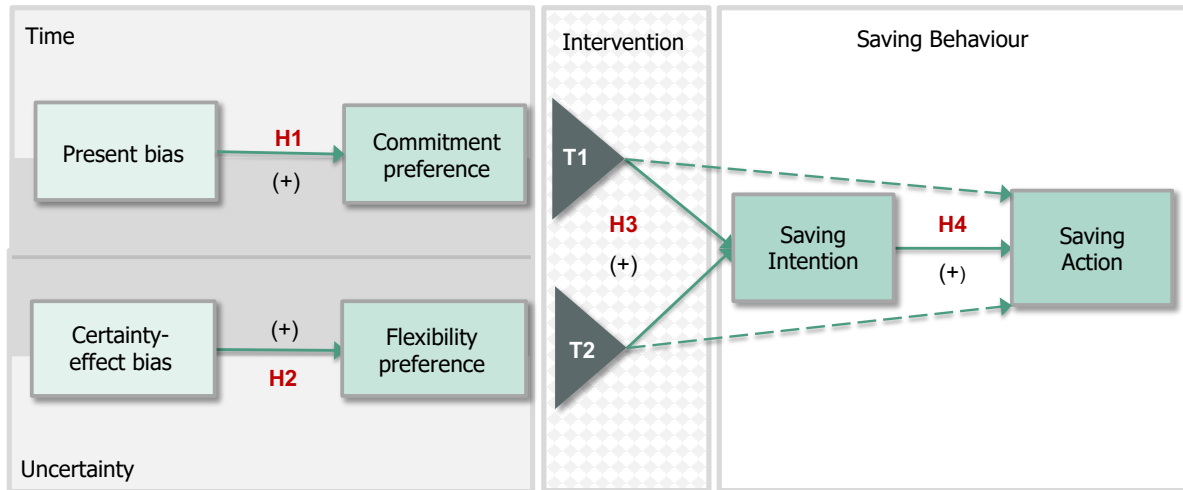


Figure 5: Conceptual framework

Source: Author's own

During the first phase of the study, a baseline survey with a series of hypothetical choice questions was posed to participants (refer to Section 3.5.4 and Appendix 4). These questions were effective to detect the decision anomalies of present bias and certainty-effect bias whilst eliciting preferences for commitment and flexibility in saving (Pejsachowicz & Toussaert, 2017). Separate interventions designed to manipulate participants' preferences for commitment and flexibility were subsequently run (refer to Section 3.5.5 and Appendix 5). Lastly, participants were presented with an endline survey to measure the impact of the two interventions on their saving intentions (refer to Section 3.5.6 and Appendix 4). The design and function of the complete data collection instrument are discussed in more detail in Section 3.5.

The second phase of the study involved testing whether the intention-change interventions resulted in improved saving action. A post hoc survey required participants to self-report their saving transactions over 30 days following the interventions. According to Rindfleisch, Malter, Ganesan and Moorman (2008), this constitutes a longitudinal study as data on participants' choices and behaviour were collected over a period of time. A comprehensive discussion of the second phase of the study can be found in Section 3.5.7.

3.2.3 Online behavioural experimentation

Online behavioural experiments are increasing in popularity due to the benefits of convenience, cost-effectivity and access to more diverse populations (Palan & Schitter, 2018). However, an online environment poses unique challenges which were considered in the experimental design of the study. For example, the success of the experiment was dependent on several technologies for connectivity, including the server that hosts the experiment, the participants' Internet service provider, the Internet browser that presents the experiment to the

participant and the media or content used in the experiment itself (Anwyl-Irvine, Massonnié, Flitton, Kirkham & Evershed, 2019; Grootswagers, 2020). These factors were considered when designing the data collection instrument and intervention (Appendices 4 and 5) and pilot-tested in detail to ensure both the media used and the length of the surveys did not overburden technology or require excessive data costs from participants.

Conducting the experiment online offered the added benefit of tracking participants' reaction times to questions (Anwyl-Irvine et al., 2020), which is frequently used as an indication of the quality of responses in behavioural studies. Furthermore, the practicality, effectiveness of data management and wide reach of digital tools (Grootswagers, 2020) made online data collection appropriate for this particular study where a large sample size was required.

3.2.4 Overview of the intervention design

The interventions were designed to manipulate commitment and flexibility preferences to effect change in participants' saving intentions. While this was an explanatory study, the nature of the interventions was a self-reflective task comprising qualitative questions which were completed by all participants (Chen, 2013; Chen et al., 2017). Self-reflective tasks were considered to be the most appropriate and least invasive means through which individuals' subjective preferences for commitment and flexibility could be manipulated to test their equally subjective intentions. The self-reflection tasks guided participants through a self-administered thought process by posing questions that required active responses and saving decision-making. Section 3.5.5 and Appendix 5 provide details about the design choices and specific questions asked during each intervention.

3.2.5 Risks associated with an experimental design

The inherent risks of an experimental study were considered in the overall design of this study. Table 4 summarises the main risk mitigation strategies that were implemented, with more detailed discussions on these strategies and related design choices included in the sections that follow.

Table 4: Experimental design risks and mitigations

| No. | Risk | Mitigation strategies |
|-----|--|---|
| 1 | No valid counterfactual (control group) was created for a reliable comparison of ATE sizes with the treatment groups. This comparison is the most basic measure required to determine the impact of interventions in an RCT (Glennester & Takavarasha, 2013). | <ol style="list-style-type: none"> 1. The control group received no treatment. 2. Random assignment of participants to experimental groups ensured that no statistically significant differences existed between the key characteristics of the control group and the two treatment groups <i>before</i> the treatments commenced (List, 2011) (refer to Section 3.4.2). 3. <i>Stratified</i> random assignment of participants to the experimental groups further allowed for an unbiased estimate of the ATE per treatment group (List, Sadoff & Wagner, 2011) (refer to Section 3.4.2). |
| 2 | Intervention is not appropriate and has negligible ATE sizes per treatment group (not statistically significant or not measurable), which affects the accuracy of causal inferences about the effectivity of the manipulations. | <ol style="list-style-type: none"> 1. Control variables were introduced (refer to Section 3.5.3) to better explain small ATE sizes. 2. Heterogeneous treatment effects between different subgroups (strata) and the experimental groups were analysed (refer to Section 3.6.4). 3. Manipulation checks were introduced to ensure the construct validity of the treatments (Podsakoff & Podsakoff, 2018). |
| 3 | Adequate statistical power to make causal inferences is lacking. | A conservative Minimum Detectable Effect (MDE) size (0.02 standard deviations) (Cohen, 1992) was estimated and used in a statistical power calculation to determine a large target sample size that would ensure at least 80% power for the particular statistical tests chosen for the study (refer to Section 3.4.3). |
| 4. | Significant 'noise', confounds and spurious associations were found between key variables. | The conservative between-subject experimental design which depends on randomisation for internal validity (Charness et al., 2012) was chosen to reduce this risk (refer to Sections 3.2.2 and 3.7). |

Source: Author's own

3.3 Unit and level of analysis

The unit of analysis for this study was an individual who perceives financial scarcity. This perception is a subjective state often experienced in poverty and low-income contexts but is not limited to any particular income group. These individuals face unique challenges and have very specific requirements for financial products to be able to save (Martin & Hill, 2015). Data was collected and analysed at the level of the individual to determine how their preferences for commitment and flexibility impact their saving behaviour.

3.4 Population and sampling strategy

The target population for this research project was all individuals resident in South Africa with perceived financial scarcity and who wished to improve their saving behaviour despite the financial resource constraints they experience. However, due to the subjectivity of perceived financial scarcity, no complete and objective list exists for all such individuals in South Africa. For this reason, the sampling frame comprised those individuals who perceived financial scarcity and considered this to be a saving constraint (subjective constraint).

Perceived financial scarcity originates from an individual's subjective reality of resource scarcity or 'scarcity mindset' (Mullainathan & Shafir, 2014). This perception of resource or financial scarcity is relative to an individual and includes (but is not limited to) absolute poverty or income levels. It is a "discrepancy between one's current resource levels and a higher, more desirable reference point" (Cannon et al., 2019, p.104). Recruited participants were therefore screened against the selection criteria for perceived financial scarcity before they were allowed to partake in the study (refer to Appendix 4, Part 1 screening questions).

Limitations on resources and time did not allow for the entire sampling frame to be investigated. For this reason, samples of participants were selected following the strategies discussed in the next sections.

3.4.1 Participant recruitment and data collection mode

Individuals who perceive financial scarcity in South Africa were recruited for participation in the study through email campaigns and advocacy on social media via the researcher's network. Participant recruitment was further supplemented through the Prolific Academic platform to reach the target sample size. Prolific Academic is a crowdsourcing platform widely used in behavioural research to recruit participants for reliable and high-quality responses and offers diversity in terms of the potential participant pool (Palan & Schitter, 2018; Peer, Brandimarte, Samat & Acquisti, 2017).

Individuals who were reached through the recruitment strategies chose to participate and were therefore self-selected for the study. A truly random sample was not possible, since no sampling frame existed from where the target population could be randomly drawn. A random selection of participants would have increased the likelihood of a sample that is representative of the total population to reduce selection bias (Banerjee, Karlan & Zinman, 2015). While non-probability sampling techniques such as convenience and snowball sampling were applied in this study's recruitment process, participants were later randomly assigned to the experimental groups (refer to Section 3.4.2).

Since the researcher recognised the risk of introducing selection bias to the study through these sampling techniques, strategies were implemented to mitigate the risk that individuals who self-selected to participate in the study, were significantly different from those individuals who did not participate (Glennerster & Takavarasha, 2013). The strategies that were introduced in five steps to increase the representativeness of the sample population are summarised in Table 5.

Table 5: Strategies to mitigate selection bias

| Step | Mitigation strategies |
|------|--|
| 1 | Care was taken to promote participation in this study to a diverse group of South African residents, and to avoid a select audience overly biased towards personal financial management and saving. |
| 2 | Recruitment data and statistics tracked on the Gorilla platform where the instrument was hosted, suggest that the Consent Form (Appendix 4, Part 1) functioned as a deterrent to 'bots' and participants unwilling to participate in an academic study. This may have assisted somewhat to improve the quality of data collected, as potentially disengaged individuals were discouraged from participation. |
| 3 | Potential participants were advised of the participation criteria upfront, namely i) current age between 18 and 65 years, ii) South African residency, and iii) earning an income (albeit from any means). |
| 4 | Potential participants who met the above criteria and accessed the online survey link were then pre-screened for perceived financial scarcity (refer to Section 3.5.1). The purpose of this screening was to ensure that only appropriate participants from the target population according to the main research question were included in the study. |
| 5 | Stratified random assignment of participants into the experimental groups was automated and programmed into the data collection instrument to avoid selection bias into treatment and control groups. Participants were therefore not given a choice of a group; were separated and unaware of the existence of other experimental groups than the one they were assigned to. |

Source: Author's own

In summary, the risk of selection bias in the overall study was addressed by promoting participation to diverse individuals and then leveraging the informed consent, participation criteria and pre-screening questions to select appropriate participants. Participants were subsequently randomly assigned to the experimental groups to avoid selection bias at the experimental level.

Access to the data collection instrument was gained via a shared Internet web link compatible with all Internet browsers and accessible from either computers or mobile phones. This web link directed participants to the Gorilla platform which hosted the online behavioural experiment and made reliable and user-friendly access possible (Anwyl-Irvine et al., 2019). This online mode simplified the collection of data and improved the effectiveness of subsequent data analysis and management. At no time were participants' identities revealed and only anonymised data were accessed and analysed. This is discussed in more detail in Section 3.5.

3.4.2 Randomisation

If properly designed and executed, randomised experiments provide a credible method to estimate the impact of an intervention (Banerjee & Duflo, 2009). There are multiple ways to incorporate randomisation into an experimental design to increase the rigour and credibility of evidence on the impact of the proposed intervention (Glennerster & Takavarasha, 2013). In

this study, stratified randomisation was applied to assign participants to the experimental groups as illustrated in Figure 6. Stated differently, participants were grouped into ‘buckets’ otherwise known as sub-lists or strata, based on their characteristics in respect of a key variable. As per Figure 6, ‘Intent’ and ‘Low/No Intent’ were the only two strata chosen for this study, which relate to participants’ saving intention measured before the intervention (at baseline).

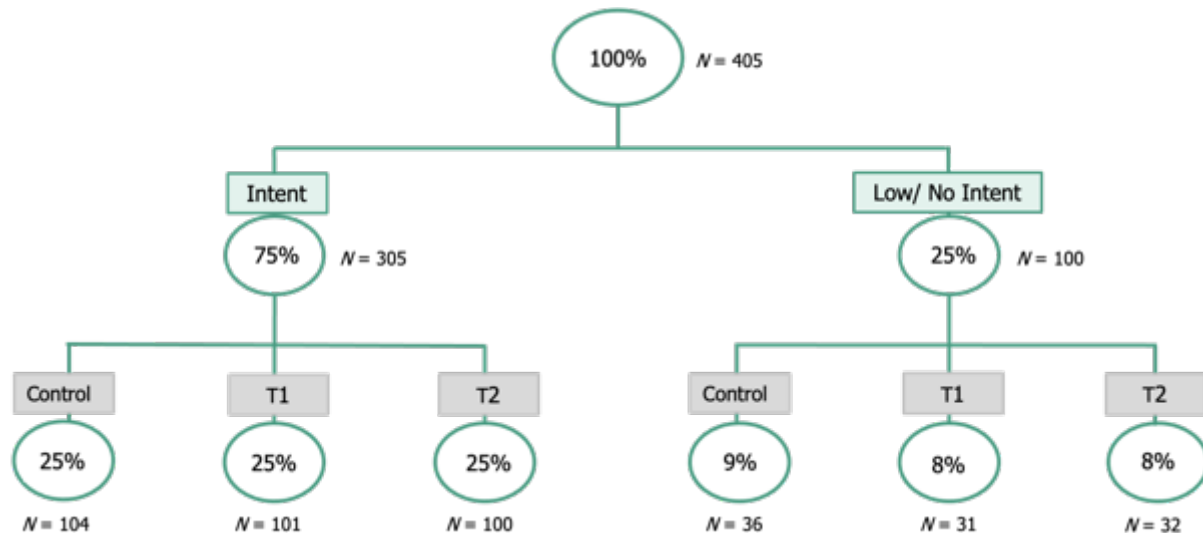


Figure 6: Stratified random assignment

Source: Author’s own

Stratification was programmed into the data collection instrument for two reasons. Firstly, to ensure that the control and treatment groups were balanced based on chosen characteristics (stratification variables) and secondly to increase statistical power (Duflo, Glennerster & Kremer, 2007; Glennerster & Takavarasha, 2013). However, it becomes challenging to achieve balance on all stratification variables between the experimental groups when a large number is selected – which, in turn, reduces statistical power (Duflo et al., 2007). Benefits derived from stratification are therefore greatest when stratification variables are limited and prioritised based on how strongly they correlate with the outcome of interest, which in this instance is saving intention. Glennerster and Takavarasha (2013) suggest the baseline measure of the main dependent variable (Saving Intention) is an important stratification variable since it has the highest potential correlation to the outcome. For example, saving intention before the intervention (at baseline) is considered to be strongly correlated to saving intention after the intervention (at endline). Consequently, participants’ saving intent (or lack thereof), was measured first and used as a first level classification for their random assignment to experimental groups.

Based on their strata (Intent or Low/No Intent), participants were randomly assigned in equal numbers to either a control group or to one of two treatment groups through an algorithm of the Gorilla platform. Thus, the number of participants in each experimental group per stratum was approximately one-third of their particular strata's sample size. Randomising in this way prevents any additional observed or unobserved characteristics of participants from influencing the assignment to treatment and ensures that any bias is equally spread between the control and treatment groups (List et al., 2011). This minimises the risk that treatment is correlated with individual characteristics and allows for an unbiased estimate of the ATE for a group and a comparison with a true counterfactual (List et al., 2011)(refer to Table 4, Point 1).

3.4.3 Statistical power and sample size rationale

A 'highly powered' experiment increases the likelihood that treatment effects (even small changes in a group's ATE) will be detected to decrease the risk of making erroneous inferences on the experimental impact. The same formula used to determine statistical power can also be used to determine the required sample size of a study. The statistical power of a randomised experiment improves with a large sample size (Banerjee et al., 2015), as it expands the breadth of characteristics in the subject pool to allow for the generalisation of the research findings.

When the target sample size for this study was determined, several parameters of a statistical power calculation were considered, namely i) the statistical significance level; ii) the power of the subsequent hypothesis tests, and iii) the MDE size estimated for the intervention (List et al., 2011). The conventional parameters used in experimental studies across various disciplines were assumed for the first two parameters. These assumptions were that i) a target had a 95% confidence level with a significance interval of 5% and ii) the required power of the statistical tests (used to evaluate the differences in the group means) were set at a minimum of 80%. In short, this means that the researcher wanted at least an 80% chance that a statistically significant effect would be detected (Glennester & Takavarasha, 2013).

Estimation of an MDE size for treatment is complex and subjective without access to robust data (List et al., 2011) but important as this estimate materially influences the calculation of the target sample size. For example, to achieve 80% power performing a multiple linear regression (MLR) analysis with two independent variables (as per Section 3.6.4), Cohen's rule of thumb for a conservative, small MDE of 0.02 standard deviations would require a total sample size of 481 (Cohen, 1992). Comparatively, a medium MDE size of 0.15 standard deviations requires a total sample size of only 67 (Cohen, 1992).

The researcher was guided by two metrics to choose an appropriate MDE size for this study, to use in the power calculation for the calculation of the targeted sample size. Mertens,

Herberz, Hahnel and Brosch (2022) performed a meta-analysis on behavioural intervention studies, which included 45 studies in the domain of financial behaviour. The results of these studies indicated that a small detectable effect size of 0.25 standard deviations (95% confidence interval) should be expected on average for similar studies (Mertens et al., 2022). Furthermore, the researcher considered the objectives of this particular study's interventions, namely to improve saving intention measured through a seven-point Likert scale (refer to Section 3.5.6). Results from pilot-testing this saving intention measure provided preliminary MDE size estimates between 0.2 and 0.7 standard deviations for the treatments (based on *t*-tests for the difference between two independent means). These estimates from the pilot-testing results fell between Cohen's (1992) small and medium effect size categories for *t*-tests. As a result, a conservative approach was taken to assume a *small* MDE size in principle to ensure the calculation would result in a large target sample size.

The *a priori* statistical power calculation offered a target sample size before the experiment was conducted, and this calculation was repeated post hoc to further assess if a statistically significant result was emerging (Faul, Erdfelder, Lang & Buchner, 2007). Based on the required 80% power (for the MLR analysis performed - Section 3.6.4) and an estimated small MDE size of 0.02 standard deviations (Cohen, 1992), the target sample size for this study was calculated as 404. This calculation was performed through G*Power, a flexible statistical power analysis program for behavioural sciences (Faul, Erdfelder, Buchner & Lang, 2009).

3.4.4 Sampling statistics

The total working population in South Africa between the ages of 18 and 65 as per the 2021 mid-year statistics (Stats SA, 2021) were approximately 39.1 million. Research conducted by Old Mutual in 2021 found that approximately 56% of individuals with an income of at least ZAR8,000 per month were feeling high to overwhelming levels of financial stress (Old Mutual, 2021). Since the exact number of South African residents who perceive financial scarcity is not known, the 56% financial stress ratio (Old Mutual, 2021) was used as a proxy to estimate the size of the target population for this study (21.9 million). Following the recruitment strategies as discussed in Section 3.4.1, an estimated 5,219 individuals were presented with the opportunity to complete the online survey experiment, of which 830 responded (a response rate of approximately 15.9%). These statistics are presented in Figure 7 for ease of reference.

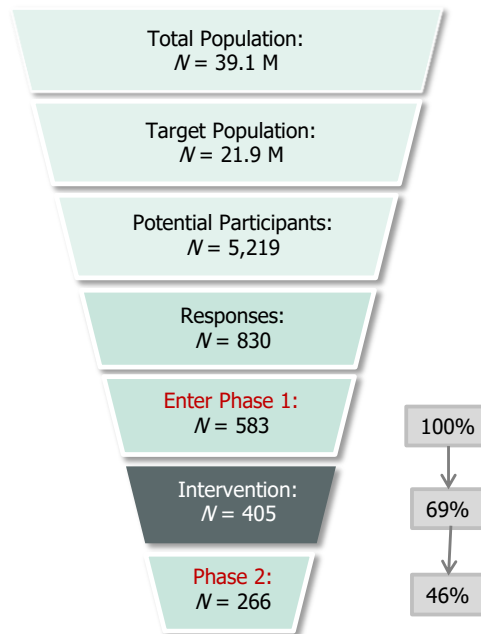


Figure 7: Sampling statistics

Source: Author's own

Individuals who qualified for participation based on their measures of perceived financial scarcity represented approximately 70.2% of all respondents ($N = 583$). The target sample size ($N = 405$) as discussed in the previous section was reached by continuously monitoring attrition due to incomplete responses, quality rejections and missing data whilst recruitment was in process. The high attrition rate during Phase One was predicted (from pilot-testing results, refer to Section 3.5.1), due to the necessary manipulation checks and missing data quality controls programmed into the online instrument - which possibly increased friction. Lastly, attrition between Phases One and Two was controlled through automated participation reminders sent to participants after the delay period of 30 days lapsed. This was made possible via the Gorilla platform where the online instrument was designed and hosted. The reduced sample size of 266 for Phase Two was also expected from the pilot-testing results and was still adequate to reliably test the final hypothesis (H_4) post hoc.

3.5 Measurement instruments and data collection methods

Data was collected by way of an online instrument that combined demographic and baseline survey questions, hypothetical choice experiments (H_1 and H_2), interventions (H_3) (Phase One) and ex-post self-reports (Phase Two) after a delay of 30 days. Before publishing the final instrument (refer to Appendix 4) for the commencement of the data collection process, it underwent extensive pilot testing. Findings from the pilot tests and design choices made for each of the components of the data instrument are discussed in this section.

3.5.1 Findings from piloting the measurement instruments

A total of four rounds of pilot testing (total $N = 45$) were completed to ensure that the various parts of the data collection instrument operated as intended, and would result in quality, appropriate data to test the hypotheses and to answer the overarching research question. The purpose and findings of each of the four pilot rounds are presented in Table 6, while Appendix 3 provides a summary of the amendments made to the data collection instrument before it was published, based on the findings from the pilot-testing rounds.

Table 6: Findings from pilot-testing

| No. | N | Purpose of pilot-test | Population | Findings |
|-----|-----|--|--|---|
| 1 | 5 | Early feedback on comprehension, practicality, and completion time (instrument provided in hardcopy) | Family and friends: a non-representative, convenience sample | Timing estimates were good but the instrument had to be improved in terms of: <ul style="list-style-type: none"> - data to answer H_1 and H_2; - format, presentation |
| 2 | 7 | Accessibility from multiple platforms and devices, format, presentation, completion time (Online) | Different family and friends: a non-representative, convenience sample | Timing estimates were good, and the online instrument was accessible but format and user-friendliness needed improvements |
| 3 | 16 | Interaction between different software used in instrument, functionality, screening for the target population | Participants screened for: <ul style="list-style-type: none"> - perceived financial scarcity; and - income | Timing estimates were still good. The sample was skewed towards females. Data for H_1 and H_2 were unclear |
| 4 | 17 | Functionality, improved screening, and testing with forced delays to ensure that longitudinal study/accessibility would work. Test stratification. | Participants screened for: <ul style="list-style-type: none"> - perceived financial scarcity; - income; and - quotas were introduced to ensure gender-balance | The longitudinal study worked practically (one day delay between phases tested: 28% attrition). Thus, higher attrition was predicted for a 30 days' delay. Stratification error found and corrected |

Source: Author's own

After completing the pilot instrument, all participants were asked to complete a few qualitative questions to elicit their feedback on matters such as the clarity of instructions, length of the survey, presentation and any technological challenges experienced while completing the online survey. Suggestions for improvements were incorporated as far as possible and special care was taken to ensure that all technological friction was removed and that the experimental design was programmed correctly and functioned accurately. Data collection then proceeded in two phases according to the process illustrated in Figure 8. Each part of the data collection

instrument, or step of the data collection process as displayed in this figure, is individually discussed in the sections that follow.

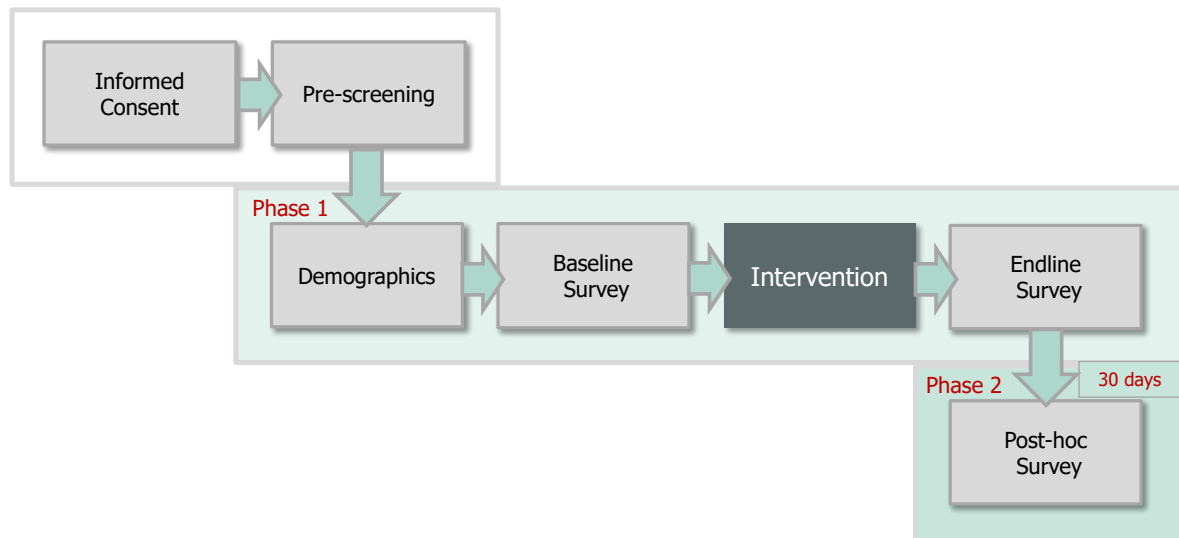


Figure 8: Data collection process

Source: Authors' own

3.5.2 Participant pre-screening

Participants were pre-screened to ensure that only individuals who met the selection criteria were included as subjects of interest in the study. The main participation requirement was that individuals perceived financial scarcity and revealed this by completing a short survey before entry to the study was allowed. Secondly, potential participants were required to have a source of income and be permanently based in South Africa. Collectively, these requirements were set to control the specific context of the study which was conducted online.

Individuals with perceived financial scarcity experience more uncertainty (Martin & Hill, 2015) and it affects their decision-making in general (Mullainathan & Shafir, 2014). Perceived financial scarcity has been reliably measured with four questions (Cronbach's alpha = 0.95), asking participants to i) rate their satisfaction with their current financial situation; ii) the extent to which they can spend money freely; iii) how financially free they feel, and iv) whether they believe their income is enough to cover unexpected or emergency expenses. These four questions were derived from previous studies conducted by Wu, Cheek and Shafir (2021) and Paley, Tully and Sharma (2019).

Potential participants were asked to complete these four questions, rating their answers on a seven-point Likert scale that ranged from one (not at all) to seven (very much or definitely). Lower numbers indicated greater perceived financial scarcity; thus a potential participant passed the screening test when their average rating across all four questions was smaller or

equal to four. Individuals who did not meet the criteria were thanked for their interest in this study but were not allowed to proceed and therefore excluded from stratified random assignment to the experimental groups.

3.5.3 Phase One: Demographic information

Demographic data of the sample population of individuals who perceived financial scarcity were collected to control for the equality of means (of characteristics) between the control and treatment groups and to improve the precision of the subsequent impact evaluation. Data such as age, gender, level of education, level of income (Cronqvist & Siegel, 2015; Dholakia et al., 2016; Martin & Hill, 2015), self-assessed financial literacy (Babiarz & Robb, 2013) and number of dependents (Old Mutual, 2021) were selected to serve as control variables in the statistical analyses of treatment effects (impact). The decision to specifically include each one of these control variables was based on evidence of their ability to influence saving behaviour, especially from studies conducted in developing countries (Martin & Hill, 2015; Old Mutual, 2021).

There were two requirements for the control group which were key to the design of a randomised impact evaluation study such as this. Firstly, how well the control group compared to the treatment groups and secondly, how well it mimicked the counterfactual. It was verified through descriptive statistical techniques that the participants in the three experimental groups were not statistically significantly different in terms of their key characteristics as derived from their demographic data (refer to Sections 4.5.2 and 4.6.2 in the next chapter). These were necessary balance tests to ensure the comparability of the control group with the treatment groups to determine the ATEs (Ashraf et al., 2006) during impact evaluation.

The 'counterfactual', as per the second requirement for the control group mentioned above, is the outcome at the same point in time, had the intervention *not* been introduced (Harrison & List, 2004). This was mimicked by excluding participants in the control group from any treatments. Therefore, the only difference between the three groups after a random assignment was the fact that the control group received no treatment during the intervention.

3.5.4 Phase One: Baseline Survey

The baseline survey was presented to all participants irrespective of the experimental group they were eventually assigned to (refer to Appendix 4). This survey was constructed to capture participants' biases and preferences to test the first two hypotheses (H_1 and H_2), and to measure saving intention before its experimental manipulation. This baseline measure of saving intention served as a reference point and covariate for quantifying and comparing the impact of the interventions on saving intention post hoc (at the endline).

The first hypothesis (H_1) specifically tested if there was an association between participants' present biased behaviour and commitment preference. Both these constructs were tested through within-subject choice experiments, as the method was reliably used in prior studies to predict present biased behaviour (Ashraf et al., 2006; Sprenger, 2015), and to elicit participants' commitment preferences (Ashraf et al., 2006; Bond & Sigurdsson, 2018). Present biased behaviour was measured through a series of hypothetical choice questions (four to five in total per participant), which were path-dependent based on the answer to the first question posed. Appendix 7 illustrates the different experimental paths which participants followed based on their particular answers. The main purpose of these question iterations was to determine time inconsistency in choices, which is an indication of possible hyperbolic discounting and/or present biased behaviour (Bond & Sigurdsson, 2018). Present bias, as a particular form of time-inconsistent behaviour, was measured by a switch from sooner-smaller (SS) rewards to larger-later (LL) rewards when a time delay was added to the hypothetical choice set (Janssens et al., 2017). Similar to the methodology of the global study performed by Ruggeri et al. (2022), this measure was not concerned with the calculation of exact discount rates or inflexion points.

The second hypothesis (H_2) tested if an association could be observed between participants' certainty-effect biased behaviour and flexibility preference. Both constructs were also measured through within-subject choice experiments, per the methods used in prior studies (Baucells & Heukamp, 2010; Baucells & Heukamp, 2012; Keren & Roelofsma, 1995; Tversky & Kahneman, 1986). As a first step, four hypothetical choice questions were presented in the baseline survey to measure certainty-effect bias through two mechanisms: the common ratio effect (Kahneman & Tversky, 1979) and the common delay effect (Baucells & Heukamp, 2012). The common ratio effect questions were designed to test certainty preferences when probabilities of hypothetical risky choices were divided by a common ratio, for example, 5% (refer to Appendix 4, Part 2, 2.1, Questions [g] and [h]). A common time delay, for example, three months, was also added in a choice between two risky prospects to test the common delay effect (refer to Appendix 4, Part 2, 2.1, Questions [g] and [i]). Certainty-effect bias was observed if participants reversed their certainty preferences when probabilities were reduced, or a time delay was added to the hypothetical choices offered.

According to Pejsachowicz and Toussaert (2017), preferences are best revealed (measured) through the choices participants make. These revealed preferences serve as predictors of subsequent behaviour, similar to the role of predictive econometric models (McFadden, 2001; Toubia, Johnson, Evgeniou & Delquié, 2013). The baseline hypothetical choice sets were therefore considered to be the most appropriate instrument to elicit participants' preferences for commitment and flexibility (H_1 and H_2). Commitment preference (H_1) was measured

through three sets of hypothetical questions which differed from each other in terms of the cost of commitment choices (no cost, monetary cost or time cost) (Casari, 2009). Similarly, flexibility preference (H₂), was measured through four hypothetical choice sets offering choices between different cost scenarios (flexibility at no cost, low monetary cost, high monetary cost and time cost) (Casari, 2009). Appendix 4 (Part 2, 2.1, Questions [j] to [0]) demonstrates how these choice sets have been adjusted to the South African context in terms of currency and monetary value.

Within-subject experimental designs are particularly useful to measure and analyse heterogeneity in participants' preferences and behaviour. The results from testing the first two hypotheses also served as early predictions of how participants could respond to the treatments and the effect on their subsequent saving intention (H₃) and saving action taken (saving behaviour) (H₄). However, both saving intention and saving action were also measured at baseline to ensure accurate measurement of experimental treatment effects. To measure baseline saving intention (H₃), participants were asked to complete three questions, rating their answers on a seven-point Likert scale that ranged from one (strongly agree) to seven (strongly disagree) with lower numbers indicating greater saving intention. The saving intention questions originate from the TPB (Ajzen, 2013) and were selected from this theory as no distinct measures for saving intention were available from Behavioural Economic literature. Data on saving action (H₄) at baseline was collected by asking participants to self-report the amount they saved for emergency expenses in the past 30 days with a short motivation for the particular amount.

3.5.5 Phase One: Interventions

Each of the two treatment groups underwent a distinct intervention, while the control group remained unaware of these treatments. The main aim of these interventions was to increase participants' saving intention in such a way that it would also translate into saving action to infer an increase in saving behaviour. The interventions operated through self-reflection tasks which participants performed by answering a set of specifically framed questions (Chen, 2013). These questions were inspired by a self-reflection intervention performed in the field of education (Chen et al., 2017) but adapted to the context and target population in terms of linguistics and framed specifically to prime saving intention (Forster, Lieberman & Friedman, 2004) (refer to Appendix 5).

The specific self-reflection questions that formed the treatments of this study are grounded in the 'wise intervention' approach from the field of social psychology, which emphasises subjective meaning-making to help individuals flourish (Walton & Wilson, 2018). Actively thinking about when, where and how scarce resources can be used to accomplish goals, has

shown to improve implementation intention and subsequent action in other fields such as education and health (Chen et al., 2017; Gollwitzer, 1999). The application of this wise intervention approach to encourage discretionary saving behaviour is novel in the sense that it focuses on self-reflection and increasing intrinsic motivation. This has received less research attention in Behavioural Economic literature compared to interventions focused on external motivators and physical saving devices. Thus, the intervention design chosen for this study is considered to be a potential methodological contribution to Behavioural Economic literature.

For this study, two distinct interventions were designed to manipulate the independent variables, namely Commitment Preference and Flexibility Preference in saving choices, through differences in the framing of self-reflection questions. The first treatment group completed a set of self-reflection questions framed to be strictly commitment-focused (hard commitment intervention), whilst the questions posed to the second treatment group were similar but allowed for some flexibility (soft commitment intervention). The two treatments differed in terms of the level of choice restrictions (commitment) offered in the questions, since flexibility naturally implies more freedom of choice or fewer restrictions (Amador et al., 2006). In addition, the hard commitment treatment required more specificity when declaring the amount and timing of the intended saving action. The questions for each treatment are presented in detail in Appendix 5. In summary, both tasks required that participants with perceived financial scarcity self-reflect on how they can actively use their scarce resources to save.

The specific experimental design of this study allowed for the results of the manipulations to be analysed both separately and collectively. This is beneficial to better isolate the individual effects of the two manipulations (per $H_{3[a]}$ and $H_{3[b]}$) and also to draw conclusions on which one impacted saving intention the most (per $H_{3[c]}$) for a potential practical contribution to saving product designers. These manipulations served as the mechanism by which the independent variables (Commitment and Flexibility Preferences) produced changes in the dependent variables, namely Saving Intention and Saving Action. Changes in participants' saving intentions were directly inferred from the results of these manipulations (treatment effects), while changes to saving actions were assumed to be indirectly associated with the manipulations.

Participants' answers to the self-reflective questions offered the potential for a supplementary, exploratory dimension to the study beyond merely assessing whether the interventions achieved their aims by measuring their outcomes. The self-reflective questions were specifically framed to prompt participants' saving intentions in the context of financial resource scarcity, and not to answer any specific research question. However, answers to these

questions offered rich insights into participants' context, financial constraints and decision-making processes within these constraints.

3.5.6 Phase One: Endline Survey

The impact of the intervention on the participants saving intentions was measured through any change in the answers to the specific questions directed at their saving intention posed at baseline (refer to Appendix 4). This endline survey was completed by the two treatment groups' participants directly after their respective commitment and flexibility interventions as presented in Appendix 5. Since the three saving intention questions posed in the endline survey were the same as those included in the baseline survey, they were already pilot-tested and needed no further refinement at the endline.

3.5.7 Phase Two: Post hoc Survey

The second phase of the study required all participants from both the control and treatment groups to report the actions they had taken over one month (30 days) post the interventions to realise their saving intentions. The purpose of measuring the impact of the intention-change interventions on saving action after a period lapsed was twofold. Firstly, to increase the validity of the findings by reducing common method variance bias in data collection (Rindfleisch et al., 2008). Secondly, a positive change in saving intention logically takes time to translate into a possible change in saving action, which reflects in actual saving frequency and savings balances. A period of one month (30 days) is deemed sufficient to measure whether participants' saving intention translated into short-term saving action, as financial scarcity often requires saving small amounts regularly (Karlan et al., 2014).

Saving action was therefore observed if the volume, frequency or amounts of saving transactions were executed according to, or exceeding, a participant's declared saving intentions. After participants completed Phase One of the data collection instrument and 30 days lapsed, Phase Two of the study became accessible to all. All participants who opted to participate in Phase Two were allowed access to continue with the same instrument using the same online links. The targeted sample size (refer to Section 3.4.3) was considered to be sufficiently large to cover the natural attrition of participants as well as participants who opted out of completing Phase Two to sufficiently test the fourth hypothesis (H_4). Results from qualitative questions posed to participants during the pilot tests suggested that participants were motivated to learn more about their saving behaviour and were interested to undertake such a self-assessment.

Participants were asked to self-assess their saving decisions and commitments made during Phase One and to report their saving activity (transactions) during the 30 days following this

(refer to Appendix 4, Part 3). These self-assessments of saving actions were used for inferences on the relationship between saving intention and saving action per H_4 .

3.6 Data analysis techniques and methods

Data were analysed using appropriate descriptive and inferential statistical techniques to test the four hypotheses as formulated in the previous chapter. Participants' responses to the surveys were quantitative, thus best suited for statistical analysis of standardised data from large samples (Morvant-Roux, Guérin, Roesch & Moisseron, 2014). The International Business Machines Corporation (IBM) Statistical Package for the Social Sciences (SPSS®) software was used as the tool to conduct all the statistical tests as described in the sub-sections to follow.

3.6.1 Descriptive statistics and balance test

As a first step, and to lay the groundwork for the analyses to follow, the demographics of the total sample population of 405 participants were statistically analysed to describe and profile the total sample data. Some of these demographic data elements also served as control variables (per Section 3.5.3) in subsequent statistical tests and were mostly categorical. For this reason, a frequency table was constructed to summarise how many times the individual categories of a variable appeared in the total sample (presented as frequencies) and to measure the relative importance of each category (presented as percentages) (Wegner, 2016).

In addition to analysing the descriptive statistics for the total sample, frequency tables were also constructed for the three experimental groups. This was an important step to test for balance and comparability across the three groups to test H_3 , meaning that no statistically significant differences existed between the groups in terms of key characteristics. When the groups are comparable in terms of their observable and unobservable characteristics, any subsequent differences that arise between the groups can be attributed to the treatments - rather than due to pre-existing differences between participants in either group (Banerjee & Duflo, 2009). Valid inferences on the relative impacts of the respective treatments are therefore only possible when the groups are balanced (Dupas, 2011; Glennerster & Takavarasha, 2013).

The balance test for comparability across the three experimental groups required different statistical tests to be performed for categorical and continuous variables. The appropriate statistical tests for comparing categorical variables were either Pearson's Chi-square test or Fisher's Exact test, depending on sample sizes. Continuous variables were compared between the groups based on the coefficient estimates (and standard errors) of the difference

between baseline means and by calculating the p-value for Analysis of Variances (ANOVA) *F*-tests. Comparability between the groups was crucial to demonstrate effective randomisation in selecting the participants before the commencement of the treatments (List, 2011). Where statistically significant differences between groups were observed during data collection, the random assignment process and statistical analyses were repeated until this was reasonably resolved (refer to results in Sections 4.5.2 and 4.6.2).

3.6.2 Phase One: Analysis of hypothetical choice experiments (H_1 and H_2)

Behavioural biases and preferences, as revealed by participants' answers to the choice sets presented in the baseline survey (refer to Appendix 4, Section 2.1 and Appendix 7), were analysed to test H_1 and H_2 . More specifically, this involved assessments on the prevalence of present bias and certainty-effect bias in their decision-making, and whether they preferred commitment or flexibility before the experimental interventions.

Once these biases and preferences were measured, the independent-samples Mann-Whitney U Test was applied to determine if there were differences in the commitment and flexibility preferences of individuals who perceived financial scarcity and displayed biased behaviour, compared to those who did not (refer to H_1 and H_2). The possibility of these differences was suggested by empirical evidence from prior studies as discussed in the previous chapter (H_1 : Exley & Naeker, 2016; Laibson, 2015)(H_2 : Krishna & Sadowski, 2014; Saito, 2015). The independent-sample Mann-Whitney U Test was appropriate for testing these two hypotheses since the variables of interest were categorical and normal distributions were not assumed. The null hypothesis in both cases assumed that the variables were independent (do not influence each other). The results of these tests are presented in the next chapter (refer to Sections 4.3.2 and 4.4.2).

The relationships in the first two hypotheses were analysed at a bivariate level only and no control variables were considered since these are secondary, exploratory hypotheses only. H_1 and H_2 were formulated for two reasons; firstly to test the associations predicted by theory in the context of individuals who perceive financial scarcity, and secondly to gain a better understanding of the sample population's biases and preferences which underly their saving behaviour. The results of these tests also allowed for richer inferences on the effect of the experimental manipulations conducted and the analysis of hypotheses H_3 and H_4 .

Evaluation of multicollinearity between the H_1 and H_2 variables was also important to ensure the regression model specification for H_3 was parsimonious and only included key, independent variables. By gaining an understanding of the associations (or lack thereof) between these variables, it was possible to evaluate the appropriateness of commitment preference and flexibility preference as the key independent variables for experimental

manipulation. The methodology to evaluate the impact of manipulating commitment and flexibility preferences on saving intention is described next.

3.6.3 Phase One: Impact evaluation through predictive modelling (H₃)

The first part of the impact evaluation process involved an MLR analysis to derive a predictive model that would account for the variance in the dependent variable, Saving Intention (Garson, 2014). Furthermore, the relative importance of each independent variable in explaining a proportion of this variance in saving intention (through the R^2 statistic) can be established through this statistical test. A randomised experiment, such as the one conducted in this study, has an advantage over other research methods as it can reveal important aspects of a treatment's impact without the need for additional assumptions (Banerjee & Duflo, 2009). This simplifies the statistical analysis required and is another reason for selecting standard MLR to determine causal relationships between the two main independent variables (Commitment and Flexibility Preferences) and the dependent variable (Saving Intention). The following formula was estimated to test H₃:

Formula 1:

$$Y_i = c + \bar{\beta}_i T_i' + D_i' X_i + R_i' X_i + \varepsilon_i$$

Where:

Y_i is a measure of saving intention for individual i ,

c (the constant) is the mean of the control group,

$\bar{\beta}_i$ is the ATE of the treatment dummy variables,

T_i' is a vector of treatment dummy variables (T_1 : hard commitment; T_2 : soft commitment),

D_i' is a vector of characteristics controlled for (Age, PFL, Income level, Gender),

X_i is the slope (regression) coefficients,

R_i' is a vector of specified independent variables (Commitment Score and Flexibility Score),

ε_i is the error term (variation) in the estimate of the regression coefficient.

Formula 1 was estimated for each treatment to determine their ATE (Banerjee et al., 2015) on the dependent variable: Saving Intention (Y_i). The research design ensured that perfect compliance was achieved, meaning that all participants in the treatment groups received treatment and no participants in the control group received any treatment. Consequently, a simple difference-of-means provided an unbiased estimate of each treatment's ATE in a randomised experiment such as this study where no attrition (between baseline and endline

in Phase One) or spillovers were observed (EGAP, 2022). Each treatment group's ATE on saving intention was therefore compared to the control group's mean (C) to analyse three key results. The first two comparisons determined the relative size of each treatment's impact ($H_{3[a]}$ and $H_{3[b]}$), while the third was done to conclude which treatment was most effective ($H_{3[c]}$) to improve saving intention. In summary, the treatment dummy variables (T_i') were the most interesting coefficients in this impact evaluation, since they indicated the impact of the respective treatments.

Results were assessed for variability and were found to be unacceptable if the regression model was run for the total sample population without consideration of the two strata. Heteroscedasticity was observed in the distribution of the total sample population due to a high level of variability in the results between the Intent and Low/No Intent strata. For this reason, two separate regression models were estimated to test for any heterogeneity in the treatment effects between the two strata. This subgroup analysis was performed to increase precision and to identify observable characteristics (control variables) that explained the reasons for the variability in their treatment effects compared to each other (Dupas & Robinson, 2013). The results of these analyses are presented and discussed in detail in the next chapter.

The first part of the impact evaluation involved predictive modelling through regression analysis as discussed in this section. The second part of the impact evaluation process was to determine and evaluate the differences in treatment effects *between-groups* and *within-groups* over time as discussed in the section that follows.

3.6.4 Phase One: Impact evaluation through heterogeneity analysis (H_3)

The main purpose of an experimental research design is to determine causal relationships between independent and dependent variables in a controlled environment (Harrison & List, 2004; List, 2011). One way to test whether such a causal relationship exists is to manipulate the independent variable(s) one at a time to determine if and how this impacts the dependent variable(s) (Banerjee & Duflo, 2009). Stated differently, the 'causal effect' for a particular participant is the difference between an outcome experienced after an intervention, compared to the outcome that the participant would have experienced without receiving the intervention treatment.

The impact of each treatment on participants' saving intentions was evaluated through both *between-group* and *within-group* comparisons of estimated treatment effects to gain a better understanding of heterogeneity between the two strata. *Between-group* comparisons of the endline results were done at two levels: firstly, the baseline results of the control group and the endline results of each of the treatment groups were compared to reveal whether the

treatments had any material effect on saving intention compared to the counterfactual (Harrison & List, 2004)(refer to $H_{3[a]}$ and $H_{3[b]}$). Secondly, a comparison between the two treatment groups was performed to determine the relative impacts of their treatments and to identify which treatment was most effective in increasing saving intention (refer to $H_{3[c]}$).

The research design allowed for *within*-group comparisons through multiple observations of saving intention scores using the same scale at different time points; before the treatments (baseline), immediately after the treatments (endline) and 30 days after the treatments (follow-up). These repeated measurements were conducted for the same participants in the three experimental groups in each stratum according to a within-subjects research design. The one-way repeated measures ANOVA tests were deemed to be the most appropriate test statistic to compare saving intention scores for the same participants at these three different points in time. The underlying assumptions of ANOVA calculations were tested before the analysis, as discussed in Section 4.5.4 of the next chapter.

3.6.5 Attrition between Phase One and Phase Two

Attrition was observed in both strata, with a 30% attrition rate in the Intent stratum compared to a 49% rate in the Low/No Intent stratum. This phenomenon seems logical since average saving intent was lower in the Low/No Intent subgroup at the onset of the study. Since average treatment effects between experimental groups were compared separately for each stratum, their different attrition rates had no impact on the internal validity of the results. Table 7 summarises the attrition from Phase One to Phase Two for each stratum.

Table 7: Attrition from Phase One to Phase Two per stratum

| | Intent | Low/No Intent | Total |
|----------------------------|--------|---------------|------------|
| H_3 : Phase One <i>N</i> | 305 | 100 | 405 |
| H_4 : Phase Two <i>N</i> | 215 | 51 | 266 |
| Compliance rate | 70% | 51% | 66% |
| Attrition rate | 30% | 49% | 34% |

Source: Author's own

Attrition was also unequal between the three experimental groups within each stratum, as can be seen from the sample size numbers in Table 8. In particular, attrition in the control groups for both strata was higher than in the treatment groups. Since the control group participants did not participate in the saving intention intervention, it can be speculated that they found less value in continued participation in the study.

Table 8: Attrition from Phase One to Phase Two per treatment group

| | Intent | | | Low/No Intent | | |
|--|----------------|----------------|---------|----------------|----------------|---------|
| | T ₁ | T ₂ | Control | T ₁ | T ₂ | Control |
| H ₃ : Phase One <i>N</i> | 101 | 101 | 104 | 31 | 33 | 36 |
| H ₄ : Phase Two <i>N</i> | 74 | 80 | 62 | 20 | 17 | 14 |
| <i>Difference from Control Group N</i> | +12 | +18 | - | +6 | +3 | - |
| Compliance rate | 73% | 79% | 60% | 65% | 52% | 39% |
| Attrition rate | 27% | 21% | 40% | 35% | 48% | 61% |

Source: Author's own

Despite this selective attrition, the Phase Two balance tests between the experimental groups (per Section 4.6.2) in each strata revealed no statistically significant differences in their key characteristics. The internal validity of comparisons between the three experimental groups in each strata were therefore not compromised. Nevertheless, it was decided not to perform between-group comparisons for heterogeneity analyses of saving action as post hoc tests to H₄, since this was only a secondary hypothesis. This final hypothesis was analysed through an MLR model, as discussed in the next section.

3.6.6 Phase Two: Saving Intention and Saving Action (H₄)

Savings transactions and balances obtained from all participants' self-assessment reports in Phase Two of the study represented their saving actions taken during the 30-day delay period. Where the treatments produced statistically significant increases in saving intention (per H₃), they should also produce an increase in subsequent saving action if a causal relationship exists (Webb & Sheeran, 2006). A simple linear regression model was used to determine the relationship between saving intention and saving action after the delay period of 30 days, modelled as follows:

Formula 2:

$$Y_i = c + D'_i X_i + R'_i X_i + \varepsilon_i$$

Where:

Y_i is a measure of saving action in Phase Two,

c (the constant) is the intercept of the regression line,

D'_i is the characteristics controlled for (Saving Action at Baseline, Income Group)

X_i is the slope (regression) coefficients,

R'_i is the key independent variable (Saving Intention Score at Phase Two),

ε_i is the error (variation) in the estimate of the regression coefficient.

In coherence with the methodology followed for the regression analysis of H_3 , separate regression models were developed for the Intent and Low/No Intent strata. The results of this regression analysis per Formula 2 quantified the relationship between saving intention and saving action for each stratum. In addition, a correlation analysis (Pearson's correlation coefficient) was performed to measure the strength of this relationship to indicate how accurate and reliable the estimate of saving action (Y_i) per stratum is. The correlation analysis per stratum was possible since the underlying assumptions of this test statistic were met. It was assumed that a linear relationship existed between the two continuous variables; data were collected from random samples, outliers had no material effect on test results and the Central Limit Theorem (CLM) was applied based on the stratum's sample sizes which were larger than the norm of $N = 30$.

3.6.7 Overview of hypotheses testing to answer the research question

While the first two hypotheses (H_1 and H_2) were designed to test theory and findings from prior literature in the context of perceived financial scarcity, the third hypothesis (H_3) represented experimental manipulation and was the focal point of this study. Appendix 5 provides a brief overview of the intervention design. As discussed in the literature review chapter, saving intention does not necessarily translate into saving action over time. The fourth and last hypothesis (H_4) tested whether improved saving intention resulted in improved saving action over 30 days. These results offered practical evidence on how the savings behaviour of individuals with perceived financial scarcity could potentially be improved. Furthermore, the findings also provided broad contextual insights to define customer profiles for individuals who perceive financial scarcity based on their revealed preferences. This can potentially be incorporated into practical advisory services and savings products tailored to these customer profiles.

Throughout this study, it was understood that the overall credibility of the impact evaluation and inferences from results would depend on the quality of data that was collected. Potential problems in respect of data quality were considered in each stage of the research process to allow for the timely implementation of mitigation strategies. This is discussed in the next section.

3.6.8 Data preparation and quality

This study aimed to collect and analyse high-quality data that was both complete and accurate. To ensure this, best practices from relevant literature were adopted as far as time and

available resources allowed. Participants were evaluated based on three quality criteria and were excluded from the data if they failed these checks, as summarised in Figure 9.

Firstly, an Instructional Manipulation Check (IMC) was explicitly designed into the data collection instrument to check a participant’s level of attention to the instructions. Secondly, the effect of the treatment was analysed to flag if a participant revealed an outlier treatment effect. Lastly, the Gorilla platform allowed for the functionality to measure response times for all tasks. As such, the response times for the self-reflection intervention exercise were measured and all times measured that were quicker than three standard deviations of the group average were considered outliers. In total, 27 participants were excluded from the data and analysis based on failing all three criteria of this data quality strategy.

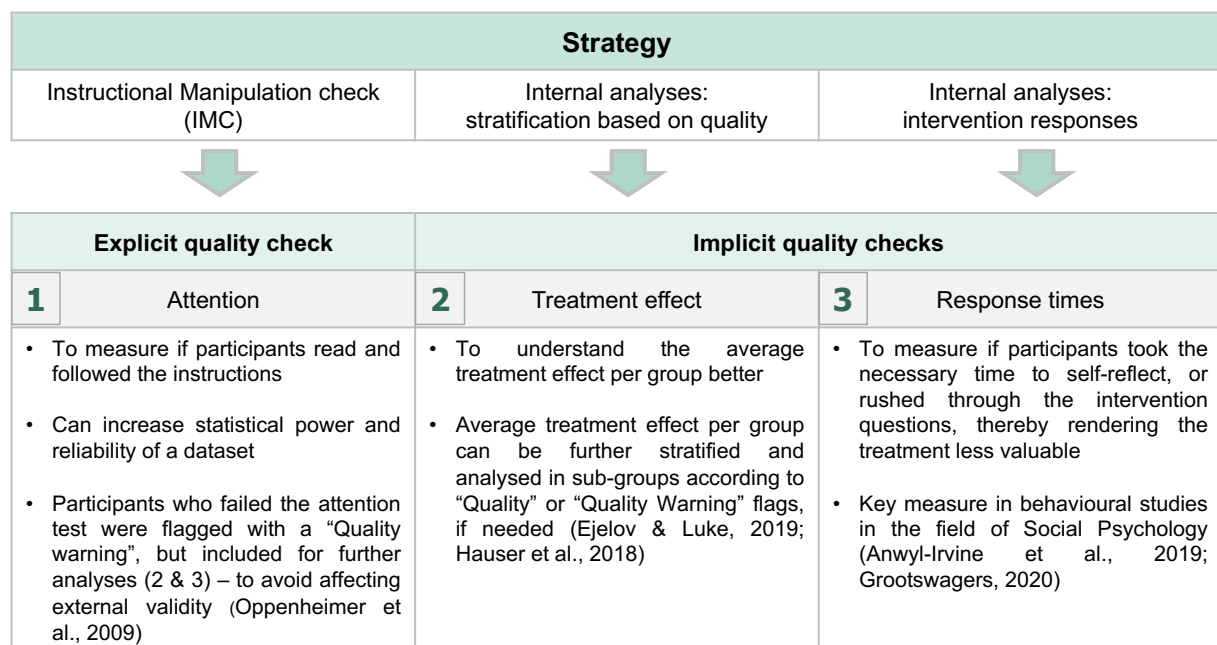


Figure 9: Data quality strategies

Source: Author’s own

Furthermore, field experiments sometimes involve an increased number of control variables to account for all possible variability in the experimental setting, not only during the experimental design phase but also during data analyses (Gneezy, 2017). The researcher developed the experimental protocol as presented in Appendix 2 to maintain a system that enabled them to address situational factors and observed irregularities during data collection (Gneezy, 2017), to ensure the analysis of accurate data.

It is often impossible in social experiments to hide the experimental objective from either the individual who implements the treatment, or the subject. This ‘experimenter effect’ (Harrison & List, 2004) can introduce bias into the data collected as being part of an experiment may influence behaviour (Banerjee & Duflo, 2009). The researcher acknowledged this possibility

and designed the experiment to be as unobtrusive as possible to avoid these effects. For example, participants were unaware of the existence of the other experimental groups or the specific aim of their treatments (where applicable), which could have influenced their responses through social desirability bias or the experimenter effect.

3.6.9 Missing data strategies

As per the impact evaluation process discussed earlier (see Section 3.6.3), pilot testing was performed to identify risks of missing data after participants completed the survey instruments. Responses to all questions in the pilot survey and treatments were checked for consistency and unnecessary friction was removed where missing data was observed. It was important to identify and correct issues that resulted in incomplete survey responses since such cases must be discarded and excluded from the randomised sample. This also affects the comparability of the three groups which is a key requirement for effective randomisation, as discussed earlier. When this occurred during the data collection process, new participants were randomly selected again until the comparability of the groups was reinstated. Thus, the value of pilot-testing the data collection tools was not only in more complete data collection but also in the prevention of potential randomisation bias and multiple sampling iterations.

All survey questions key to testing the four hypotheses were programmed to be obligatory; participants received an error message and were unable to move forward if a key question was left unanswered. However, a trade-off had to be made between making key questions obligatory and increasing friction when completing the survey, which contributes to participant attrition rates. Collectively, the strategies discussed in this section prevented the need to include data from incomplete surveys to a large extent and simplified the data cleaning processes.

3.7 Validity and reliability

The internal validity and reliability of the entire study were considered along five broad dimensions, as summarised in Table 9. Firstly, by choosing the context where data were collected carefully in terms of appropriateness to answer the research question. For example, under conditions of financial scarcity individuals may have high commitment preferences for precautionary savings (Galperti, 2015; Laibson, 2015; O'Donoghue & Rabin, 2015), while their preferences for flexibility and liquidity may also be elevated due to uncertainty about future consumption needs (Afzal et al., 2017; Dupas & Robinson, 2013; Kreps, 1979). Since saving is particularly challenging for those who perceive financial scarcity due to these opposing preferences, this context was considered the most appropriate to test saving decision-making over time and under uncertainty.

Secondly, the reliability of the study was greatly increased by transparency on all methods of data collection and analysis, which also improved the replicability of the study for future researchers. In the third instance, the whole purpose of the experimental design was to manipulate one variable at a time to provide internally valid estimates of its ATEs on the population of interest (Banerjee & Duflo, 2009). The chosen between-subject design also made it possible to separate the causal effect of the intervention from other confounding factors so that causality could be validly inferred (Banerjee & Duflo, 2009; Gneezy, 2017). Since the internal validity of this particular design depended on randomisation (Charness et al., 2012), participants were randomly assigned to the experimental groups. Lastly, by stratifying along participants' baseline measures of saving intent, more reliable and accurate inferences of the interventions' treatment effects were possible (Glennester & Takavarasha, 2013) (refer to Section 3.4.2).

Table 9: Strategies for internal validity and reliability

| No. | Dimension | Strategic choice |
|-----|---------------------|--|
| 1 | Context | Perceived financial scarcity was chosen as the most appropriate context to conduct interventions aimed at increasing saving intention and action (behaviour) (Dalton et al., 2019; Dupas & Robinson, 2015) |
| 2 | Transparency | The aim of this methodology chapter was to disclose all design choices and methods executed during the study |
| 3 | Experimental design | Between-subject design was selected as a conservative experimental approach (Charness et al., 2012) to allow for valid causal inferences (Banerjee & Duflo, 2009; Gneezy, 2017). |
| 4 | Random assignment | The internal validity of a between-subject design depends on randomisation (Charness et al., 2012), thus participants were randomly assigned to the experimental groups. |
| 5 | Stratification | Baseline saving intention measures were used as strata for targeted random assignment to experimental groups and increased accuracy of inferences on ATEs. |

Source: Authors' own

External validity (or generalisability) was improved by achieving the large sample size target required for randomisation, which makes replication in other environments or studies at a larger scale (for example, nationwide) possible. Furthermore, in environments where an individual is facing a single decision (whether to save or not), the between-subject experimental design of this study might increase external validity (Charness et al., 2012).

3.8 Methodological limitations

Despite all controls built into the research design and efforts taken to ensure the reliability and validity of results, some methodological limitations remain. These limitations were identified and mitigated, where possible, as described in the sub-sections to follow.

3.8.1 *Researcher biases*

The researcher recognised possible optimism-bias related to the outcome of the study. Firstly, that the behavioural intervention will be effective to enhance saving behaviour; and secondly, that observed behavioural change will relate to the intervention and will subsequently be measurable after the experiment was conducted. For this reason, the literature review was expanded to consider prior studies with no observable treatment effects. The experimental design was subsequently been refined to allow for the possibility and measurement of even small or modest treatment effects.

3.8.2 *Time horizon*

Human behaviour is subject to change over time. Therefore, no inferences will be made on the transference of saving behaviour into periods beyond the time of data collection (Williams, 2007).

3.8.3 *Cultural and language differences*

Due to the cultural and language diversity in South Africa, English is not the home language for many across all income groups. This was mitigated by piloting the surveys to ensure simple, unambiguous phrasing of questions in the survey and intervention (for example, refer to Appendices 3 and 4) to prevent true meanings from being lost in translation.

3.8.4 *Self-reported data and social desirability bias*

The action of saving as part of saving behaviour was measured through self-reported data requested from all participants - in both the treatment and control groups. The reliability of this type of data is inferior to observed or externally collected secondary data, as it likely introduced some social desirability bias to the study. Social desirability bias could play a role in inflating participants' stated saving intentions and/or saving actions (Sheeran et al., 2017), resulting in comparatively weaker external validity of the inferences on findings.

3.8.5 *Risks associated with experimental design*

Weak design and protocol may lead to an intervention with no statistically significant impact. Low or no impact measured despite a robust design and controls would be a finding in itself.

However, it does limit the range of possible statistical analyses, as well as the inferences that can be drawn from the findings (Gneezy, 2017; List, 2011).

If an intervention leads to small or undetectable treatment effects, no causal inferences would be possible. The TPB (Ajzen, 2012) may in such a case provide some explanation for saving intention and subsequent saving behaviour or lack thereof. For this reason, survey questions to measure saving intention were derived from the TPB survey questionnaire (Ajzen, 2012) to reduce the risk of instrument bias and to improve the internal validity of the study (refer to Appendix 2). A further limitation of the overall research design is that it did not explain *why* and *how* saving decision-making (intention and action) or behaviour change happens since no qualitative questions were posed to participants to explore these questions in-depth.

3.8.6 Risks associated with online experimentation

Technical barriers, such as hardware capability, stable Internet access and Internet browser compatibility can affect participants' ability to access and complete online surveys and experiments successfully. To mitigate this risk, the Gorilla platform was selected to host this study as it enabled online experimentation that was reliable, open and accessible to a wide range of technical abilities (Anwyl-Irvine et al., 2020).

3.8.7 Ethical considerations of RCTs

A common ethical concern of RCTs is that a group of individuals (the control group) will purposefully be denied a possibly beneficial treatment (Banerjee & Duflo, 2009). However, the intervention involved only self-reflection treatments administered through a set of questions to answer. Since no incentives, financially or otherwise, were offered to participants in the treatment groups, no group of participants stood to gain financially or otherwise from external sources to the exclusion of others.

Furthermore, this study was grounded in the philosophy of pragmatism and aimed at contributing to knowledge on possible practical solutions for increasing saving rates over a longer term. Should the findings be significant, more individuals with perceived scarcity may benefit from more appropriate savings solutions developed according to their needs and context.

3.9 Conclusion

While the experimental design was considered appropriate to answer the overarching research question, the researcher recognised the scientific rigour required in the design and execution of an RCT. Key elements of this study's research design, which determined the inferences possible from the findings, were the stratified random assignment of participants to

experimental groups; the particular interventions chosen, and the impact evaluation methods applied. The overall validity and reliability of this study were considered in the research design to mitigate risks, increase the robustness and transparency of the research process and allow for causal inferences to be made from the results.

Chapter 4: Research Results

4.1 Introduction

The empirical results from executing the study according to the methodology discussed in Chapter 3 are presented in the sections that follow. Sample characteristics are described through the demographic profile of respondents (Section 4.2) followed by the results for each of the four hypotheses presented in Sections 4.3 to 4.6 before the chapter concludes. These results are further discussed with detailed reference to the extant literature in Chapter 5.

4.2 Sample characteristics

The key characteristics of the sample was determined through a quantitative analysis of respondents' demographic profiles, which is also visually presented in Figure 10. The results of this analysis provided the background for interpretation of all subsequent results.

4.2.1 *Demographic profile of participants*

Individuals who perceived financial scarcity and participated in the study were asked to complete a series of demographic questions as discussed in Section 3.5.3 of the previous chapter. The purpose of these questions was threefold; firstly to gain a better understanding of the sample of individuals who perceive financial scarcity in South Africa and elected to participate in this research. Secondly, to enable the researcher to control that no statistically significant differences existed between the key characteristics of the three experimental groups before the interventions (Ashraf et al., 2006), as per H₃ discussed in Section 4.5.1. Lastly, to identify control variables for in-depth analysis of heterogeneity in treatment effects post hoc (Athey & Imbens, 2017) as discussed in Sections 4.5.4 and 4.5.5 to follow.

The demographic questions were operationalised mostly through categorical variables, for which frequencies are the most appropriate descriptive statistics (Pallant, 2016). Based on the total sample size of 405 participants, Figure 10 illustrates the percentage of participants per category for six demographics, while Appendix 6 provides a summary of the actual number (frequency) of participants per sub-category. This view of the overall sample characteristics is based on data collected from questions posed at baseline in which all participants participated - before their randomised allocation into treatment groups.

In summary, the results from demographic questions indicate a youthful sample of participants with 31% ($N = 126$) below the age of 25 years and a 58% ($N = 235$) majority who can be described as Millennials (born between 1981 and 1996) with ages from 25 to 41 years. Most participants had at least a tertiary qualification ($N = 285$; 71%) and were perceived to have somewhat high, to very high, financial literacy ($N = 240$; 62%). The distribution of the perceived

financial literacy (PFL) score continuous variable was negatively skewed (skewness $-.64$; kurtosis $.69$) but this skewness measure fell within the acceptable range of plus-or-minus 2; this threshold was proposed by George and Mallery (2018).

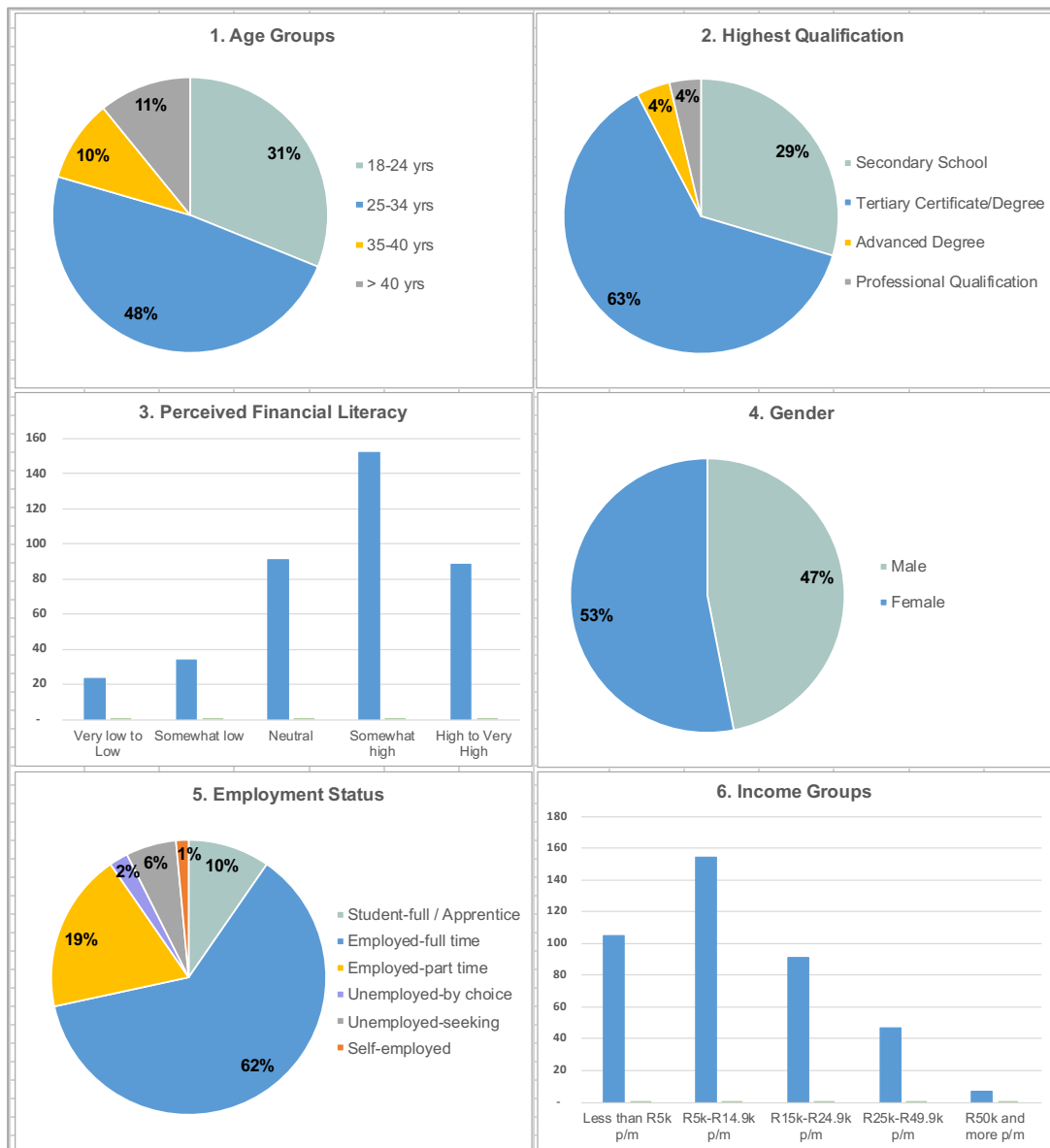


Figure 10: Demographic profile of sample participants

Source: Author's own

The sample population comprised 190 (47%) males and 215 (53%) females, while 78% ($N = 315$) of all participants reported having one or more dependents. Responses to a qualitative question indicated that dependents ranged from immediate family members such as children, siblings, spouses and parents to extended family members such as nieces, nephews, uncles and aunts. These results correspond to commercial data collected in South Africa where those who provide financial support to both younger and older dependents, are colloquially known

as the 'sandwich generation' (Old Mutual, 2021). These additional responsibilities place a strain on personal finances and make saving for emergency expenses vital but challenging.

Potential participants were asked to participate in the study only if they have some source of income. The purpose of this question was to ensure a lack of income could be excluded as a reason for a lack of saving behaviour - which could potentially skew the experimental treatment effects. As a result, 83% ($N = 333$) of participants' main source of income was from full- or part-time employment. Despite this, 259 (64%) of participants earned less than ZAR15,000 per month per the lowest two income categories for this study, resulting in a positively skewed distribution as per Figure 10. Since this research targeted individuals who perceive financial scarcity, it was expected that a high percentage of participants would fall within lower-income groups. However, it is also evident from this data that financial scarcity is perceived across a spectrum of income groups and is not limited to the lowest income groups only. Higher income groups were not excluded from the study in order to comply with the pre-determined experimental protocol (refer to Appendix 2) which required no *post hoc* changes to the experimental design. The descriptive statistics discussed in this section provided the background for the hypotheses testing described in the sections to follow.

4.3 H₁: Present bias and commitment preference

The purpose of the first hypothesis was to test if present biased participants revealed different commitment preferences compared to participants who were not present biased. This was analysed through both descriptive statistics (Tables 11, 12 and 13) and inferential statistics (Table 14). The null hypothesis as presented in Table 10 assumed that the two variables of interest were independent and no difference would be observed.

Table 10: Hypothesis 1

| Hypothesis 1 | |
|--------------|---|
| H_0 | There is no difference in the commitment preferences of individuals with perceived financial scarcity who are present biased, compared to those who are not present biased. |
| H_1 | There is a difference in the commitment preferences of individuals with perceived financial scarcity who are present biased, compared to those who are not present biased. |

Source: Author's own

4.3.1 Descriptive statistics of constructs

Descriptive statistics on categorical variables are presented in frequencies and percentages (Wegner, 2016) as per Table 11. These results indicated that most participants were not present biased ($N = 288$, 71%), which specifically means they did not reverse their preference

for SS monetary gains for LL gains when a delay of 12 months was added to the chosen scenario. Additional measures of time preferences revealed that the majority of participants prefer immediate gains ($N = 279$, 69%) but also displayed time-inconsistent choices ($N = 309$, 76%) by changing this preference when an inflexion point in the hypothetical choices was reached. This study was not designed *per se* to determine at which inflexion point participants change their preferences but rather to understand if participants were consistent in their preferences.

A discounting score was derived for each participant from the choices they made from the range of hypothetical scenarios as presented in Appendix 7. The distribution of these discounting scores supports the notion that most participants have a preference for SS monetary gains (Categories 3 to 5: $N = 271$, 67%), and demonstrates the heterogeneity between participants and the inconsistency in their decision-making.

Table 11: Frequencies for constructs related to time preferences

| Variable | Name | Category | Frequency | Percentage |
|---|-----------|-----------------|------------|-------------|
| Present biased | PBiased | 0 No | 288 | 71% |
| | | 1 Yes | 117 | 29% |
| | | Total | 405 | 100% |
| Time preference for immediate gains | TimePref | 0 No | 126 | 31% |
| | | 1 Yes | 279 | 69% |
| | | Total | 405 | 100% |
| Preference reversals/ Inconsistent decisions | PrefRev1 | 0 No | 96 | 24% |
| | | 1 Yes | 309 | 76% |
| | | Total | 405 | 100% |
| Discounting Score | DiscScore | 0 Always LL | 12 | 3% |
| | | 1 Most times LL | 50 | 12% |
| | | 2 Sometimes LL | 72 | 18% |
| | | 3 Sometimes SS | 107 | 26% |
| | | 4 Most times SS | 80 | 20% |
| | | 5 Always SS | 84 | 21% |
| | | Total | 405 | 100% |

Source: Author's own

An analysis of the second H₁ construct revealed that most participants did not prefer commitment, whether at no cost ($N = 278$, 69%), at a monetary cost ($N = 300$, 74%) or at a time cost ($N = 320$, 79%) (Table 12). Similar to the methodology applied by Ruggeri et al. (2021), a commitment preference score was subsequently derived for each participant from their choices under these three hypothetical scenarios. A score of zero means that a participant had no commitment preference, while a score of three suggests that a participant always preferred commitment whether at *no cost*, at a *monetary cost* or at a *time cost*. The purpose of this commitment preference score was to operationalise Commitment Preference - which is one of the continuous independent variables manipulated in the experiment (H₃).

Table 12: Frequencies for constructs related to commitment preferences

| Variable | Name | Category | Frequency | Percentage |
|--|---------|--------------|------------|-------------|
| Commitment Preference 1 (No cost) | Commit1 | 0 No | 278 | 69% |
| | | 1 Yes | 127 | 31% |
| | | Total | 405 | 100% |
| Commitment Preference 2 (Monetary cost) | Commit2 | 0 No | 300 | 74% |
| | | 1 Yes | 105 | 26% |
| | | Total | 405 | 100% |
| Commitment Preference 3 (Time cost) | Commit3 | 0 No | 320 | 79% |
| | | 1 Yes | 85 | 21% |
| | | Total | 405 | 100% |

Source: Author's own

The Commitment Preference score reflects a distribution that is positively skewed (skewness .94; kurtosis -.31) towards no preferences for commitment ($N = 213$, 53%) among individuals who perceive financial scarcity (Table 13). Furthermore, the results of a Shapiro-Wilks test, $W(405) = 0.76$, $p < 0.001$ indicated a significant departure from normality (refer to Section 4.5.2), which is the reason for selecting the non-parametric Mann-Whitney U Test for the inferential statistic tests.

Table 13: Commitment preference score distribution

| Variable | Name | Score | Frequency | Percentage |
|-----------------------------|----------|---------------------|------------|-------------|
| Commitment Preference Score | ComScore | 0 No commitment | 213 | 53% |
| | | 1 Some commitment | 97 | 24% |
| | | 2 Mostly commitment | 65 | 16% |
| | | 3 Always commitment | 30 | 7% |
| | | Total | 405 | 100% |

Source: Author's own

4.3.2 Inferential statistics: Mann-Whitney U Test

The independent-samples Mann-Whitney U Test was applied to determine if there was a difference in commitment preferences of individuals who perceived financial scarcity and were present biased, compared to those who were not present biased. This is a non-parametric technique that assumes random samples and independent observations which were not violated. The statistical tables are presented in Appendix 8.1 and median commitment preference scores for each group are reflected in Table 14.

Table 14: Median commitment preference scores per group

| Present biased | <i>N</i> | Median (<i>Md</i>) |
|----------------|------------|----------------------|
| 0 No | 288 | 0 |
| 1 Yes | 117 | 0 |
| Total | 405 | 0 |

Source: IBM SPSS Statistics 28

The group with the largest number of participants ($N = 288$) included those who were not present biased, and this group had a median score of zero which indicates no commitment preference. However, the median score was the same for present biased participants, which does not signal a clear behavioural pattern amongst the majority of participants. The Mann-Whitney U Test, therefore, revealed no significant difference in the commitment preference scores of participants who were present biased ($Md = 0, N = 117$) and those who were not ($Md = 0, N = 288$), $U = 16176, z = -.69, p = .49, r = .03$ (a small effect size as per Cohen, 1988). The sample evidence is not strong enough to reject the null hypothesis in favour of H_1 at a 5% level of significance ($\alpha = 0.05$).

H_1 was analysed at a bivariate level and no control variables were considered since this was a secondary, exploratory hypothesis only. The results are helpful to gain a better

understanding of the sample population’s biases and preferences which underly their saving behaviour and allow for a richer understanding of the subsequent hypotheses’ results (H_3 and H_4).

4.4 H₂: Certainty-effect bias and Flexibility Preference

The second hypothesis was formulated to test if certainty-effect biased participants displayed different flexibility preferences compared to those who were not certainty-effect biased. The null hypothesis presented in Table 15 assumed that no difference would be observed from the results of descriptive (Tables 16, 17 and 18) and inferential statistics (Table 19).

Table 15: Hypothesis 2

| Hypothesis 2 | |
|--------------|---|
| H_0 | There is no difference between the flexibility preferences of individuals with perceived financial scarcity who are certainty-effect biased, compared to those who are not certainty-effect biased. |
| H_1 | There is a difference between the flexibility preferences of individuals with perceived financial scarcity who are certainty-effect biased compared, to those who are not certainty-effect biased. |

Source: Author’s own

4.4.1 Descriptive statistics of constructs

The frequencies per Table 16 indicated that most participants preferred certainty over risk (Category 1 to 3, $N = 302$, 78%) and were not certainty-effect biased ($N = 292$, 72%). This means that they did not reverse this preference when probabilities were lowered by a common ratio between choices (common ratio-effect), or when a common delay of three months was added to choices (common delay-effect). Furthermore, most participants ($N = 238$, 59%) seemed to be consistent in their choices of certainty over risk across the different hypothetical scenarios. A certainty preference score was derived for each participant from their choices and the distribution of scores supported the notion that the majority of participants had a preference for certainty (Categories 3 to 4: $N = 277$, 68%) and demonstrated the heterogeneity in participants’ decision-making.

Table 16: Frequencies for constructs related to certainty preferences

| Variable | Name | Category | Frequency | Percentage |
|---|-----------|----------------------------|------------|-------------|
| Risk Preference | Risk | 1 100% certainty (0% risk) | 213 | 55% |
| | | 2 75% certainty (25% risk) | 63 | 16% |
| | | 3 67% certainty (33% risk) | 26 | 7% |
| | | 4 50% certainty (50% risk) | 59 | 15% |
| | | 5 25% certainty (75% risk) | 27 | 7% |
| | | Subtotal | 388 | 100% |
| | | Missing data | 17 | |
| | | Total | 405 | |
| Certainty-effect biased | CEBiased | 0 No | 292 | 72% |
| | | 1 Yes | 113 | 28% |
| | | Total | 405 | 100% |
| Preference reversals/ Inconsistent decisions | PrefRev2 | 0 No | 238 | 59% |
| | | 1 Yes | 167 | 41% |
| | | Total | 405 | 100% |
| Certainty Preference Score | CertScore | 0 Always risk | 15 | 4% |
| | | 1 Mostly risk | 33 | 8% |
| | | 2 Neutral | 80 | 20% |
| | | 3 Mostly certainty | 141 | 35% |
| | | 4 Always certainty | 136 | 33% |
| | | Total | 405 | 100% |

Source: Author's own

The frequencies presented in Table 17 indicate that most participants preferred flexibility at no cost ($N = 278$, 69%), at a low monetary cost ($N = 253$, 62%) and at a time cost ($N = 216$, 53%) but not at a large monetary cost ($N = 180$, 44%). Consistent with the methodology applied to calculate a commitment preference score (H_1), a flexibility preference score for each participant was derived from the four flexibility preference questions (Table 18).

Table 17: Frequencies for constructs related to flexibility preferences

| Variable | Name | Category | Frequency | Percentage |
|--|-------|--------------|------------|-------------|
| Flexibility Preference 0 (No cost) | Flex0 | 0 No | 127 | 31% |
| | | 1 Yes | 278 | 69% |
| | | Total | 405 | 100% |
| Flexibility Preference 1 (Small monetary cost) | Flex1 | 0 No | 152 | 38% |
| | | 1 Yes | 253 | 62% |
| | | Total | 405 | 100% |
| Flexibility Preference 2 (Larger monetary cost) | Flex2 | 0 No | 225 | 56% |
| | | 1 Yes | 180 | 44% |
| | | Total | 405 | 100% |
| Flexibility Preference 3 (Time cost) | Flex3 | 0 No | 189 | 47% |
| | | 1 Yes | 216 | 53% |
| | | Total | 405 | 100% |

Source: Author's own

A flexibility preference score of zero as per Table 18 means that a participant had no flexibility preference, while a score of four suggests that a participant always preferred flexibility whether at *no cost*, at a *small monetary cost*, a *larger monetary cost* or at a *time cost*. The purpose of this flexibility preference score was to operationalise flexibility preference, which was one of the continuous independent variables manipulated in the experiment (H₃).

Table 18: Flexibility Preference Score distribution

| Variable | Name | Score | Frequency | Percentage |
|------------------------------|-----------|----------------------|------------|-------------|
| Flexibility Preference Score | FlexScore | 0 No flexibility | 76 | 19% |
| | | 1 Some flexibility | 60 | 15% |
| | | 2 Neutral | 72 | 18% |
| | | 3 Mostly flexibility | 65 | 16% |
| | | 4 Always flexibility | 132 | 32% |
| | | Total | 405 | 100% |

Source: Author's own, statistics computed via IBM SPSS Statistics 28

The scores reflect a distribution that was negatively skewed (skewness $-.26$; kurtosis -1.39) towards always having a preference for flexibility ($N = 132, 32\%$), and also signals a high level of heterogeneity in participants' preferences for flexibility. Furthermore, the results of a Shapiro-Wilks test, $W(405) = 0.85, p < 0.001$ indicated a significant departure from normality (also refer to Section 4.5.2), which is the reason for selecting the non-parametric Mann-Whitney U Test as discussed in the next section.

4.4.2 Inferential statistics: Mann-Whitney U Test

The independent-samples Mann-Whitney U Test was also used to determine if there was a difference in the flexibility preferences of individuals who perceived financial scarcity and were certainty-effect biased, compared to those who were not certainty-effect biased. This non-parametric technique assumes random samples and independent observations which were not violated. The statistical tables are presented in Appendix 8.2 and the median flexibility preference scores for each group are reflected in Table 19.

Table 19: Median flexibility preference scores per group

| Certainty-effect biased | <i>N</i> | Median (<i>Md</i>) |
|-------------------------|------------|----------------------|
| 0 No | 292 | 2 |
| 1 Yes | 113 | 3 |
| Total | 405 | 2 |

Source: IBM SPSS Statistics 28

Based on the flexibility preference scores summarised in Table 19, it is evident that the group with the largest number of participants ($N = 292$) comprised those who were not certainty-effect biased with a median score of two, indicating neutrality in their flexibility preferences. The median score of three for certainty-effect biased participants revealed that this group generally preferred flexibility. However, the Mann-Whitney U Test revealed no significant difference in the flexibility preference scores of participants who were certainty-effect biased ($Md = 3, N = 113$) and those who were not ($Md = 2, N = 292$), $U = 16934, z = .43, p = .67, r = .02$ (a small effect size as per Cohen, 1988). The sample evidence was therefore not strong enough to reject the null hypothesis in favour of H_1 at $\alpha = 0.05$.

H_2 was analysed at a bivariate level and no control variables were considered since this was a secondary, exploratory hypothesis only. The results are helpful to gain a better understanding of the sample population's biases and preferences which underly their saving behaviour and allow for richer inferences on the results of subsequent hypotheses (H_3 and H_4).

4.5 H₃: Impact evaluation of interventions per strata

The third hypothesis consisted of three parts to evaluate the impact of two between-subject interventions on saving intention and to identify which one had the largest effect. Both interventions provided an opportunity for participants to self-reflect on a short-term saving plan but differed in terms of the level of commitment or flexibility required from participants. The first intervention required strict saving commitments, while the second allowed more freedom of choice and flexibility in committing to a short-term saving plan. Table 20 provides the three sub-hypotheses.

Table 20: Hypothesis 3

| Sub-hypotheses | |
|----------------|---|
| $H_3(a)$ | A strict (hard) commitment intervention has a positive impact on the saving intentions of individuals who perceive financial scarcity (T_1). |
| $H_3(b)$ | A flexible (soft) commitment intervention has a positive impact on the saving intentions of individuals who perceive financial scarcity (T_2). |
| $H_3(c)$ | A flexible (soft) commitment intervention (T_2) has a stronger positive impact on the saving intentions of individuals who perceive financial scarcity compared to a strict (hard) commitment intervention (T_1). |

Source: Author's own

Per the experimental design discussed in the previous chapter, the Saving Intention dependent variable was measured at the baseline for all participants irrespective of the experimental group they were eventually assigned to. This was purposefully done to ensure an accurate estimation of the ATEs per group post-intervention. Based on these initial measures of saving intention, participants were classified into either an Intent or Low/No Intent stratum for stratified random allocation to one of the treatment groups or the control group. This section proceeds with discussions on pre-analysis assumption testing for Multiple Linear Regression (MLR), descriptive statistics calculated for each stratum, and an impact evaluation conducted for the interventions according to the sub-hypotheses listed in Table 20.

4.5.1 Testing of assumptions for Multiple Linear Regression (MLR)

Assumption 1: Sample size

The methodology for determining the overall sample size of 405 participants was discussed in the previous chapter. According to Green (1991), sample size requirements for multiple regression can be calculated with the following formula as a rule of thumb:

Formula 3:

$$N > 50 + 8m$$

Where:

N is the required sample size, and

m is the number of independent variables in the regression formula.

This formula was used to test the assumption that the sample sizes for both the Intent ($N = 305$) and Low/No Intent ($N = 100$) stratum were adequate to perform a subgroup regression analysis. Provided that a maximum of six covariates (independent variables) were used in the Low/No Intent regression formula ($N = 50 + 8(6) = 98$), both sample sizes were deemed adequate to ensure the generalisability of results.

Assumption 2: Multicollinearity and singularity

Multicollinearity and singularity respectively refer to the problems of correlations between, and combinations of, independent variables in multiple regression models. These problems could inflate standard errors and undermine the ability to compare effect sizes between independent variables (Garson, 2014). The collinearity statistics and collinearity diagnostics tables derived as part of the multiple regression calculation procedure presented in Appendices 11 and 13 indicate variance inflation factor (VIF) values smaller than five – the common rule of thumb threshold which indicates a multicollinearity problem (Pallant, 2016). Therefore, the assumptions of Ordinary Least Squares (OLS) regression were not violated in terms of multicollinearity.

Assumption 3: Outliers

Since outliers may have undue influence on the results of a multiple regression model, extreme observations for both dependent and independent variables were identified (refer to the Casewise Diagnostics table in Appendix 10 which lists six outliers). Checks were subsequently performed to determine the sensitivity of the regression results to the inclusion or exclusion of these observations from the analysis. These checks involved running the regression models with and without the identified outliers and comparing the results to determine any significant differences. In addition, Cook's Distance (as per the residuals statistics tables in Appendices 11 and 13) indicated maximum values smaller than one (Tabachnick & Fidell, 2013), which is also an indication that the identified outliers had no significant effect on the regression results.

The decision not to exclude the outliers from the analysis a priori was taken as this is common practice with large data sets (Glennerster & Takavarasha, 2013) and supported comparability

and balance between the experimental groups by keeping their original sample sizes intact. The importance of this inter-group balance is discussed in more detail in Section 4.5.2.

Assumption 4: Sample distribution

The assumptions of normality, linearity, homoscedasticity and independence of residuals were checked by inspecting and interpreting the residuals scatterplots as presented in Appendices 11 and 13. While the residuals on the Normal Probability Plots (P-P plots) indicated some departure from normality (the straight diagonal line), this is often the case with large samples (Pallant, 2016). This departure from normality was confirmed by the Shapiro-Wilk tests performed on Saving Intent at the endline dependent variable for each stratum (Intent: $W(305) = 0.75, p < .001$; Low/No Intent $W(100), p < .001$). However, for large sample sizes, test results are usually unaffected by violations of normality based on the CLM. According to this phenomenon, the sampling distribution of the mean is always normal, regardless of how values are distributed in the population.

Initially, when the total sample of 405 observations was included in a single regression model, the assumption of homoscedasticity was violated as the observations of participants in the Intent and Low/No Intent strata were distinct and clustered together. For this reason, the decision was made to perform a subgroup analysis and estimate separate regression models for each stratum. This decision resolved the homoscedasticity problem as can be seen from the rectangular distribution of the residuals on the scatterplots in Appendices 11 and 13. As a result, the homoscedasticity assumption was no longer violated in each of the two separate regression models.

In summary, apart from the normality assumption violations which did not affect the test results, none of the key MLR assumptions were violated in either one of the subgroup analyses for the two strata, Intent and Low/No Intent. Based on the results of these pre-analysis assumption checks, descriptive statistics were calculated to test the balance between the experimental groups as discussed in the next section.

4.5.2 Descriptive statistics and balance tests

It is standard practice to conduct a balance test to check whether the experimental groups are comparable along key characteristics after participants were randomly assigned (Ashraf et al, 2006; Calderone, Fiala, Mulaj, Sadhu & Sarr, 2018; Dupas, 2011). Tables 21 and 22 summarise the key characteristics (variables) and balance tests between the groups for each stratum after baseline data were collected and the randomised assignment was conducted (but before the experiment was run). Since randomisation is key to this study, this check was performed to ensure that stratified random assignment was executed as planned.

The balance test for categorical variables was conducted using Pearson's chi-square (χ^2) to evaluate how likely it was that any observed differences between the three independent experimental groups arose by chance. The data of the Intent stratum passed both the assumption of categorical variables of interest and the assumption of independent groups of interest before these χ^2 tests were undertaken. The expected cell count assumption (of at least five) was also checked during the review of the test output and violations were only found in the Low/No Intent strata due to the small sample sizes in the experimental groups. For this reason, Fisher's Exact Test was utilised for this stratum to test if the proportions of categories in two variables significantly differed from each other. The results of these tests are two-sided p -values which are reported in Table 22.

Table 21: Inter-group comparison of key variables – Intent stratum

| Categorical variables | Control vs. T ₁ | Control vs. T ₂ | T ₁ vs. T ₂ |
|-----------------------------|----------------------------------|----------------------------------|-----------------------------------|
| Age Group | $\chi^2 (3) = .44$ $p = .93$ | $\chi^2 (3) = 3.63$ $p = .30$ | $\chi^2 (3) = 2.14$ $p = .54$ |
| Highest Qualification Group | $\chi^2 (3) = 5.58$ $p = .13$ | $\chi^2 (3) = 5.33$ $p = .15$ | $\chi^2 (3) = 1.00$ $p = .80$ |
| Gender | $\chi^2 (1) = 0.47$ $p = .83$ | $\chi^2 (1) = 1.25$ $p = .26$ | $\chi^2 (1) = 1.77$ $p = .18$ |
| Employment Status Group | $\chi^2 (5) = 5.45$ $p = .36$ | $\chi^2 (5) = 6.89$ $p = .23$ | $\chi^2 (5) = 2.70$ $p = .75$ |
| Income Group | $\chi^2 (4) = 7.06$ $p = .13$ | $\chi^2 (4) = 4.52$ $p = .34$ | $\chi^2 (4) = .89$ $p = .93$ |

| Continuous variables | Control | T ₁ | T ₂ | ANOVA F-stat p -value |
|--|-----------------|-----------------|-----------------|----------------------------|
| Intent Stratum | $N= 104$ | $N= 103$ | $N= 98$ | $N= 305$ |
| PFL Score (Scale from 1 to 7) | 4.68 (0.117) | 4.74 (0.128) | 4.62 (0.128) | 0.77 |
| Commitment Preference Score (Scale from 0 to 3) | 0.76 (0.087) | 0.74 (0.099) | 0.78 (0.093) | 0.96 |
| Flexibility Preference Score (Scale from 0 to 4) | 2.15 (0.148) | 2.32 (0.151) | 2.18 (0.152) | 0.70 |
| Saving Intent Score at Baseline (Scale from 1 to 7) | 1.69 (0.073) | 1.62 (0.074) | 1.67 (0.083) | 0.83 |

Source: Author's own

Notes:

Continuous variables: Means and Standard Error (in parenthesis) are displayed for the three experimental groups.
* Statistically significant difference at the 5% level ($> \alpha = 0.05$).

The results of the Intent stratum's balance test for both categorical and continuous variables show p-values which are all acceptable at the 5% level of significance ($> \alpha = 0.05$)(Table 21). The null hypothesis that there were no significant differences between the proportions of the key variables in the three groups was therefore accepted. This means that the stratified random assignment process was effective to ensure balance and comparability between the key characteristics of participants assigned to the various experimental groups. Appendix 9 offers more comprehensive details on all the demographic variables and their categories per experimental group in the Intent stratum.

Table 22: Inter-group comparison of key variables – Low/No Intent stratum

| Categorical variables | Control vs. T₁ | Control vs. T₂ | T₁ vs. T₂ |
|------------------------------|----------------------------------|----------------------------------|--|
| Age Group | $p = .59$ | $p = .71$ | $p = .98$ |
| Highest Qualification Group | $p = .32$ | $p = .40$ | $p = 1.00$ |
| Gender | $p = .47$ | $p = .09$ | $p = .45$ |
| Employment Status Group | $p = .38$ | $p = .05$ | $p = .67$ |
| Income Group | $p = .37$ | $p = .01^*$ | $p = .40$ |

| Continuous variables | Control | T₁ | T₂ | ANOVA F-stat p-value |
|--|-----------------|----------------------|----------------------|---------------------------------|
| Intent stratum | N= 36 | N= 31 | N= 33 | N= 100 |
| PFL Score (Scale from 1 to 7) | 4.29 (0.234) | 4.6 (0.238) | 5.03 (0.215) | .07 |
| Commitment Preference Score (Scale from 0 to 3) | 1.03 (0.185) | 0.84 (0.197) | 0.7 (0.166) | .43 |
| Flexibility Preference Score (Scale from 0 to 4) | 2.28 (0.238) | 2.42 (0.292) | 2.82 (0.248) | .31 |
| Saving Intent Score at Baseline (Scale from 1 to 7) | 4.71 (0.144) | 5.29 (0.185) | 5.16 (0.147) | .03* |

Source: Author's own

Notes:

Categorical variables: two-sided p -values of Fisher's Exact Test.

Continuous variables: Means and Standard Error (in parenthesis) are displayed for the three experimental groups.

* Statistically significant difference at the 5% level ($> \alpha = 0.05$).

Similar to the results of the Intent stratum's balance test, most of the results of the Low/No Intent stratum showed p-values which were acceptable at the 5% level of significance ($> \alpha = 0.05$)(Table 22). Statistically significant differences (at the 5% significance level) were observed in only two instances. Firstly, the Income Group frequencies in the control group

differed from the T_2 group in respect of 10 participants, which were significant in sample sizes of $N = 36$ and $N = 33$ respectively. Compared to T_2 , the control group had a higher concentration of participants in the lower two income groups who earned less than ZAR15,000 per month. Secondly, a significant difference was observed between the baseline saving intention scores of the control and T_1 groups in the Low/No Intent stratum. Since the control group had a lower mean score than the treatment groups, this indicated that control group participants in this stratum had higher saving intent on average before the experiment started. These differences in baseline results were considered in the interpretation of the heterogeneous treatment effects analysed in the sections to follow and discussed in Chapter 5. Appendix 11 offers more comprehensive details on all the demographic variables and their categories per experimental group in the Low/No Intent stratum.

With the comparability between the experimental groups checked and confirmed for both strata, the next step in the analysis was to determine and compare the ATEs between the groups. This is discussed in the sub-section that follows.

4.5.3 Estimating ATEs through MLR

A classic ATE analysis for a randomised experiment is usually performed in two steps. As a first step, the means of the Saving Intention dependent variable were estimated for all participants who were randomly allocated to either the control or one of the two treatment groups. This was followed by a comparison of these estimated means between the groups to determine what happened to the average participant who received one of the treatments (Glennster & Takavarasha, 2013).

The saving intention means for each of the three experimental groups were estimated through an MLR model as described in Section 3.6.3, Formula 1. According to the experimental design of this study, the stratified random allocation was applied to create three experimental groups for each of the Intent and Low/No Intent strata. A best-fit MLR model was first derived for the Intent stratum ($N = 305$) and then run separately for the Low/No Intent stratum ($N = 100$) to determine if it was a good fit for both. However, the best-fit model for the Intent stratum was found to be a much weaker fit for the Low/No Intent stratum. A revised MLR model was therefore developed using appropriate control variables to increase model fit and the accuracy of predicting saving intention scores of participants in the Low/No Intent stratum.

Detailed results from running the two MLR models are available in the coefficients tables in Appendices 11 and 13, while Table 23 provides a summary of the models to estimate the impact of the treatments on saving intention. These results are interpreted separately for each stratum (subgroup) and discussed in the subsections that follow.

Estimating saving intention for the Intent subgroup

Saving intention scores were regressed on five predictor variables, namely Saving Intention at Baseline, Commitment Score, Flexibility Score, PFL, Age Group, and two dummy variables for T₁ and T₂. These variables accounted for approximately 55.4% of the variance in endline saving intention scores of participants who had the intention to save at baseline ($R^2 = .554$, Adjusted $R^2 = .543$), which was statistically significant at the 5% level ($p < .001$).

The MLR analysis for the Intent stratum revealed that each Saving Intention at Baseline, PFL and Age made separate, statistically significant contributions to the model predicting saving intention scores (refer to Table 23). Collectively, these three predictor variables accounted for 45% of the variance in saving intention scores after the treatments. Total Intent at Baseline ($\beta = .667$, $p < .001$) was the most influential individual predictor, followed by PFL ($\beta = -.153$, $p < .001$) and Age ($\beta = .098$, $p = .015$). Neither the Commitment Score nor Flexibility Score revealed a significantly unique contribution to the prediction of saving intention scores, which may be due to the overlap with other variables in the model (Pallant, 2016). Nevertheless, these independent variables were kept in the model because omitting them reduced R^2 to .550 (Adjusted R^2 to .542), which represented a slightly weaker regression model even though it would have been more parsimonious. Furthermore, these variables remained of interest to the study as they tied H₁ and H₂ together with H₃. Using Formula 1 (refer to Section 3.6.3), a point estimate of the average saving intention score (\bar{Y}_i) can be estimated for various scenarios by substituting the x_i -values for the five predictor variables in the Intent stratum model (1).

The beta coefficients of the two dichotomous treatment dummy variables for T₁ and T₂ reflect changes in the saving intention score of each treatment group compared to the control group (reference group). It can be observed from Table 23 that both T₁ ($\bar{\beta}_{T1} = -.129$, $p = .005$) and T₂ ($\bar{\beta}_{T2} = -.129$, $p = .005$) were effective to lower saving intention scores, which is an indication of higher average saving intention amongst participants allocated to the treatment groups. These positive treatment effects provided preliminary statistical evidence to reject the null hypothesis in favour of H_{3(a)} and H_{3(b)} (refer to Table 20). However, the two treatments had similar effects with both the soft commitment treatment (T₂) ($\bar{\beta}_{T2} = -.129$) and the hard commitment treatment (T₁) ($\bar{\beta}_{T1} = -.129$) increasing the saving intention scores of participants. Therefore, the null hypothesis was not rejected in favour of H_{3(c)} (as per Table 20) for participants in the Intent subgroup.

Table 23: Summary of the MLR models to estimate the impact of treatments on saving intention

| Variables | Intent stratum (1) | | Low/No Intent stratum (2) | |
|---|--------------------|---------|---------------------------|---------|
| | Beta | p-value | Beta | p-value |
| Hard Commitment Treatment (T ₁) | -.129 | .005* | -.358 | <.001* |
| Soft Commitment Treatment (T ₂) | -.129 | .005* | -.272 | .011* |
| Saving Intention Score at Baseline | .667 | <.001* | .537 | <.001* |
| Commitment Preference Score | .027 | .633 | .120 | .320 |
| Flexibility Preference Score | .093 | .100 | .054 | .653 |
| PFL | -.153 | <.001* | N/a | N/a |
| Age | .098 | .015* | N/a | N/a |
| Income | N/a | N/a | -.189 | .041* |
| Constant | - | <.001 | - | .684 |
| R ² | .554 | | .289 | |
| Adjusted R ² | .543 | | .243 | |
| Sample size N (Random) | 305 | | 100 | |

Source: Author's own

Notes:

T₁ and T₂ are the two treatment groups.

The omitted group indicator (reference indicator) in this regression corresponds to the control group.

Cell values are beta weights (β) is the standard error of the estimate.

*Statistically significant at the 5% level.

Estimating saving intention for the Low/No Intent subgroup

The saving intention scores of this subgroup were regressed on four predictor variables, namely Saving Intention at Baseline, Commitment Score, Flexibility Score, Income Group, and two dummy variables for T₁ and T₂. These variables accounted for approximately 28.9% of the variance in endline saving intention scores of participants who had low/no intention to save at baseline ($R^2 = .289$, Adjusted $R^2 = .243$), which was statistically significant at the 5% level ($p < .001$).

The MLR analysis for the Low/No Intent subgroup revealed that Saving Intention at Baseline ($\beta = .537$, $p < .001$) and Income ($\beta = -.189$, $p = .041$) made statistically significant *unique* contributions to the model predicting saving intention scores. These predictor variables accounted for 28% of the variance in saving intention scores after the treatments. Neither of the two main predictor variables, Commitment Score and Flexibility Score, revealed a

significantly unique contribution to the prediction of saving intention scores, which may be due to the overlap with other independent variables in the model (Pallant, 2016). Nevertheless, these independent variables were kept in the model because omitting them reduced R^2 to .283 (Adjusted R^2 to .243), which represented a slightly weaker regression model even though it would have been more parsimonious. Furthermore, these variables remained of interest to the study as they tied H_1 and H_2 together with H_3 . Using the model as per Formula 1 (refer to Section 3.6.3), a point estimate of the average saving intention score (\bar{Y}_i) can be estimated for various scenarios by substituting x_i -values for the four predictor variables in the Low/No Intent stratum model (2).

The beta coefficients of the two dichotomous treatment dummy variables for T_1 and T_2 reflected changes in the saving intention score of each treatment group in comparison to the control group (reference group). Both T_1 ($\bar{\beta}_{T_1} = -.358, p < .001$) and T_2 ($\bar{\beta}_{T_2} = -.272, p = .011$) were effective to lower saving intention scores which is an indication of higher average saving intention amongst participants allocated to the treatment groups. These positive treatment effects were especially meaningful when the saving intention scores measured at baseline were considered (refer to Table 22). Control group participant scores were lower compared to the treatment groups at this time, which means that these participants had a higher intent to save before the experiment. A statistically significant difference (at the 5% level) between the control and T_1 groups was also reported in Table 22. This provided preliminary statistical evidence to reject the null hypothesis in favour of $H_{3(a)}$ and $H_{3(b)}$ (refer to Table 20). However, the hard commitment treatment (T_1) seemed to have been more effective than the soft commitment treatment (T_2) ($\bar{\beta}_{T_1} = -.358$ versus $\bar{\beta}_{T_2} = -.272$ is a $\beta = -.086$ difference) to increase saving intention for participants. Therefore, the null hypothesis was not rejected in favour of $H_{3(c)}$ (refer to Table 20) for participants in the Low/No Intent subgroup.

The conclusions made for each of the three sub-hypotheses based on the results from the two MLR models are presented in Table 24. In summary, the null hypotheses were rejected in favour of $H_{3(a)}$ and $H_{3(b)}$ but not for $H_{3(c)}$ in both strata. The evidence suggests that both the hard (T_1) and soft (T_2) commitment treatments had a statistically significant effect on saving intention scores - irrespective of the subgroup. When these two treatments were compared for each subgroup after controlling for covariates, the hard commitment treatment seemed to be equally impactful compared to the soft commitment treatment for the Intent participants but more impactful than the soft commitment treatment for the Low/No Intent participants. To increase the validity of inferences about the impact of the two treatments in each of the subgroups, further analyses were conducted to gain a better understanding of the heterogeneity within the groups' ATEs (refer to Section 4.5.4).

Table 24: H₃ conclusions for the Intent and Low/No Intent strata

| Hypotheses | Control vs. T ₁ | Control vs. T ₂ | T ₁ vs. T ₂ |
|---|---|---|---|
| Intent stratum | | | |
| H _{3(a)} : T ₁ increased saving intention | Reject H ₀ ($\bar{\beta}_{T1} = -.129, p = .005$) | | |
| H _{3(b)} : T ₂ increased saving intention | | Reject H ₀ ($\bar{\beta}_{T2} = -.129, p = .005$) | |
| H _{3(c)} : T ₂ increased saving intention more than T ₁ | | | Fail to reject H ₀ -.129 ($\bar{\beta}_{T2}$) less -.129 = ($\bar{\beta}_{T1}$) = zero difference |
| Low/No Intent stratum | | | |
| H _{3(a)} : T ₁ increased saving intention | Reject H ₀ ($\bar{\beta}_{T1} = -.358, p < .001$) | | |
| H _{3(b)} : T ₂ increased saving intention | | Reject H ₀ ($\bar{\beta}_{T2} = -.272, p = .011$) | |
| H _{3(c)} : T ₂ increased saving intention more than T ₁ | | | Fail to reject H ₀ -.272 ($\bar{\beta}_{T2}$) less -.358 = ($\bar{\beta}_{T1}$) = .086 difference |

Source: Author's own

4.5.4 Heterogeneity analysis: One-way repeated measures ANOVA

This study's research design allowed for multiple observations of saving intention scores using the same scale at different time points - before the treatments (baseline), immediately after the treatments (endline) and 30 days after the treatments (follow-up). These repeated measurements were conducted for the same participants in the three experimental groups in each stratum according to a within-subjects research design.

The general assumptions that apply to parametric tests, such as ANOVA, required the dependent variable (saving intention score) to be continuous, which was indeed the case. The assumption that observations for participants in the three groups were made independently from each other with no possibility of spillover effects was also met. Variability of saving intention scores for each of the groups was assumed to be similar and Levene's test for homogeneity of variances confirmed this assumption for all comparisons (*p-values* >.05, therefore not significant). The Shapiro Wilk tests' result indicated that the normal distribution assumption was not met for the two strata (refer to Section 4.5.1, Assumption 4) but the ANOVA statistical technique is reasonably tolerant of this violation in analyses with large sample sizes (Pallant, 2016), such as this study.

Results of the within-group comparisons for the Intent subgroup

A one-way repeated measures ANOVA was conducted to compare saving intention scores at Time 1 (baseline), Time 2 (endline) and Time 3 (30-day follow-up period) for participants in the two treatment groups of the Intent stratum. A paired-sample t-test was more appropriate for the control group as participants' saving intention scores were only compared between Time 1 (baseline) and Time 3 (30-day follow-up period) since no measurement was taken at Time 2. The descriptive statistics and test results are presented in Table 25 and statistically significant effects were observed for time in all three experimental groups. A Bonferroni adjustment was required for the two treatment groups since two within-group comparisons were made between three time periods, thus the significance level was reduced to 2.5% (5% level divided by the number of comparisons [two]).

Table 25: Comparison of saving intention scores at multiple times - Intent stratum

| Within-group analyses | <i>N</i> | Mean | Standard Deviation | Results |
|---------------------------|----------|------|--------------------|--|
| T₁ | | | | One-way repeated measures ANOVA |
| Time 1 (Baseline) | 76 | 1.59 | .726 | Wilks' Lambda = .82, $F(2, 74) = 8.03$, $p < .001^{**}$ |
| Time 2 (Endline) | 76 | 1.39 | .628 | |
| Time 3 (30-day follow-up) | 76 | 1.84 | 1.163 | |
| Effect size | | | | partial eta squared = .18 |
| T₂ | | | | One-way repeated measures ANOVA |
| Time 1 (Baseline) | 78 | 1.65 | .810 | Wilks' Lambda = .88, $F(2, 76) = 5.10$, $p = .008^{**}$ |
| Time 2 (Endline) | 78 | 1.42 | .702 | |
| Time 3 (30-day follow-up) | 78 | 1.74 | 1.147 | |
| Effect size | | | | partial eta squared = .12 |
| Control | | | | Paired samples t-test |
| Time 1 (Baseline) | 62 | 1.55 | .672 | $t(61) = -3.43$, $p = .001^*$ |
| Time 2 (Endline) | N/a | N/a | N/a | |
| Time 3 (30-day follow-up) | 62 | 2.18 | 1.425 | |
| Effect size | | | | eta squared = .16 |

Source: Author's own

Notes:

Control group: Saving intention scores were only measured at Baseline (Time 1) and at the 30-day follow-up (Time 3), since this group received no treatments.

Blue arrows indicate where (between which times) the significant differences occurred.

* Statistically significant at the 5% level.

** Statistically significant at the 2.5% level. A Bonferroni adjustment was made to account for two within-group comparisons

These results suggest that there was a significant change in saving intention scores over time in all three experimental groups. Further investigation of the results revealed that the significance originated specifically between Time 1 and Time 2, and between Time 2 and Time 3 for both treatment groups. This is evident from the decrease in mean values of saving intention scores per treatment group from Time 1 to Time 2 reported in Table 25. A reduction in this score represents an increase in saving intention as per the measurement instrument used. However, this trend then reversed between Time 2 and Time 3 for both the treatment groups – an indication that the treatment effects did not last for 30 days (Phase Two follow-up period) after the interventions.

Similarly, the saving intention scores of the control group participants who did not receive any treatments, increased significantly during the 30-day follow-up period (from Time 1 to Time 3, no measurement was taken at Time 2). Furthermore, when the mean saving intention scores measured at Time 1 were compared between the groups, the control group participants scored lower, which represented higher saving intent than the treatment groups at this time. The opposite was observed at Time 3, as this group's mean score was higher (meaning lower saving intent) compared to the treatment groups. This indicates that other, unobserved factors may have lowered saving intention (increase in saving intention scores) for all participants in the Intent stratum during the 30-day follow-up period.

The effect sizes of the changes in saving intention over time for each experimental group according to the eta squared calculations were large for T₁ (.18) and the control group (.16) but only moderate for T₂ (.12). This is according to the guidelines proposed by Cohen (1988) which regard results of .14 and more as a large effect size, and results from .06 to .13 as moderate effect sizes.

Results of the within-group comparisons for the Low/No Intent subgroup

A one-way repeated measures ANOVA test was also conducted to compare saving intention scores at Time 1 (baseline), Time 2 (endline) and Time 3 (one-month follow-up) for participants in the two treatment groups of the Low/No Intent stratum. A paired-sample t-test was once again more appropriate for the control group as participants' saving intention scores were only compared between Time 1 (baseline) and Time 3 (30-day follow-up period) since no measurement was taken at Time 2. The descriptive statistics and test results are presented in Table 26 and statistically significant effects were observed for time in the two treatment groups. A Bonferroni adjustment was required for the two treatment groups since two within-group comparisons were made between three time periods, thus the significance level was reduced to 2.5% (5% level divided by the number of comparisons [two]).

These results suggested that there was a significant change in saving intention scores over time in the two treatment groups. Further investigation of the results revealed that the significance originated specifically between Time 1 and Time 2, and between Time 1 and Time 3 for Treatment Group 1 (T₁). A significant difference was only observed between Time 1 and Time 3 for T₂. This is evident from the decrease in mean values of saving intention scores per treatment group from one period to the next as reported in Table 26. A reduction in this score represents an increase in saving intention as per the measurement instrument used. It is important to note that this trend is maintained between Time 2 and Time 3 for both the treatment groups – an indication that the treatment effects lasted for 30 days (Phase Two follow-up period) after the interventions.

Table 26: Comparison of saving intention scores at multiple times - Low/No Intent stratum

| Within-group analyses | N | Mean | Standard Deviation | Results |
|---------------------------|-----|------|--------------------|--|
| T₁ | | | | One-way repeated measures ANOVA |
| Time 1 (Baseline) | 20 | 5.35 | 1.023 | Wilks' Lambda = .44, F (2, 18) = 11.34, p < .001** |
| Time 2 (Endline) | 20 | 4.03 | 1.964 | |
| Time 3 (30-day follow-up) | 20 | 3.37 | 1.548 | |
| Effect size | | | | partial eta squared = .56 |
| T₂ | | | | One-way repeated measures ANOVA |
| Time 1 (Baseline) | 17 | 5.25 | .854 | Wilks' Lambda = .35, F (2, 15) = 13.68, p < .001** |
| Time 2 (Endline) | 17 | 4.59 | 1.766 | |
| Time 3 (30-day follow-up) | 17 | 3.24 | 1.645 | |
| Effect size | | | | partial eta squared = .65 |
| Control | | | | Paired samples t-test |
| Time 1 (Baseline) | 14 | 4.57 | .910 | t (13) = 1.18, p = .26 |
| Time 2 (Endline) | N/a | N/a | N/a | |
| Time 3 (30-day follow-up) | 14 | 4.07 | 1.415 | |
| Effect size | | | | eta squared = .10 |

Source: Author's own

Notes:

Control group: Saving intention scores were only measured at Baseline (Time 1) and at the 30-day follow-up (Time 3), since this group received no treatments.

Blue arrows indicate between which times the significant differences occurred.

* Statistically significant at the 5% level.

** Statistically significant at the 2.5% level. A Bonferroni adjustment was made to account for two within-group comparisons

Similarly, the saving intention scores of the control group participants, who did not receive any treatments, increased during the 30-day follow-up period (from Time 1 to Time 3, no measurement was taken at Time 2). Furthermore, when the mean saving intention scores measured at Time 1 were compared between the groups, the control group participants scored lower, which represented a higher saving intent than the treatment groups at this time. The opposite was observed at Time 3, as this group's mean score was higher (meaning lower saving intent) compared to the treatment groups. However, the score decrease was not significant for this group. This may be an indication of other, unobserved factors that influenced the increase in saving intention (decrease in saving intention scores) to some extent for all participants in the Low/No Intent stratum during the 30-day follow-up period.

The effect sizes of changes in saving intention scores over time for each experimental group according to the eta squared calculations were large for the treatment groups ($T_1 = .56$, $T_2 = .65$) according to the guidelines proposed by Cohen (1988) (results of .14 and more is considered to be a large effect size). However, the effect size for the control group (.10) was only moderate according to the Cohen (1988) guideline.

To conclude, the evidence from the within-group analyses supported the results from the MLR analysis in that both treatments had a positive impact on saving intention. However, the treatments had a positive impact only immediately after the interventions for participants in the Intent stratum. The effect sizes of both treatments seemed to have been larger and lasted longer (at least for the 30-day follow-up period), for participants in the Low/No Intent stratum.

4.6 H₄: The relationship between saving intent and action

The final hypothesis was formulated to evaluate the relationship between saving intention and saving action among individuals who perceive financial scarcity and underwent one of two commitment interventions. The null hypothesis presented in Table 27 assumed that no positive relationship would be observed and the results were analysed through descriptive (Table 28) and inferential statistics (Table 30).

Table 27: Hypothesis 4

| Hypothesis 4 | |
|--------------|--|
| H_0 | There is no positive relationship between the saving intention and saving action among individuals who perceived financial scarcity. |
| H_1 | There is a positive relationship between saving intention and saving action among individuals who perceived financial scarcity. |

Source: Author's own

4.6.1 Testing of assumptions and residuals analysis for MLR

Assumption 1: Sample size

As a starting point, Formula 3 (refer to Section 4.5.1) was used to test the assumption that the Intent ($N = 216$) and Low/No Intent ($N = 51$) subgroups had appropriate sample sizes for multiple regression analyses. According to this formula, the sample size was indeed adequate for the Intent stratum (minimum sample size required: $N = 50 + 8[3] = 74$) but not for the Low/No Intent stratum (minimum sample size required: $N = 50 + 8[2] = 66$) to ensure 80% statistical power and generalisability of results. While Formula 3 (Green, 1991) was only one rule of thumb for sample sizes, the general rule is no less than 50 participants for a correlation or regression analysis and this threshold further increases with the number of independent variables added. For example, Harris (1985) suggested a minimum sample size of 52 ($N = 50 + 2$ independent variables) for the Low/No Intent stratum. The Low/No Intent stratum's sample size was, therefore, on the boundary of what was considered acceptable for the regression and correlation analyses. Consequently, the possibility of a low-powered regression model was acknowledged and taken into account in the inferences made from the regression results of the Low/No Intent stratum in the next chapter.

Assumption 2: Multicollinearity and singularity

The Collinearity statistics and collinearity diagnostics tables derived as part of the multiple regression calculation procedure presented in Appendices 14 and 15 indicate VIF values smaller than five – the common rule of thumb threshold which indicates a multicollinearity problem (Pallant, 2016). Therefore, the assumptions of OLS regression were not violated in terms of multicollinearity.

Assumption 3: Outliers

Since outliers may have an undue influence on the results of a multiple regression model, extreme observations for both dependent and independent variables were identified. The Casewise diagnostics tables in Appendices 14 and 15 list five outliers for the Intent strata and one outlier for the Low/No Intent Strata. Checks were subsequently performed to determine the sensitivity of the regression results to the inclusion or exclusion of these observations from the analysis. These checks involved running the regression models with and without the identified outliers and comparing the results to determine any significant differences. In addition, Cook's Distance as per the residuals statistics tables in Appendices 14 and 15 indicated maximum values smaller than one (Tabachnick & Fidell, 2013), which is also an indication that the identified outliers had no significant effect on the regression results.

The decision not to exclude the outliers from the analysis a priori is common practice with large data sets (Glennister & Takavarasha, 2013) and support comparability and balance between the experimental groups by keeping their original sample sizes intact. The importance of this inter-group balance is discussed in more detail in Section 4.6.2. Furthermore, all participants were asked to provide a reason for the change in their saving balance from Phase One to Phase Two and the answers of the outliers were found to be reasonable explanations for the larger-than-predicted variances.

Assumption 4: Sample distribution

The assumptions of normality, linearity, homoscedasticity and independence of residuals were checked by inspecting and interpreting the residuals scatterplots as presented in Appendices 14 and 15. While the residuals on the Normal Probability Plots (P-P plots) indicate some departure from normality (the straight diagonal line), this is often the case with large samples (Pallant, 2016). This departure from normality was confirmed by Shapiro-Wilk tests performed on the Saving Intent at endline dependent variable for each stratum (Intent: $W(305) = 0.75$, $p < .001$; Low/No Intent $W(100)$, $p < .001$). However, for large sample sizes, test results are usually unaffected by violations of normality based on the CLM. According to this phenomenon, the sampling distribution of the mean is always normal, regardless of how values are distributed in the population.

In summary, apart from the normality assumption violations which did not affect the test results, none of the key MLR assumptions were violated in either one of the subgroup analyses for the two strata, Intent and Low/No Intent. Based on the results of these pre-analysis assumption checks, the descriptive statistics were calculated to test the balance between the experimental groups as discussed in the next section.

4.6.2 Descriptive statistics and balance tests

Balance tests were conducted to check whether the experimental groups in each stratum were still comparable along key characteristics in Phase Two after the attrition as mentioned in Section 3.6.6. Tables 28 and 29 summarise the key characteristics (variables) and balance tests between the groups for each stratum at the commencement of Phase Two. Since comparability between the groups was key to this study, this check was performed to ensure that participant attrition between Phase One and Phase Two did not affect this negatively.

The balance test for categorical variables was conducted using Pearson's chi-square (χ^2) to evaluate how likely it was that any observed differences between the three independent experimental groups arose by chance. The data of the Intent stratum passed both the assumption of categorical variables of interest and the assumption of independent groups of

interest before these χ^2 tests were undertaken. The expected cell count assumption (of at least five) was also checked during the review of the test output and violations were only found in the Low/No Intent strata due to the small sample sizes in the experimental groups. For this reason, Fisher's Exact Test was utilised for this stratum to test if the proportions of categories in two variables significantly differed from each other. The results of these tests are two-sided p -values which are reported in Table 29.

The balance test also involved a comparison between the means of continuous variables in the three groups and whether they were significantly different from each other, using the ANOVA F -statistic. Normal distributions (per Assumption 4, Section 4.6.1) and samples that were randomly selected and independent from each other were assumed for the execution of these tests.

Table 28: Inter-group comparison of key variables – Phase Two: Intent stratum

| Categorical variables | Control vs. T ₁ | Control vs. T ₂ | T ₁ vs. T ₂ | |
|---|----------------------------------|----------------------------------|-----------------------------------|-------------------------------|
| Age Group | $\chi^2 (3) = .94$ $p = .82$ | $\chi^2 (3) = 1.72$ $p = .63$ | $\chi^2 (3) = 2.42$ $p = .49$ | |
| Highest Qualification Group | $\chi^2 (3) = 3.33$ $p = .34$ | $\chi^2 (3) = 2.38$ $p = .50$ | $\chi^2 (3) = 1.97$ $p = .58$ | |
| Gender | $\chi^2 (1) = .50$ $p = .48$ | $\chi^2 (1) = 46.$ $p = .50$ | $\chi^2 (1) = 2.14$ $p = .14$ | |
| Employment Status Group | $\chi^2 (4) = 1.11$ $p = .89$ | $\chi^2 (4) = 1.06$ $p = .90$ | $\chi^2 (4) = .25$ $p = .99$ | |
| Income Group | $\chi^2 (4) = 1.08$ $p = .90$ | $\chi^2 (4) = 2.89$ $p = .58$ | $\chi^2 (4) = 1.02$ $p = .91$ | |
| Continuous variables | Control | T ₁ | T ₂ | ANOVA F -stat p -value |
| | $N = 62$ | $N = 76$ | $N = 78$ | $N = 218$ |
| PFL Score (Scale from 1 to 7) | .53 (.064) | .59 (.057) | .47 (.057) | .35 |
| Commitment Preference Score (Scale from 0 to 3) | 1.95 (.182) | 2.33 (.174) | 2.19 (.182) | .33 |
| Flexibility Preference Score (Scale from 0 to 4) | 2.50 (.226) | 2.11 (.228) | 2.31 (.220) | .48 |
| Saving Action (amount) at Baseline | 2.97 (.276) | 2.36 (.147) | 2.86 (.283) | .16 |

Source: Author's Own

Notes:

Continuous variables: Means and Standard Error (in parenthesis) are displayed for the three experimental groups.

* Statistically significant difference at the 5% level.

The results of the Intent stratum’s balance test for both categorical and continuous variables (Table 28) showed p-values which were all acceptable at the 5% level of significance ($> \alpha = 0.05$). The null hypothesis that there were no significant differences between the proportions of the key variables in the three groups was therefore accepted. Despite the attrition between Phases One and Two (refer to Section 3.6.5), balance and comparability between the various experimental groups remained in place for the Intent stratum’s analysis of H₄.

Similar to the results of the Intent stratum’s balance test, the results for both categorical and continuous variables in the Low/No Intent stratum (Table 29) showed p-values which were all acceptable at the 5% level of significance ($> \alpha = 0.05$). Despite the attrition between Phases One and Two (refer to Section 3.6.6), balance and comparability between the various experimental groups remained in place for the Low/No Intent stratum’s analysis of H₄.

Table 29: Inter-group comparison of key variables – Phase Two: Low/No Intent stratum

| Categorical variables | Control vs. T ₁ | Control vs. T ₂ | T ₁ vs. T ₂ | |
|---|----------------------------|----------------------------|-----------------------------------|-------------------------|
| Age Group | $p = .68$ | $p = .71$ | $p = .54$ | |
| Highest Qualification Group | $p = .10$ | $p = .23$ | $p = .57$ | |
| Gender | $p = .74$ | $p = 1.00$ | $p = 1.00$ | |
| Employment Status Group | $p = .57$ | $p = .06$ | $p = .49$ | |
| Income Group | $p = .56$ | $p = .07$ | $p = .70$ | |
| Continuous variables | Control | T ₁ | T ₂ | ANOVA F-stat p-value |
| | <i>N</i> = 14 | <i>N</i> = 20 | <i>N</i> = 17 | <i>N</i> = 51 |
| PFL Score (Scale from 1 to 7) | .57 (.137) | .50 (.115) | .53 (.125) | .92 |
| Commitment Preference Score (Scale from 0 to 3) | 2.00 (.378) | 1.90 (.362) | 2.76 (.369) | .20 |
| Flexibility Preference Score (Scale from 0 to 4) | 2.64 (.476) | 2.75 (.481) | 1.65 (.477) | .21 |
| Saving Action at Baseline | 3.93 (1.051) | 2.60 (.343) | 3.35 (.737) | .41 |

Source: Author’s Own

Notes:

Categorical variables: two-sided p -values of Fisher's Exact Test.

Continuous variables: Means and Standard Error (in parenthesis) are displayed for the three experimental groups.

* Statistically significant difference between the means at the 5% level.

With the comparability between the experimental groups checked and confirmed for both strata, the next step in the analysis was to estimate the ATEs between the groups through regression analysis. This is discussed in the sub-section that follows.

4.6.3 Evaluating relationships through Multiple Linear Regression

The saving action means for each of the three experimental groups were estimated through MLR models as described in Section 3.6.7, Formula 2. According to the experimental design of this study, the stratified random allocation was applied to create three experimental groups for each of the Intent and Low/No Intent strata. A best-fit MLR model was first derived for the Intent stratum ($N = 216$) and then run separately for the Low/No Intent stratum ($N = 51$) to determine if it was a good fit for both. However, the number of independent variables in the best-fit model had to be kept to a minimum for the Low/No Intent stratum due to the sample-size limitations discussed in Section 4.6.1. A revised MLR model was therefore developed using only a single control variable to evaluate the relationship between saving intention and saving action of participants in this stratum.

Detailed results from running the two MLR models are available in the coefficients tables in Appendices 14 and 15, while Table 30 provides a summary of the models to evaluate the relationship between saving intention and saving action. These results are interpreted separately for each of the strata (subgroups) and discussed in the subsections that follow.

Evaluating the relationship between saving intention and saving action for the Intent subgroup

Saving action measurements were regressed on three predictor variables, namely Total Saving Action (amount) at Baseline, Saving Intention at Phase Two and Income Group. These predictors accounted for only approximately 16.5% of the variance in the saving action taken by participants who had the intention to save at baseline ($R^2 = .165$, Adjusted $R^2 = .153$), which was statistically significant at the 5% level ($p < .001$).

The MLR analysis for the Intent stratum revealed that two of the predictor variables made statistically significant *unique* contributions to the model predicting saving intention scores. These two predictor variables together account for approximately 13% of the variance in saving action taken after the treatments. Total Saving Action at Baseline ($\beta = .258$, $p < .001$) was the most influential individual predictor, closely followed by the Income Group ($\beta = .252$,

$p < .001$). Using Formula 2 (refer to Section 3.6.7), a point estimate of the average saving action amount (\bar{Y}_i) can be estimated for various scenarios by substituting the x_i -values for the five predictor variables in the Intent stratum model (1).

It was observed from Table 30 that Saving Intention Score at Phase Two ($\beta = -.105$, $p = .097$) had a negative value when controlled for Saving Action at Baseline and Income. These results suggested a non-significant, negative relationship between the Saving Intention score and Saving Action variables measured in Phase Two. It also predicted that the average amount saved (saving action) by a participant would increase with ZAR10.50 per month given a one-unit decrease in their saving intention score while the other two variables in the model remained constant. To answer H_4 , the strength of the relationship between saving intention scores and saving action was determined by calculating the Pearson correlation, which revealed only a weak negative correlation, $r = -.106$, $N = 216$, $p = .060$, according to Cohen's (1988) guidelines. A participant's saving intention was the inverse of their saving intention score, meaning that an insignificant and weak positive relationship was observed between saving intention and saving action. The results, therefore, provided insufficient statistical evidence to reject the null hypothesis in favour of H_4 (refer to Table 27).

Evaluating the relationship between saving intention and saving action for the Low/No Intent subgroup

The saving action of this subgroup was also regressed on only two predictor variables - Saving Action at the Baseline and Saving Intention Score at Phase Two due to the sample size restrictions ($N = 51$). These predictors accounted for approximately 12.1% of the variance in saving action taken at Phase Two by participants who had low/no intention to save at baseline ($R^2 = .121$, Adjusted $R^2 = .084$), which was statistically significant at the 5% level ($p = .045$).

The MLR analysis for the Low/No Intent subgroup revealed that only Savings Intention Scores at Phase Two ($\beta = -.290$, $p = .039$) made a statistically significant *unique* contribution to the model predicting saving action taken. This predictor variable accounted for only 8.3% of the variance in saving action taken after the treatments. Excluding the Saving Action at Baseline variable from the model would have reduced R^2 to .068 (Adjusted R^2 to .049), which was a much weaker model even though more parsimonious. The decision was therefore taken to include this variable for increased precision in estimating Saving Action at Phase Two for the Low/No Intent stratum. Using the model as per Formula 2 (refer to Section 3.6.7), a point estimate of the average saving action taken (\bar{Y}_i) was estimated for various scenarios by substituting x_i -values for the two predictor variables in the Low/No Intent stratum model (2).

Table 30: Summary of the MLR models to evaluate the relationship between saving intention and saving action

| Variables | Intent stratum (1) | | Low/No Intent stratum (2) | |
|-------------------------------------|--------------------|---------|---------------------------|---------|
| | Beta | p-value | Beta | p-value |
| Saving Action at Baseline | .258 | <.001* | .233 | .095 |
| Saving Intention Score at Phase Two | -.105 | .097 | -.290 | .039* |
| Income Group | .252 | <.001* | N/a | N/a |
| Constant | - | .416 | - | <.001 |
| R^2 | .165 | | .121 | |
| Adjusted R^2 | .153 | | .084 | |
| Sample size N (Random) | 216 | | 51 | |

Source: Author's own

Notes:

Cell values are beta weights (β) is the standard error of the estimate.

*Statistically significant at the 5% level.

It was observed from Table 30 that Saving Intention Score at Phase Two ($\beta = -.290$, $p = .039$) had a negative value when controlled for Saving Action at Baseline. These results suggested a significant (at the 5% level), negative relationship between the saving intention score and saving action variables measured in Phase Two. It also predicted that the average amount saved (saving action) by a participant would increase with ZAR29 per month given a one-unit decrease in their saving intention score while the other variable in the model remained constant. To answer H_4 , the strength of the relationship between saving intention scores and saving action was determined by calculating the Pearson correlation which revealed only a weak negative correlation, $r = -.260$, $N = 51$, $p = .033$, according to Cohen's (1988) guidelines. A participant's saving intention was the inverse of their saving intention score, meaning that a significant, yet weak positive relationship was observed between saving intention and saving action. The results, therefore, provided sufficient statistical evidence to reject the null hypothesis in favour of H_4 (refer to Table 27).

In summary, the conclusions made for each of the two subgroups based on the results from the two MLR models, are summarised in Table 31 below. The null hypothesis was rejected in favour of H_4 for only the Low/No Intent stratum.

Table 31: H₄ conclusions for the Intent and Low/No Intent strata

| Subgroup analysis | Conclusions |
|--|---|
| Intent stratum | |
| Positive relationship between Saving Intention and Saving Action | Fail to reject H_0 Regression: $\beta = -.105, p = .097$ Pearson Correlation: $r = -.106, p = .060$ |
| Low/No Intent stratum | |
| Positive relationship between Saving Intention and Saving Action | Reject H_0 Regression: $\beta = -.290, p = .039^*$ Pearson Correlation: $r = -.260, p = .033^*$ |

Source: Author's own

4.7 Conclusion

The first two hypotheses were tested to gain a better understanding of the sample population in terms of specific biases and preferences which literature predicted to influence saving behaviour (refer to Chapter 2, Sections 2.2 to 2.5). The H₁ results revealed no association between present biased behaviour and preference for commitment. Similarly, no association was found between certainty-effect biased behaviour and preference for flexibility in the results of H₂. Thus, the sample population's commitment and flexibility preferences in financial decisions were determined by other factors in addition to present bias and certainty-effect bias. Furthermore, most individuals who perceived financial scarcity preferred flexibility over commitment in their financial decision-making, Figure 11 illustrates how participants' preferences compared when there were no costs involved (free), and how these preferences changed when decisions became costly in terms of money and time.

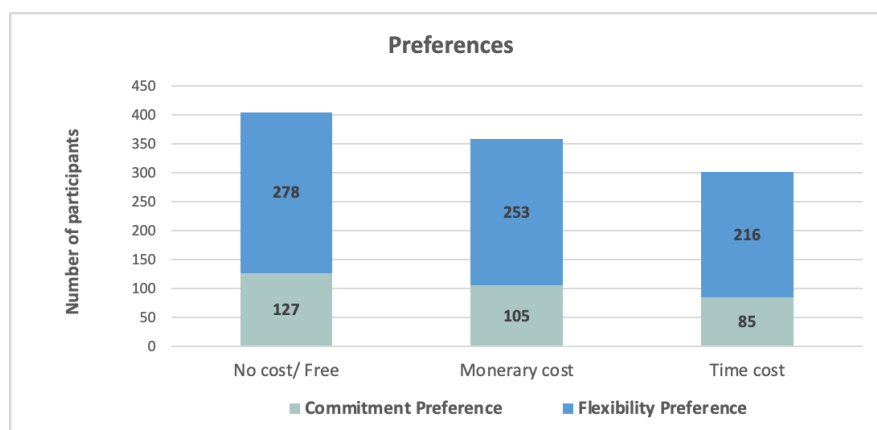


Figure 11: Comparison of commitment and flexibility preferences at different costs

Source: Author's own

The subgroup analyses for testing H₃ harboured different results between the Intent and Low/No Intent strata, which is best illustrated by Figure 12. The H_{3(a)} and H_{3(b)} MLR results

suggested that both the hard commitment (T_1) and soft commitment (T_2) treatments were effective in increasing saving intention in the Intent and Low/No Intent strata immediately after the intervention (Time 2). However, according to the results of $H_{3(c)}$, the two treatments were equally effective to increase intention in the Intent stratum but the hard commitment (T_1) treatment was more effective in the Low/No Intent stratum. Furthermore, the results of the heterogeneity analysis seemed to indicate that the effect of both treatments was only immediate for the Intent stratum but endured the 30-day delay period (Time 3) for the Low/No Intent stratum. Saving intention for this stratum continued to increase over the 30 days, and this increase was largest for participants who received the soft commitment (T_2) treatment.

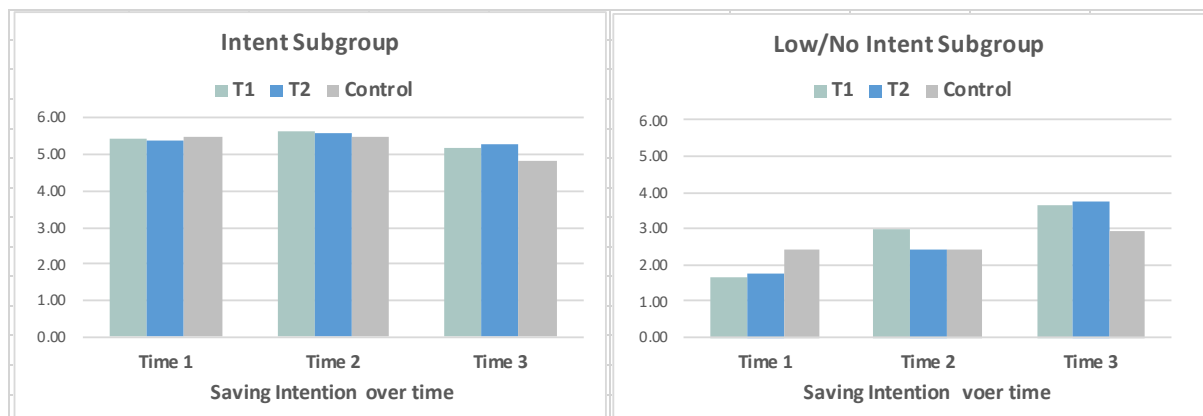


Figure 12: Change in average saving intention for each stratum's experimental groups over time

Source: Author's own

Finally, the results of the MLR and Pearson correlations for the two strata (H_4) suggested weak positive relationships between saving intention and saving action for both the Intent and Low/No Intent strata. This relationship for each stratum is illustrated in Figure 13, which shows amounts saved were highest when saving intention scores were lowest on the seven-point scale. Saving intention is the inverse of saving intention scores, which means that the lowest score represents the highest level of savings intention. Since the relationship was weakly positive, the MLR models predicted that participants (on average) were likely to report only a small increase in amounts saved after the 30-day delay period (Time 3) if their saving intention increased. These results are further explored concerning extant literature in the discussion chapter that follows.

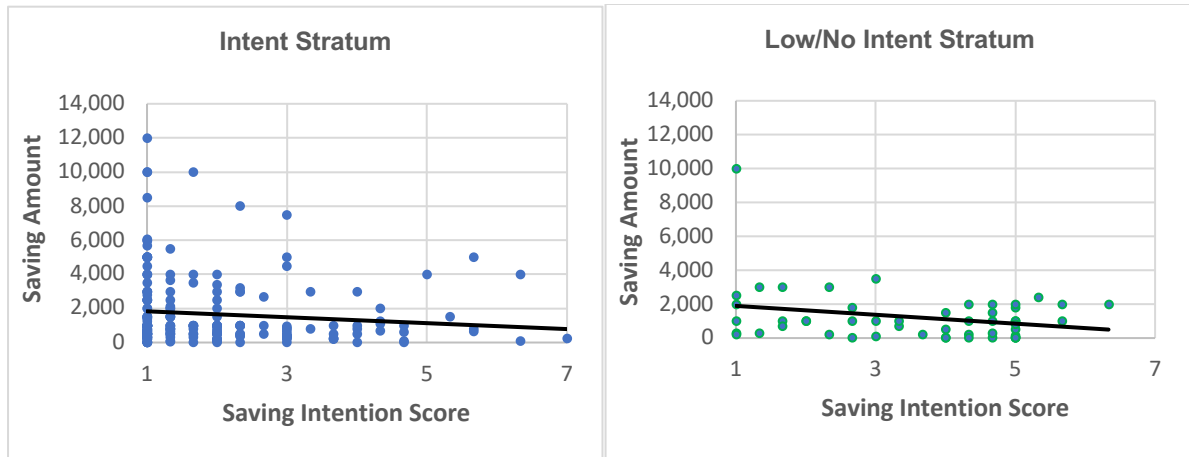


Figure 13: Amount saved per saving intention score for each stratum

Source: IBM SPSS Statistics

Chapter 5: Discussion of results

5.1 Introduction

In this chapter, the empirical results presented in the previous chapter are discussed and interpreted regarding evidence from literature. H_1 to H_4 are discussed in sequential order (Sections 5.2 to 5.5) following the conceptual framework presented in Figure 4, before the chapter concludes with a summary of the key findings.

5.2 H_1 : Present bias and Commitment Preference

The results of H_1 are summarised, visually presented (Figure 14) and compared to extant evidence from literature on present bias and commitment preference. This section concludes with the key findings to answer this first hypothesis.

5.2.1 Summary of H_1 test results

Descriptive frequencies and percentages (per Table 11) indicated that most participants were not present biased ($N = 288$, 71%), which means that they did not reverse their preference for SS monetary gains in the present for LL gains when a delay of 12 months was added to hypothetical choices. Additional measures of time preferences revealed that most participants preferred immediate gains ($N = 279$, 69%) and displayed time-inconsistent choices ($N = 309$, 76%) by changing this preference when a personal inflexion point in the sequence of hypothetical choices was reached. This study was not designed to determine at which inflexion point participants change their preferences *per se*, but rather to understand if participants were consistent (or not) in their preferences.

Statistical tests (per Table 12) to describe commitment preferences revealed that the majority of participants did not prefer commitment, whether at no cost ($N = 278$, 69%), at a monetary cost ($N = 300$, 74%) or at a time cost ($N = 320$, 79%). Commitment preference scores (Table 13) therefore reflected a distribution that was positively skewed (skewness .94; kurtosis -.31) towards no preference for commitment ($N = 213$, 53%) among individuals who perceived financial scarcity. Figure 14 illustrates this skewness in the commitment preference score distributions for those with present bias and those who displayed no present biased behaviour. For this reason, the non-parametric Mann-Whitney U Test was selected to test H_1 , as discussed in the previous chapter.

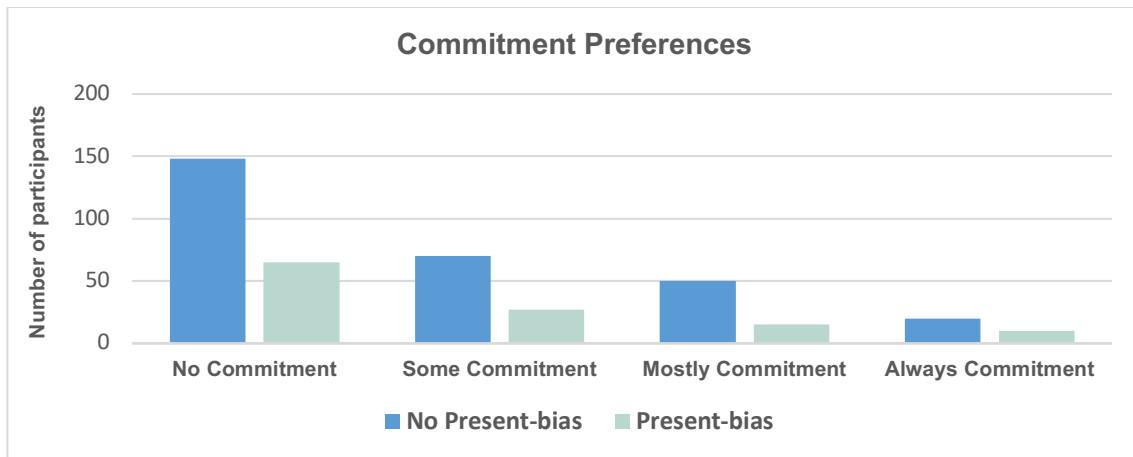


Figure 14: Distribution of Commitment Preference Scores

Source: Author's own

The Mann-Whitney U Test results (Table 14) revealed no significant difference in the commitment preference scores of participants who were present biased ($Md = 0$, $N = 117$) and those who were not ($Md = 0$, $N = 288$), $U = 16176$, $z = -.69$, $p = .49$, $r = .03$ (a small effect size as per Cohen, 1988). A median commitment preference score of zero indicates no preference for commitment, which was expected based on the distribution presented in Figure 14. Since no distinctive behavioural pattern was detected, the sample evidence was not strong enough to reject the null hypothesis in favour of H_1 at a 5% level of significance ($\alpha = 0.05$).

In summary, the results for H_1 demonstrated heterogeneity in participants' present bias and commitment preferences, with the majority weighted towards no present bias and no preference for commitment. This was an early indication of variability in the sample population and that the subsequent experimental manipulation might also have harboured a range of different results. These results were interpreted with guidance from extant literature on present biased behaviour and commitment preferences in the context of financial scarcity, as discussed in the next sections.

5.2.2 Present bias in the context of financial scarcity

Present bias is a short-term discounting model that originated from time-inconsistent preferences (Strotz, 1955) and can explain situations where it would supposedly be a mistake to base decisions on immediate gratification, such as saving decisions (Alan & Ertac, 2015; Jackson & Yariv, 2014; Laibson & List, 2015; O'Donoghue & Rabin, 2015; Strotz, 1955). In this study, present biased behaviour was measured through hypothetical choice sets (Jackson & Yariv, 2014; Janssens et al., 2017; Sprenger, 2015) to determine if participants displayed a bias towards SS rewards (immediate gratification) in the present but switched this preference to LL rewards when the same options were offered for 12 months into the future.

The H_1 results indicated that most participants preferred immediate rewards ($N = 279$, 69%) but did not reveal present bias ($N = 288$, 71%) as generated by hyperbolic discounting behaviour (Laibson, 1997). Otherwise stated, most participants did not show diminishing impatience by reversing their preferences from SS rewards to LL rewards when a delay of 12 months was added to the hypothetical choice set. Their choices for SS rewards were also consistent irrespective of the size of the reward amounts which were tested under five different hypothetical scenarios. Thus, the timing of rewards seemed to have carried more weight than the amount of the rewards in their hypothetical choices. According to Halevy (2008), present bias weakens significantly when immediate and delayed conditions (the future) are viewed as risky or uncertain. Hardisty and Pfeffer (2017) explored these effects of uncertainty on individuals' time preferences and found that they prefer immediate gains specifically when the future was uncertain. On the other hand, participants in their study preferred future gains when the present was uncertain (Hardisty & Pfeffer, 2017). Based on this evidence, it seemed that most participants perceived the future to be uncertain at the time of the study and, therefore, consistently chose immediate gains (SS rewards).

Present bias is only one of many decision anomalies possible in the context of financial scarcity. Since the scope of this study was purposefully restricted to identifying only if individuals who perceive financial scarcity were present biased or not, other unobserved anomalies in their decision-making were presumed. While most participants did not display present biased behaviour as expected (Laibson, 1997), they revealed consistent impatience, or the immediacy effect, by placing a disproportionate value on immediate outcomes (Keren & Roelofsma, 1995). Alternative explanations for these seemingly irrational, impatient intertemporal choices may be a lack of attention to the future (Cohen et al., 2020; Karlan et al., 2016) or liquidity constraints (Carvalho et al., 2016). These alternative explanations suggest that literature on decision-making in the context of financial scarcity may offer further insights into the results.

The prevailing view in scarcity literature (refer to Section 2.2) is that it leads to present bias and myopic decisions overly focused on the present (Bernheim et al., 2015; Shah et al., 2015). Scarcity, and more specifically a scarcity mindset, alter financial decision-making in this way due to a limitation on cognitive 'bandwidth' which reduces attention to future consequences (Bernheim et al., 2015; Mullainathan & Shafir, 2013). Scarcity's effect on intertemporal decision-making could also be more nuanced and be driven by different biases, inattention or confusion about trade-offs depending on the type of resource scarcity experienced, financial or otherwise (Carvalho et al., 2016; Giné et al., 2018; Shah et al., 2015; Schilbach et al., 2016). Furthermore, uncertainty is often intrinsic to intertemporal decision-making (Casari & Dragone, 2015) and a lived reality for those who regularly experience income shocks (Dupas &

Robinson, 2013; Goldberg, 2014; Martin & Hill, 2015). The context of financial scarcity may, therefore, be a significant reason why most participants displayed impatience instead of present bias. This is based on scarcity literature that suggests decision-making in this context may be overly focused on the present with limited attention to future consequences and confusion about optimal trade-offs with constrained resources.

5.2.3 Commitment Preference in the context of financial scarcity

Determining the participants' level of commitment preference before its H_3 manipulation (at baseline) was considered important for a richer understanding of the subsequent experimental effects. A prominent prediction in present bias literature is that individuals who are aware of their present bias, and therefore labelled as 'sophisticated' or 'partially sophisticated', prefer commitment to overcome this bias (Karlan et al., 2014; O'Donoghue & Rabin, 2015). On the contrary, naïve individuals may not prefer commitment to saving due to a lack of awareness of their present bias (Giné et al., 2018; O'Donoghue & Rabin, 2015). O'Donoghue and Rabin (2015) warned that researchers are sometimes too quick to attribute observed commitment to sophisticated present bias, as there may be other motives for why individuals commit. They also advise researchers to use their best judgement and to scientifically assess the extent to which present bias is a factor that influences economic decisions as a basis for their conclusions. The purpose of H_1 was, therefore, not to determine all the drivers of participants' commitment preferences (or lack thereof), only if present bias played a role in these preferences.

The H_1 results revealed that most participants in the sample population did not prefer commitment, whether at no cost ($N = 278$, 69%), at a monetary cost ($N = 300$, 74%) or at a time cost ($N = 320$, 79%). Furthermore, the distribution of commitment preference scores was positively skewed towards no preference for commitment among individuals who perceived financial scarcity ($N = 213$, 53%). As mentioned earlier, a popular reason for a lack of commitment preference is a lack of awareness of present biased behaviour - otherwise known as naivety (Giné et al., 2018; Karlan et al., 2014; Laibson, 1997; O'Donoghue & Rabin, 2015). However, a study performed by Augenblick, et al. (2013) measured diminishing impatience, or present bias as a form of dynamic inconsistency in preferences; the study only explained approximately 5% of the variation in commitment demand. This may be partly because multiple present-focused intertemporal choice models exist to explain this outcome (Ashraf et al., 2006; Ericson & Laibson, 2019), as discussed in the upcoming Section 5.2.4 and reflected in Table 32. Thus, reasons other than the lack of present bias observed may have contributed to participants' lack of commitment preference.

Prior studies also offer alternative suggestions for the lack of commitment preference observed. For example, a lack of willingness to pay for costly commitment (Laibson, 2015), liquidity constraints (Carvalho et al., 2016), or a larger preference for flexibility as tested through H_2 and discussed in the next section (5.3). These reasons seem particularly relevant in the context of financial scarcity. Individuals who perceive financial scarcity experience a high level of uncertainty (Casari, 2009; Karlan et al., 2014) which may lead to certainty-effect bias and flexibility preferences (Janssens et al., 2017; Krishna & Sadowski, 2014; Yoon & Kim, 2018) as opposed to commitment preferences in saving decisions (Bernheim et al., 2015; Galperti, 2015).

5.2.4 Conclusion on H_1 findings

The results for H_1 were surprising in the sense that most participants were not present biased. Yet this anomaly is widely regarded in the literature as a key influence on saving behaviour in general, as well as under conditions of financial scarcity (Bernheim et al., 2015; Karlan et al., 2014). However, participants did reveal impatience, or the immediacy effect, consistent with scarcity literature which suggests that this context impedes cognitive functioning that may lead to decision-making errors and myopic behaviour (Schilbach et al., 2016; Shah et al., 2015). In addition to contextual factors, Cohen et al. (2020) also suggest a lack of trust, temptation, imperfect forecasting, and confusion about future reward contingencies as alternative explanations for the observed behaviour.

It would be natural to assume that the lack of commitment preference observed was due to participants' lack of present bias. However, the results indicated no significant differences in the commitment preferences of participants who were present biased, and the majority who were not present biased. This signalled that present bias was not a driving force behind commitment preference, or lack thereof, in the context of this study. Table 32, as an extension of Table 2 presented in Section 2.4.2, suggests psychometric distortions and myopia as alternative present-focused decision models which may explain the lack of commitment preference observed (Ericson & Laibson, 2019). These models seem plausible since most participants ($N = 309$, 76%) displayed preference reversals or inconsistent decisions as reported in Table 11.

Table 32: Present-focused intertemporal choice models categorised

| | Dynamically consistent preferences | Dynamically inconsistent preferences |
|---------------------------------|--|--|
| Commitment preference | <ul style="list-style-type: none"> • Unitary-self temptation models • Long-term self in multiple self-models | <ul style="list-style-type: none"> • Present bias with partial sophistication • Other forms of hyperbolic discounting |
| No commitment preference | <ul style="list-style-type: none"> • Exponential discounting • Objective risks (non-exponential discounting) • Myopia | <ul style="list-style-type: none"> • Present bias with perfect naivety • Psychometric distortions (for example, perception of time, certainty-effect bias) • Myopia |

Source: Adapted from Figure 1 (Ericson & Laibson, 2019, p.18)

While the specific reasons behind the lack of commitment preference observed fell beyond the scope of this study, the role of certainty-effect bias and flexibility preferences in these results were tested in H₂. Impatience and the immediacy effect as possible psychometric distortions were discussed in Section 5.2.2. Furthermore, the role of certainty-effect bias in participants' preferences for flexibility (versus commitment) was tested in H₂.

5.3 H₂: Certainty-effect bias and Flexibility Preference

The results of H₂ are summarised, visually presented (Figure 15) and compared to extant evidence from literature on certainty-effect bias and flexibility preference. This section concludes with the key findings to answer this second hypothesis.

5.3.1 Summary of H₂ results

Descriptive frequencies and percentages (per Table 16) indicated that most participants preferred certainty over risk (Categories 1 to 3, $N = 302$, 78%) but were not certainty-effect biased ($N = 292$, 72%). This specifically means that participants did not reverse their preferences for certainty over risk when probabilities were lowered by a common ratio between choices (common ratio-effect), or when a common delay of three months was added to choices (common delay-effect).

Most participants also preferred flexibility at no cost ($N = 278$, 69%), at a low monetary cost ($N = 253$, 62%) and at a time cost ($N = 216$, 53%). Less than half of the participants preferred flexibility at a large monetary cost ($N = 180$, 44%) (refer to Table 17). Consequently, flexibility preference scores (Table 18) reflected a distribution that was negatively skewed (skewness - .26; kurtosis -1.39) towards always preferring flexibility ($N = 132$, 32%). Figure 15 illustrates this skewness in the flexibility preference score distributions for those with certainty-effect bias and those who displayed no certainty-effect biased behaviour. For this reason, the non-parametric Mann-Whitney U Test was selected to test H₂, as discussed in the previous chapter.

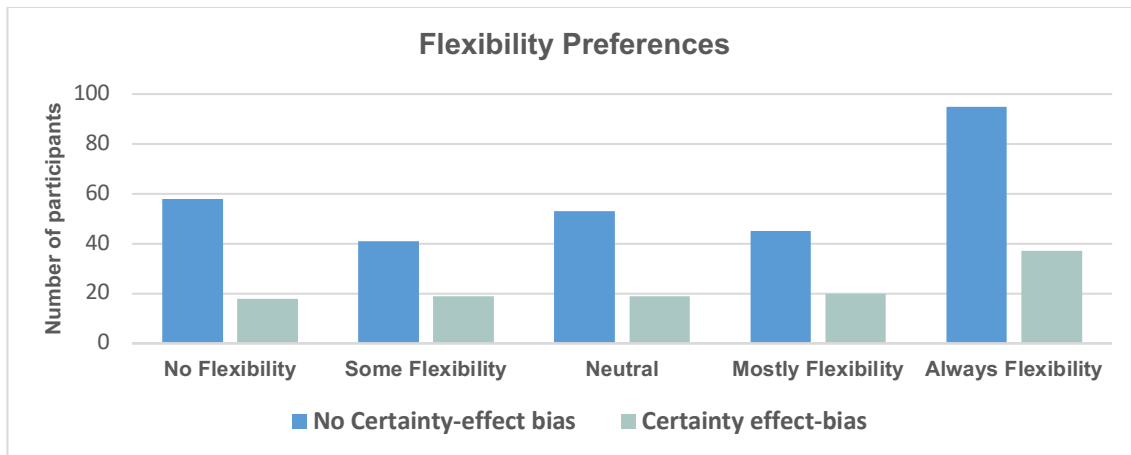


Figure 15: Distribution of Flexibility Preference Scores

Source: Author's own

The Mann-Whitney U Test results (Table 19) revealed no significant difference in the flexibility preference scores of participants who were certainty-effect biased ($Md = 3$, $N = 113$) and those who were not ($Md = 2$, $N = 292$), $U = 16934$, $z = .43$, $p = .67$, $r = .02$ (a small effect size as per Cohen, 1988). Median scores of two and three fall within the 'Neutral' and 'Mostly flexibility' categories, respectively. Since no distinctive behavioural pattern was detected from the results, the sample evidence was not strong enough to reject the null hypothesis in favour of H_2 at a 5% level of significance ($\alpha = 0.05$).

In summary, the results for H_2 demonstrate heterogeneity in participants' levels of certainty-effect bias and flexibility preferences, with the majority weighted towards no certainty-effect bias but with flexibility preferences. This was an early indication of variability in the sample population and that the subsequent experimental manipulation might also have harboured a range of different results. These results were interpreted with guidance from extant literature on certainty-effect biased behaviour and flexibility preferences in the context of financial scarcity, as discussed in the next sections.

5.3.2 Certainty-effect bias in the context of financial scarcity

The future is inherently uncertain for all (Andreoni & Sprenger, 2012; Epper et al., 2011; Halevy, 2008; Hardisty & Pfeffer, 2017) but under conditions of financial scarcity, individuals also experience uncertainty around their future income and livelihoods (Casari, 2009; Epper et al., 2011; Hamilton et al., 2018; Karlan et al., 2014; Martin & Hill, 2015). The effect of uncertainty on decision-making has been widely studied (Prelec & Loewenstein, 1991; Saito, 2015; Shmaya & Yariv, 2016) and is linked to certainty-effect bias, which is the choice of certain outcomes over merely probable outcomes (Kahneman & Tversky, 1979; Weber & Chapman, 2005). Certainty-effect bias behaves similarly to present bias, where the willingness

to sacrifice later choice options for earlier options is highest in the present (Halevy, 2008). In keeping with the literature, it was posited that the sample population would display certainty-effect biased behaviour due to the financial uncertainty and scarcity they perceived.

The results of H₂ were, therefore, surprising since most participants were not certainty-effect biased ($N= 292$, 72%), meaning that they did not reverse their preferences for certainty when probabilities or delay periods were varied between different hypothetical choice scenarios. The majority of participants mostly, or always, preferred certainty ($N= 277$, 68%) (Table 16). Even though the results indicated a lack of certainty-effect bias, most participants in the sample population consistently preferred certainty over risky and delayed outcomes ($N= 238$, 59%). Prior studies found a direct preference for certainty (Allais, 1953; Andreoni & Sprenger, 2012) which could not be explained by Prospect Theory (Kahneman & Tversky, 1979), hyperbolic discounting (Frederick et al., 2002) or preferences for a resolution of uncertainty (Kreps & Porteus, 1978). For example, according to the Allais Paradox (Allais, 1953) as a departure from the EU theory, a disproportionate preference for certainty prevails when a choice must be made between certain and uncertain options. A study by Andreoni and Sprenger (2012) found supporting evidence for this paradox based on violations of common ratio predictions (a form of certainty-effect bias per this study) when certainty was an option added to experimental conditions.

Halevy (2008) formalised the idea that present bias may be related to certainty associated with the present, and risk associated with the future. Thus, individuals may believe that only the present is certain, while future rewards and consumption are inherently uncertain (Chakraborty et al, 2020). A disproportionate preference for certainty (per the H₂ results) is therefore consistent with the present-focused decision-making as found in the results for H₁.

The possibility exists that the lack of certainty-effect bias detected in the sample population may be more practical due to the limitations of the measurement instrument. For example, since this construct was not the main focus of this study, hypothetical choice questions were asked and deemed sufficient to measure certainty-effect bias through the common ratio-effect mechanism (Kahneman & Tversky, 1979). These choice questions were, therefore, not designed to elicit preference patterns or to measure decision inflexion points through a series of choices with different probabilities. A series of hypothetical questions with a larger range of probability scenarios might have offered different results; however, this fell outside the scope of the study.

5.3.3 Flexibility Preference in the context of financial scarcity

Uncertainty may lead individuals to variety-seeking and flexibility preferences in decision-making when future shocks and risks are feared (Casari & Dragone, 2015; Janssens et al., 2017; Krishna & Sadowski, 2014; Yoon & Kim, 2018). Financial scarcity in itself also imposes constraints (Hamilton et al., 2019) and a cognitive load that impedes the capacity for complex economic decision-making (Deck & Jahedi, 2015), reinforcing the need for more options or flexibility. Thus, the results of H₂ were consistent with the literature on both decision-making under uncertainty and scarcity theory. It revealed that most participants were consistent in their flexibility preferences even when it carried a low monetary or time cost but were not willing to pay a large monetary cost for increased flexibility (refer to Table 17). It is possible that flexibility became too expensive at this point since individuals who perceive financial scarcity must constantly consider trade-offs to align their preferences with their economic reality (Shah et al., 2015).

No significant differences were found between the flexibility preferences of participants who were certainty-effect biased, and the majority who were not certainty-effect biased. This signalled that certainty-effect bias was not a driving force behind flexibility preference (or lack thereof for some participants), in the context of this study. While specific motivators behind participants' flexibility preferences fell beyond the scope of this study, the literature suggests other unobserved factors may also have played a role. According to Pejsachowicz and Toussaert (2017), a tendency to defer choice due to indecisiveness or the complexity of the choice may also cause a preference for flexibility to keep future options open.

5.3.4 Conclusion on H₂ findings

In summary, while the results were insufficient to reject the null hypothesis, it was observed that participants were consistent in their preferences for both certainty and flexibility. These preferences correspond with literature on decision-making under uncertainty (Casari & Dragone, 2015) and decision-making in the context of scarcity (Deck & Jahedi, 2015; Laajaj, 2017; Schilbach et al., 2016; Shah et al., 2015). However, the overall research question of this study is positioned in intertemporal choice under uncertainty theory that explains the interaction between time and uncertainty in decision-making. For this reason, the results of H₁ and H₂ were also jointly considered and interpreted in the section that follows.

5.4 Commitment and Flexibility Preference trade-offs

The results of the first two hypotheses revealed no present bias or certainty-effect bias in most participants' decision-making; however, impatience, time inconsistency (H₁) and consistency in preferences for certainty (H₂) were found instead. Furthermore, most participants ($N = 278$,

69%) preferred flexibility over commitment in absolute terms when the choice carried no monetary or time costs. The consistency of these preferences was subsequently tested through different monetary and time cost scenarios in the hypothetical choice questions. It is important to note that these preferences were observed at baseline and before any interventions to improve participants' saving behaviour. Commitment and flexibility preferences were also tested separately and were not regarded as opposite or mutually exclusive – the possibility that participants may value both commitment and flexibility to various extents was recognised from the onset.

Commitment and flexibility preferences originate from the time and uncertainty decision domains respectively, which should be considered together according to a growing body of literature (Andreoni & Sprenger, 2012; Chakraborty et al, 2020; Halevy, 2008; Hardisty & Pfeffer, 2017; Keren & Roelofsma, 1995; Weber & Chapman, 2005). Uncertainty is often intrinsic to intertemporal decisions, yet experimental results are frequently interpreted under the assumption of certainty (Casari & Dragone, 2015; Frederick et al., 2002; Prelec & Loewenstein, 1991). However, time and uncertainty should be combined in decision-making analyses because they are correlated (Ferecatu & Öncüler, 2016; Halevy, 2008; Saito, 2011) and affect choice via the common underlying dimension of delay, which makes an outcome uncertain (Frederick et al., 2002; Weber & Chapman, 2005). Collectively, the time and uncertainty decision domains constitute the foundation of this study's Conceptual Framework (Figure 4) and overall research question.

The interaction between time and uncertainty during decision-making is viewed from two perspectives to interpret the combined results of H₁ and H₂. According to these perspectives, as derived from literature, uncertainty may influence present bias and conversely, time (delay) may influence certainty-effect bias. From the first perspective, uncertainty possibly plays a more significant role than time preference or temptation (Epper et al., 2011) in generating present bias, otherwise known as diminished impatience over time (Andreoni & Sprenger, 2012; Halevy, 2008). Alternatively, experimental evidence has shown that when decisions in the present become risky, present bias weakens significantly (Keren & Roelofsma, 1995; Weber & Chapman, 2005), meaning that impatience persists and reverses only when uncertainty is resolved in the future (Halevy, 2008). While participants were not explicitly questioned on their perception of risk or uncertainty in the present, their context of perceived financial scarcity may have been a source of uncertainty in general (Casari, 2009; Epper et al., 2011; Hamilton et al., 2018; Karlan et al., 2014; Martin & Hill, 2015). Since most participants revealed a lack of present bias and were consistently impatient in their choices, this result may be best explained by perceived uncertainty experienced at the time of the choice experiment, in

support of the experimental findings by Keren and Roelofsma (1995) and Weber and Chapman (2005).

The second perspective for the holistic interpretation of the first two hypotheses holds that time delay increases uncertainty since the “present is known and certain, while the future is inherently risky” (Andreoni & Sprenger, 2012, p.3357). Weber and Chapman (2005) experimented with adding a time delay to hypothetical choice sets to determine if this would eliminate certainty-effect bias. This was found to be the case only when i) immediacy and certainty effects were evaluated separately, and ii) certainty-effect bias was operationalised specifically through the common-ratio form (Weber & Chapman, 2005). These two conditions were both met through this research’s design and the measurement instrument, respectively (refer to Appendix 4, Part 2, Section 2.1). However, most participants were not certainty-effect biased in the first place, therefore consistently preferred certainty despite the addition of delay in the hypothetical choice sets. It seems that adding a time delay had limited or no effect on further increased uncertainty or preferences for certainty. Thus, the earlier interpretation (refer to Section 5.3.2) that certainty was disproportionately preferred (Alias, 1953) at the time of the choice experiments and for the future, seems to hold. This may signal that the sample population perceived both the present and the future as uncertain, elevating their consistent preference for certainty.

Commitment and flexibility preference scores derived from the series of choice sets indicate that preferences were dynamic and shifted between the various cost scenarios as trade-offs were made. These preference score distributions are presented in Figure 16 and illustrate the heterogeneity in participants’ preferences, which favoured flexibility above commitment in general. This tendency was expected in the context of perceived financial scarcity, which is a condition of elevated uncertainty according to scarcity literature (Hamilton et al., 2018; Karlan et al., 2014; Martin & Hill, 2015). Some overlap between commitment and flexibility preferences can also be seen in Figure 16, confirming this study’s premise that individuals may prefer both commitment and flexibility to various extents.

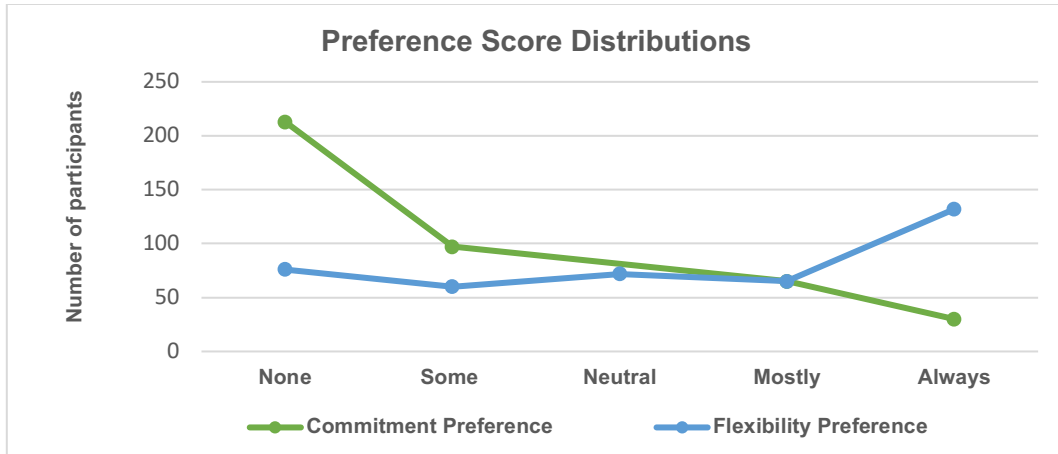


Figure 16: Comparison of Commitment and Flexibility Preference Score distributions

Source: Author's own

The purpose of H_1 and H_2 was to gain a better understanding of financial decision-making in the context of financial scarcity at baseline, to guide subsequent inferences on the experimental effects. To conclude, it was found that uncertainty may have played a more significant role in participants' decision-making before the intervention, resulting in more participants preferring flexibility over commitment at this time.

5.5 H_3 : Interventions to improve saving intention

The results of H_3 are summarised, visually presented (Figures 17 and 18) and compared to extant evidence from literature on saving intention. This section concludes with the key findings to answer this third hypothesis.

5.5.1 Summary of H_3 results

Evidence from MLR analyses suggests that both the hard (T_1) and soft (T_2) commitment treatments had a statistically significant effect on saving intention scores in both subgroups (per $H_{3[a]}$ and $H_{3[b]}$) immediately after the intervention (Time 2). When these two treatments were compared per subgroup after controlling for covariates, they were found to be equally impactful on the saving intention of Intent participants. In comparison, the hard commitment treatment (T_1) was more impactful than the soft commitment treatment (T_2) on the saving intention of Low/No Intent participants.

Additional post hoc within-group analyses were conducted per stratum to gain a better understanding of the heterogeneity in ATEs between subgroups and over time. The evidence from these analyses supports the MLR results that both the hard commitment (T_1) and soft commitment (T_2) treatments were effective to increase saving intention in the Intent and Low/No Intent strata immediately after the intervention (Time 2). However, the treatments had a positive impact *only* at Time 2 for participants in the Intent stratum. The effect sizes of both

treatments seemed to have been larger and lasted longer (at least for the 30-day follow-up period to Time 3), for participants in the Low/No Intent subgroup. Furthermore, saving intention for this stratum continued to increase over the 30 days, and this increase was largest for participants who received the soft commitment (T_2) treatment. These results are summarised in Figure 17 for quick reference.

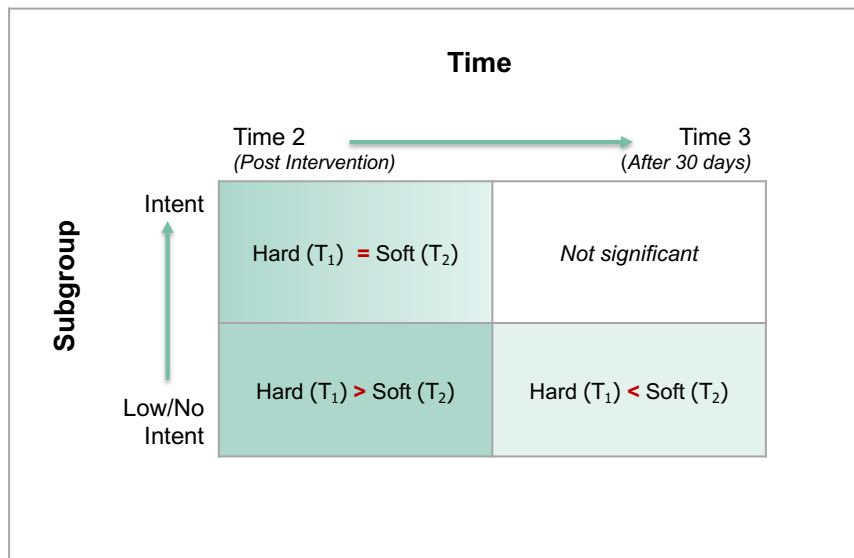


Figure 17: Matrix for comparing ATEs on saving intention between subgroups and over time

Source: Author's own

The purpose of H_3 was first to test whether each of the two treatments could increase the saving intention of participants who perceive financial scarcity ($H_{3[a]}$ and $H_{3[b]}$). Secondly, to determine which of the two treatments had the largest effect on saving intention $H_{3(c)}$ immediately after the intervention as well as after 30 days. Lastly, a post hoc analysis provided a deeper understanding of how the ATEs differed between the Intent and Low/No Intent subgroups. These results are discussed concerning literature in the sections to follow.

5.5.2 Saving intention interventions in the context of financial scarcity

The saving intention interventions conducted in this study consisted of two treatments in the form of self-reflection exercises to develop saving plans. The first treatment was a hard commitment intervention (T_1) that featured strict constraints and specific targets, while the second (T_2) offered more flexibility as a soft commitment intervention (T_2) (Janssens et al., 2017). Prior studies that conducted hard and soft interventions did so mostly in economic development studies in the poverty or low-income contexts. While the context of this study is perceived financial scarcity, it included poverty and low-income contexts, therefore the results from these studies are still relevant and informative. Hard CSDs with restrictions in terms of timing, amount, or use of savings seem to be less effective under conditions of poverty than

flexible CSDs with some freedom in how and when savings are used (Dupas & Robinson, 2013; Janssens et al., 2017; Karlan et al., 2014). Studies that tested the uptake of such hard CSDs offered to the impoverished found it to be low for reasons such as naivety on their time inconsistency or trade-offs between commitment and flexibility (Ashraf et al., 2006; Bryan et al., 2010). On the contrary, John (2019) observed a threefold positive treatment effect of a hard commitment product compared to a softer commitment alternative on bank savings of low-income individuals. However, this efficacy of hard commitment comes with the potential risk of adverse welfare effects depending on the agents' level of time inconsistency (Basu, 2014; John, 2019). In summary, the literature on CSDs in poverty or low-income contexts is inconclusive regarding which CSDs (hard versus soft) are more effective (Bryan et al., 2010) and hard commitment treatments seem to be less popular than flexible commitment treatments.

This study differed from the abovementioned body of literature which tested various CSD designs and their subsequent uptake to infer participants' preferences for commitment or flexibility. Instead, participants' preferences were elicited through hypothetical choice experiments before the intervention, whereafter they were randomly assigned to either a hard commitment or a soft (more flexible) commitment treatment. The results of the first two hypotheses (refer to H_1 and H_2 , Section 5.4) indicated that most participants had a larger preference for flexibility than commitment in their financial decision-making. Under the standard economic assumption of stable preferences, the results of the two saving intention treatments measured immediately after the interventions (refer to Time 2, Figure 17) were surprising. The two treatments were equally effective to increase saving intention for the Intent stratum participants. However, the hard commitment treatment (T_1) was more effective than the soft commitment treatment (T_2) for the Low/No Intent participants. If participants' baseline flexibility preferences (what they revealed to want) were stable and aligned with their intended action (what they planned to save as per the treatments), then the soft commitment treatment (T_2) was expected to be more effective than the hard commitment treatment (T_1).

On the whole, the H_3 results were mostly consistent with Behavioural Economic literature on revealed preferences. While participants' preferences for commitment and flexibility were not physically observed, it was revealed through the choices they made during hypothetical choice experiments (H_1 and H_2) at baseline (Time 1). By nature, preferences are incomplete (Ok et al., 2015), unstable and dynamically inconsistent over time (Chuang & Schechter, 2015; Hammond, 1976). Chuang and Schechter (2015) performed a cross-disciplinary review of the literature on experimentally-measured preferences over time and confirmed this low stability in the results. Preference reversals may have been due to inattention (Giné et al., 2018), noise, or instrument questions which were too complex for the sample population (Chuang &

Schechter, 2015; Meier & Sprenger, 2015) but not correlated to sociodemographic and situational changes (Meier & Sprenger, 2015). This study was not designed to quantify changes or reversals in preferences but rather to understand baseline preferences before manipulating commitment (T_1) and flexibility preferences (T_2) to measure their effect on saving intention. However, the respective treatment effects may signal that some participants' preferences reversed from flexibility at baseline (Time 1) to commitment immediately after the intervention (Time 2). The treatments (T_1 and T_2) were equally effective to increase saving intention for Intent-stratum participants, while the hard commitment treatment (T_1) was more effective for Low/No Intent-stratum participants. These results, therefore, support Behavioural Economic literature on the dynamic inconsistency of preferences (Chuang & Schechter, 2015; Giné et al., 2018; Meier & Sprenger, 2015).

Commitment and flexibility preferences were manipulated through active self-reflection exercises to formulate either a hard commitment saving plan (T_1) or a soft (more flexible) saving plan (T_2). No differentiation was observed between the two treatments for the Intent subgroup; however, the hard commitment treatment (T_1) was more effective for those participants who had Low/No intention to save at baseline. It is important to note that this observation was made at Time 2 – immediately after the intervention and reflects only the first part of the overall impact measurement. When the context of perceived financial scarcity is considered, this result supports prior research that found hard CSDs to be more effective than soft CSDs (John, 2019). However, saving intention was measured again after a delay of 30 days (Time 3) to assess the durability of the increase in saving intention, as discussed in the next section.

5.5.3 Heterogeneity in saving intention over time

The impact of the treatments on saving intention was evaluated on two levels because the research design of the study made these analyses possible. Firstly, the ATEs were disaggregated between the two subgroups (strata) because it was separately measured. Secondly, measurements of baseline saving intention (or lack thereof) were used to configure these subgroups and formed the basis from which changes in saving intention over time could be interpreted. Comparing the treatment effects, therefore, revealed differences on two levels, between the saving intention observation immediately after the intervention (Time 2) and 30 days later (Time 3), and between the subgroups at these times (refer to Figure 17). Results from the post hoc within-group analyses (refer to Tables 25 and 26) were used to calculate the percentage change in average saving intention per subgroup presented in Figure 18. A percentage increase in the average saving intention between two groups is denoted by the '+'-sign, and a decrease by the '-'-sign.

| Subgroup | Experimental group | Percentage change in average saving intention | | |
|----------------|--------------------|---|---------|---------|
| | | Time 1 | Time 2 | Time 3 |
| Intent | T ₁ | + 24.5% | - 32.4% | - 15.7% |
| | T ₂ | + 13.9% | - 22.5% | - 5.5% |
| | Control | | - 40.6% | |
| Low/ No Intent | T ₁ | + 24.7% | + 16.4% | + 37.0% |
| | T ₂ | + 12.56% | + 29.4% | + 38.3% |
| | Control | | + 10.9% | |

Figure 18: Change in average saving intention over time per subgroup

Source: Author's own

Interpretation of the Intent subgroup's results over time

The effect sizes of the changes in saving intention measured at Time 2 and Time 3 for each experimental group according to the eta squared calculations, were large for T₁ (.18) and the control group (.16) but only moderate for T₂ (.12) (Cohen, 1988). However, these effect sizes do not indicate between which times (Time 1 versus Time 2, or Time 2 versus Time 3) saving intention changed the most, or the direction of the effects. The percentage change in average saving intention is presented in Figure 18 to disaggregate the treatment effects and make it more comparable between the various groups, and over time. It can be observed from Figure 18 that the increase in the saving intentions of Intent-stratum participants did not endure to Time 3, for either of the two treatments. The positive saving intention effects at Time 2 reversed and the results may even suggest that both treatments had negative impacts on saving intention by Time 3. However, when the change in average saving intention between Time 1 and Time 3 of control group participants is considered (-40.6%), then T₁ (-15.7%) and T₂ (-5.5%) seemed to have counteracted other unobservable factors that impacted saving intention negatively over these 30 days to some extent. With the lowest decrease in saving intention over the delay period, the soft commitment treatment (T₂) (-5.5%) seemed to have the most durable treatment effect in this stratum.

Participants with identical saving intention measurements may differ in the quality of their intention because individual intentions are multi-dimensional and possess other properties that can affect their predictive validity (Sheeran, 2002). Examples of such intention properties

are stability over time, the strength of the intention formed, attitudinal or normative control, certainty over intentions and accessibility (Sheeran, 2002). Temporal stability is affected by events that cause a change in intention after measurement and before the observation of behaviour, which moderates the predictive accuracy of the measured intention (Fishbein & Ajzen, 2010). The findings from a meta-analysis performed by Sheeran et al. (2014) indicated that elevated risk perceptions could also change an individual's intentions and behaviour, although the effect size will most likely be low. Based on the social psychology literature on intention, the decrease in saving intention observed from Time 2 to Time 3 could be ascribed to the heterogeneity in the nature of participants' saving intentions and their risk perceptions. The finding that most participants preferred certainty and flexibility as discussed earlier in this chapter (refer to H₂, Section 5.3), may also explain the T₂ result for the Intent strata in Figure 18. This soft, or more flexible, commitment treatment (T₂) had a smaller negative effect over the 30 days for participants who revealed saving intention from the onset of the study.

Interpretation of the Low/No Intent subgroup's results over time

Within this subgroup, the effect sizes of changes in saving intention scores over time for each experimental group according to the eta squared calculations were large for the treatment groups (T₁ = .56, T₂ = .65) (Cohen, 1988). However, the effect size for the control group (.10) was only moderate according to the Cohen (1988) guideline. The effects of the two treatments on the saving intentions of Low/No intent participants were also larger compared to the Intent stratum. Furthermore, saving intention continued to increase from Time 2 to Time 3 for both treatments. While the positive effect of the soft commitment treatment (T₂) (+12.6%) was lower than the hard commitment treatment (T₁) (+24.7%) at Time 2, it had the largest effect on saving intention from Time 2 to Time 3 (29.4%). This seems to suggest that the treatment effect of T₂ was more durable over the 30-day period than T₁. The change in the saving intentions of the control group participants - who received no treatment - followed the same trend from Time 1 to Time 3 but showed a comparatively smaller increase (+10.9%). This suggests that other, unobserved factors also played a role in increasing the saving intention of all participants in the Low/No Intent stratum.

The low or negligible saving intention measured for this subgroup's participants at baseline offered a large scope for improvement. Individual saving intentions can change over time due to other, unobserved reasons as discussed earlier with the interpretation of the Intent-stratum results (Fishbein & Ajzen, 2010; Sheeran, 2002; Sheeran et al., 2014). This is also evident from the increase in the average saving intention of the control group participants (+10.9% change), even without receiving a treatment. To the best of the researcher's knowledge, no comparable subgroup analyses can be found in saving behaviour literature or in the social

psychology literature on saving intention. For this reason, the observation that saving intention continued to increase in the 30 days post-intervention, was interpreted against studies that conducted similar types of interventions but from different fields and contexts. According to Gollwitzer (1999), the effects of implementation-intention interventions, such as this study's self-reflection exercises, do not diminish over time in the same manner as behavioural intentions. Aijzen et al. (2009) stated that implementation intentions may be effective precisely because they prompt people who are not focused on the intended behaviour to carry it out. This may explain the larger treatment effects found for the Low/No Intent participants who were not focused on saving when the study started.

In conclusion, the two treatments were appropriate for immediate positive effects on saving intention, irrespective of whether participants had an intent or low/no intent before the intervention. However, increased saving intentions retracted to lower-than-baseline levels over the delay period of 30 days for participants who had intended to save before the intervention. This phenomenon was observed for both treatments but the soft, more flexible, commitment treatment (T_2) seemed to have counteracted this negative trend a bit better. Both treatments seemed to have been more impactful, and their effects endured longer for those who had low/no intention to save at the start of the study. Understanding exactly why these treatments were comparatively more effective for this subgroup is a matter for further research beyond this study. The next section discusses whether the increased saving intentions observed from testing H_3 , translated into saving action at Time 3.

5.6 H₄: Saving Intention and Saving Action

The results of H_4 are summarised and compared to extant evidence from literature on saving behaviour and the intention-behaviour gap especially. This section concludes with the key findings to answer this fourth and final hypothesis.

5.6.1 Summary of H_4 results

Statistical evidence from separate MLR analyses performed per stratum was sufficient to reject the null hypothesis in favour of H_4 in the case of the Low/No Intent stratum but not for the Intent stratum. While the relationship between Saving Intention and Saving Action was statistically significant (5% level) in the Low/No Intent stratum, only a weak positive relationship (Cohen, 1988) was found in both strata. This means that when saving intention increased, participants (on average) were likely to report only a small increase in amounts saved after a 30-day delay period. Using the two MLR models, the average increase in saving amounts was predicted to be ZAR10.50 per month for Intent participants and ZAR29 per month for Low/No Intent participants. The results are explored regarding extant literature in the section that follows.

5.6.2 The relationship between saving intention and saving action

Intention is a key driver of action according to several social psychological models of behaviour. Sheeran (2002) performed a meta-analysis of meta-analyses on intention-behaviour correlational studies and found that intention explains, on average, approximately 28% of the variance in future behaviour. Webb and Sheeran (2006) also performed a meta-analysis but specifically of 47 experimental studies that tested whether manipulating behavioural intentions engenders behaviour change. Their research showed that medium-to-large-sized intention changes translated into only small-to-medium behaviour changes (Webb & Sheeran, 2006). These meta-analyses offered useful benchmarks of treatment effect sizes and the average size of the intention-behaviour gap between what people intend to do, and what they do (Sheeran, 2002; Webb & Sheeran, 2006). While none of the experimental studies were conducted in the financial behaviour domain, the changes in saving intention and saving action observed in the study's subgroups are discussed concerning existing evidence from other fields in the remainder of this section.

Interpretation of the Intent subgroup's results

A non-significant and weak positive relationship (according to Cohen's [1988] guidelines) was observed between participants' saving intention and saving action at Time 3 for the Intent-stratum. Saving intention at Time 3 explained only 1% (R^2) of the variance in saving action, which is much lower than the average of 28% that Sheeran (2002) observed from a meta-analysis of correlational studies. This means that the intention-behaviour gap for the Intent subgroup in this study can be quantified as 99%. While correlations between intention and behaviour have medium effect sizes on average, Sheeran and Webb (2016) noted that substantial variability in terms of these effect sizes has been reported. Based on the experimental research design of this study, the impact of the saving intention treatments in this subgroup was moderate ($T_2 = .12$) to large ($T_1 = .18$, control = $.16$) (refer to Sections 4.5.3 to 4.5.4). Evidence from prior experimental studies suggests that these effects were only likely to translate into small-to-medium changes in behaviour (Webb and Sheeran, 2006). The results, as compared to the benchmarks from the literature discussed here, seem to support existing evidence. Firstly, the effect on saving action was small in terms of the predicted increase in savings amount per month (ZAR10.50). Secondly, saving intention on its own was not found to be a statistically significant contributor to saving action as per the regression model for this stratum (refer to Table 30).

To interpret these results, it is important to consider the decrease in saving intention from Time 2 to Time 3 observed for this stratum (refer to Section 5.5.3). This may be why the strength of the relationship between saving intention and saving action was weaker compared to the

Low/No Intent stratum. Furthermore, it also points to possible explanations why saving intention (at Time 3) was not found to be a statistically significant predictor of future saving action on its own. According to the literature, the decrease in saving intention from Time 2 to Time 3 may signal a lack of temporal stability in intentions and that the strength of intentions declined. Both these aspects are considered properties of intention that act as key moderators of the intention-behaviour relationship (Sheeran, 2002; Conner & Norman, 2022). Unstable saving intentions are less likely to translate into saving action (Cooke & Sheeran, 2013; Sheeran et al., 1999) and may result in past behaviour being a better predictor of future behaviour (Sheeran et al., 1999). The reason for this may be that past behaviour or greater experience of the behaviour leads to habit formation, reducing the role of intention in future behaviour (Sheeran et al., 2017). This may have been the case, as the results of the MLR analysis (refer to Section 4.6.3) seem to indicate. Saving action before the intention intervention was a better, and more significant, individual predictor of saving action after the 30-day delay ($R^2 = 7\%$) than saving intention at this time.

Webb and Sheeran (2006) classified the above as conceptual moderators that play a role in the theoretical prediction of behaviour. Measurement-based moderators and study characteristics (Webb & Sheeran, 2006) may offer secondary explanations for the large intention-behaviour gap (Hulland & Houston, 2021; Sheeran et al., 2017) and unstable intentions observed for this stratum. As a measurement-based moderator, the 30-day time interval between the intervention and behaviour measurement may have increased the intention-behaviour gap (Hulland & Houston, 2021). This could be due to events that occurred, or new information becoming available, to cause a change in intention after measurement and before the observation of behaviour. This could have lessened the stability and predictive accuracy of the measured intention (Fishbein & Ajzen, 2010; Hulland & Houston, 2021). For this reason, measuring action as close as possible to an intentional intervention is recommended (Ajzen, 2013). Similarly, using self-reporting to measure behaviour as opposed to objective measures of behaviour may also have widened the gap (Hulland & Houston, 2021). Secondly, study characteristics such as the particular sample population may also explain the results. An intention-behaviour gap is often observed in the behaviour of individuals labelled as inclined abstainers; those individuals with strong intentions who fail to act (Sheeran, 2002). Thus, a large proportion of participants in the intent subgroup could be profiled as inclined abstainers, although this may be purely speculative since no direct evidence of this fact was gathered in the course of this study.

In summary, the saving action results for the Intent subgroup support the evidence in terms of the small effect size of the saving intention intervention and an observed intention-action gap. The most likely reason for this result inferred from the available evidence seems to be a lack

of temporal stability in the saving intentions of participants in the intent subgroup. The delay in the measurement of saving action post-intervention may also have contributed to the small effect size.

Interpretation of the Low/No Intent subgroup's results

Similar to the Intent stratum, the Low/No Intent stratum's results indicated a weak positive relationship between saving intention (measured at Time 3) and saving action. This relationship was somewhat stronger than the Intent stratum, possibly due to the continued increase in saving intention post-intervention from Time 2 to Time 3 (refer to Section 5.5.3).

Saving intention at Time 3 explained only 7% (R^2) of the variance in saving action, which is much lower than the average of 28% that Sheeran (2002) observed from a meta-analysis of correlational studies (with substantial variability between studies). This means the intention-behaviour gap for the Intent subgroup in this study can be quantified as 93%. The within-group analysis of saving intention over time revealed large effects for the treatment groups ($T_1 = .56$, $T_2 = .65$) compared to the control group (.10) (refer to Sections 4.5.3 to 4.5.4). Similar to the intent stratum, the results seem to support existing evidence in terms of a small effect on saving action, which was predicted as a monthly increase in the savings amount of ZAR29. However, saving intention on its own was found to be a statistically significant contributor (at the 5% level) to saving action as per the regression model for this stratum (refer to Table 30). The latter suggests that saving intention was a stronger predictor of future behaviour in this subgroup.

The observation that saving intention (at Time 3) was a better predictor of future saving action in this subgroup may be attributable to comparably greater temporal stability that moderated the intention-behaviour relationship (Sheeran, 2002). Stable saving intentions are more likely to translate into saving action (Cooke & Sheeran, 2013; Sheeran et al., 1999) as a better predictor of future behaviour compared to past behaviour (Sheeran et al., 1999). This was indeed the case as per the results of the MLR analysis (refer to Section 4.6.3). Saving intention at Time 3 was a significant and better individual predictor of saving action after the 30-day delay ($R^2 = 8.6\%$) than past behaviour (saving action before the intervention) ($R^2 = 5.7\%$).

In summary, the saving action results for the Low/No Intent subgroup support the evidence in terms of the small effect size of the saving intention intervention and an observed intention-action gap. The most likely reason for this result inferred from the available evidence seems to be some temporal stability in the saving intentions of participants in this subgroup. Similar to the Intent subgroup, the delay in the measurement of saving action post-intervention may also have contributed to the small effect size and large intention-action gap.

Overall, the results of H_4 revealed that the intervention to change saving intentions had different effects on saving activity in the subgroups. This may be attributable to a difference between the temporal stability of intentions in the subgroups. In other words, greater temporal stability of intentions may have resulted in saving intention being a better predictor of saving action and larger effect sizes (albeit still small) in the Low/No intent subgroup. This finding is important for answering the overall research question on multiple levels. Firstly, it provides evidence of the indirect impact of the hard and soft (flexible) commitment treatments on the *saving action* of subgroups with different saving intentions. Furthermore, it completes the evidence of the treatments' impact on *saving behaviour* as a construct that includes both saving intention and saving action, as per the study's research design. Lastly, the findings revealed that the intervention particularly designed for this study is better suited, on balance, to improve the saving behaviour of those who had Low/No intent to save initially. The implications of this finding to theory and practice are discussed in the next chapter.

5.7 Conclusion

The sample population did not reveal present biased and certainty-effect biased behaviour in their financial decision-making before the intervention. This result was surprising only if the context of perceived financial scarcity is disregarded. Evidence from testing H_1 and H_2 , also suggested that most participants preferred instant gratification through the immediacy effect, were time-inconsistent and preferred certainty. Furthermore, the average participant in the sample population preferred flexibility over commitment. These baseline preferences were measured to gain a better understanding of the sample population ahead of the saving intention intervention and its impact evaluation. These preferences were interpreted regarding intertemporal choice under uncertainty theory, Behavioural Economic literature, and scarcity literature which provided contextual evidence and insights in particular.

The saving intention intervention (H_3) consisted of a hard commitment (T_1) and soft commitment intervention (T_2) which were presented to participants that were stratified into two subgroups. Both these treatments showed statistically significant (at the 5% level) effects on saving intention immediately after the intervention (Time 2) – for both the Intent and Low/No Intent subgroups. However, the unique contributions of the treatments to saving intention as per the MLR analysis differed between the subgroups. The Intent-strata MLR model found equal contributions by the two treatments, while the hard commitment treatment (T_2) was found to be a larger contributor to the Low/No Intent strata participants' saving intentions.

Over the 30-day delay period, saving intention decreased for all participants in the Intent stratum, signalling only very short-term positive effects of the treatments for these participants. On the other hand, saving intention continued to increase in the Low/No Intent stratum,

resulting in the soft commitment treatment (T_2) becoming more effective (than T_1) to improve saving intention over time. Despite this, the effect of both treatments (T_1 and T_2) endured longer in this subgroup. This suggests a possible link to participants' flexibility preferences measured at baseline and that the intervention was perhaps more appropriate for the Low/No Intent subgroup on balance.

Lastly, the relationship between saving intention and saving action was measured after a 30-day follow-up period (Time 3) to determine if the treatment effects endured and improved saving action indirectly (H_4). Weak positive relationships were found between saving intention and saving action in both strata, meaning that increased saving intention translated (weakly) into saving action. Saving intention measured at this time (Time 3) was also a significant, unique contributor to saving action in the Low/No Intent stratum. This may be due to greater temporal stability of intentions, resulting in saving intention being a better predictor of saving action and larger effect sizes (albeit still small) in this subgroup.

The findings answered the overall research question through a systematic process of hypotheses testing. Evidence was first gathered on specific biases and preferences relevant to saving behaviour to obtain a better understanding of the sample population (H_1 and H_2). Secondly, the between-group and within-group analyses revealed which of the two treatments was most effective to increase saving intention per subgroup and over time, respectively (H_3). The results are important to identify the most appropriate commitment treatments for individuals who perceive financial scarcity, with due consideration of their initial level of saving intention. Lastly, the weak relationships between saving intention and saving action in both subgroups suggested an intention-behaviour gap in the saving behaviour of the entire sample population. However, the multi-layered analysis suggested that saving intentions were more stable for the Low/No intent subgroup, where participants preferred flexibility over commitment (H_1 and H_2), and where the soft or flexible treatment (T_2) showed the greatest impact over time. As a result, saving action performance (and therefore saving behaviour) after the 30-day delay was comparatively better in this subgroup.

The implications of these findings to theory and practice are discussed in the next chapter. This study concludes in the chapter that follows with an overall summary of the research conducted, followed by discussions on contributions to literature and practice, limitations, and recommendations for future research.

Chapter 6: Recommendations and Conclusion

6.1 Introduction

Concern for the inadequate saving rates of individuals motivated this research on saving behaviour interventions. Individuals who perceived financial scarcity in the developing market context provided a rich background for testing decision theory and an intervention designed to improve saving behaviour. This intervention was designed for application in the context of financial constraints and uncertain economic conditions, whilst being cost-effective for a greater likelihood of generalisation and implementation in practice.

When individuals perceive financial scarcity, they generally prefer both saving flexibility and a strict commitment to saving for the future (Afzal et al., 2017; Dalton et al., 2016; Karlan et al., 2014). Literature from various fields called for research to expand knowledge on how these opposing preferences for commitment and flexibility interact, and in different contexts (Amador, et al., 2017; Bond & Sigurdsson, 2018; Casari, 2009; Galperti, 2017; Legrand et al., 2017). This study responded by testing how these time and uncertainty-based preferences (Ferecatu & Önçüler, 2016; O'Donoghue & Rabin, 2015) operate together in the financial decision-making and saving behaviour of individuals who perceive financial scarcity.

This chapter presents the research findings. It also discusses their implications for theory and business, draws attention to the limitations of this study and proposes key areas for future research.

6.2 Research findings

Saving behaviour, as the main outcome of interest for this study, was operationalised and tested through the separate constructs of Saving Intention and Saving Action. This allowed for a more detailed analysis and a more nuanced explanation of saving behaviour in the selected context. The main research question answered by this study was: *How do commitment and flexibility preferences impact the saving behaviour of individuals who perceive financial scarcity?*

To answer this overarching research question, four hypotheses (refer to Table 3) were tested sequentially as per the Conceptual Framework (refer to Figure 4). Primary research findings from testing these hypotheses, as well as secondary contextual and methodological findings, are discussed in the subsections to follow.

6.2.1 Commitment and flexibility preferences

Present bias is a behavioural anomaly considered to be a key influence on saving behaviour in general, especially under conditions of financial scarcity (Bernheim et al., 2015; Karlan et

al., 2014). The results for H_1 were therefore surprising in the sense that most participants did not reveal present bias in their decision-making. Instead, most participants displayed impatience or the immediacy effect, also consistent with decision-making in the context of scarcity (Schilbach et al., 2016; Shah et al., 2015). These results may be explained by the existing evidence that present bias weakens significantly and individuals specifically prefer immediate gains when the future is viewed as uncertain (Halevy, 2008; Hardisty & Pfeffer, 2017). The H_1 results further indicated that most participants lacked commitment preference and that present bias was not a driving force behind this result. Alternative present-focused decision models such as psychometric distortions (which include certainty-effect bias), and myopia may explain this lack of commitment preference observed (Ericson & Laibson, 2019) (refer to Table 32). Additional suggestions from the literature for the lack of commitment preference observed may be a lack of willingness to pay for costly commitments (Laibson, 2015), liquidity constraints (Carvalho et al., 2016), or simply a stronger preference for flexibility. The results of H_1 confirmed that commitment was preferred even less when it was offered at either a monetary cost or time cost (delay) (refer to Section 4.3.1) and their preference for flexibility was measured in testing H_2 .

Since individuals who perceive financial scarcity experience a high level of uncertainty (Casari, 2009; Karlan et al., 2014), they may display certainty-effect bias and flexibility preferences (Janssens et al., 2017; Krishna & Sadowski, 2014; Yoon & Kim, 2018) as opposed to commitment preferences in saving decisions (Bernheim et al., 2015; Galperti, 2015). The second hypothesis was derived and tested for this reason. Most participants did not reveal certainty-effect bias but were consistent in their preferences for preferred certainty and flexibility in their decision-making. This result may be due to the tendency of individuals to believe that only the present is certain, while the future is inherently uncertain (Chakraborty et al., 2020; Halevy, 2008). The disproportionate preference for certainty observed in testing H_2 is therefore consistent with most participants' present-focused decision-making found per H_1 . Furthermore, the majority of participants were consistent in both their preferences for certainty and flexibility. These preferences correspond with literature on decision-making under uncertainty (Casari & Dragone, 2015) and decision-making in the context of scarcity (Deck & Jahedi, 2015; Laajaj, 2017; Schilbach et al., 2016; Shah et al., 2015). However, the overall research question of this study is positioned in intertemporal choice under uncertainty theory that explains the interaction between time and uncertainty in decision-making. When the results from the first two hypotheses are considered holistically, it can be inferred that uncertainty played a significant role in participants' decision-making, resulting in most participants preferring flexibility over commitment.

Based on the collective results from H₁ and H₂, a financial decision-making profile can be formed of most participants in the sample population. These individuals who perceived financial scarcity, made present-focused decisions, possibly because they perceived the present and the future to be uncertain (at least at the time of participation in the study). This seems plausible based on their stable preferences for immediate rewards, certainty and flexibility. Most participants did not display present biased or certainty-effect biased behaviour typical of inconsistent decision-making, most likely due to their stable preferences. Participants were not required to make an absolute choice between commitment and flexibility but most had a stronger preference for flexibility than commitment in financial decision-making. This profile of individuals who perceived financial scarcity and chose to participate in this study provided a background for the interpretation of the results of the primary hypotheses that follow.

6.2.2 Interventions to increase saving intention (H₃)

H₁ and H₂ served to profile participants who perceived financial scarcity based on select biases and preferences, whilst determining the status of their preferences before any interventions. The purpose of H₃ was to manipulate these baseline preferences and to measure the intervention's impact on saving intentions. All participants were included in one of two subgroups based on their level of saving intention before the intervention and then randomly allocated to an experimental group. This allocation to an experimental group determined whether a participant received a hard commitment treatment, a soft (flexible) commitment treatment or no treatment at all (control group). Results were obtained from multi-layered between-group and within-group analyses. Comparisons of treatment effects were firstly made between experimental groups in each subgroup, then also compared and interpreted at the subgroup level. Since saving intention was measured at different times, the results for each experimental group were also compared at these times. These results are best summarised and illustrated in Figure 17 (refer to Chapter 5) and the findings are organised per subgroup in this section.

Saving intention change in the Intent subgroup

The impacts of the hard commitment (T₁) and the soft, flexible commitment treatment (T₂) on saving intentions immediately after the intervention (Time 2), were equal and statistically significant. If the flexibility preferences of most participants (as found per H₂) were stable and aligned with their saving intentions, then the soft commitment treatment (T₂) was expected to be more effective than the hard commitment treatment (T₁). Thus, some participants' preferences may have changed to commitment after the intervention. In this respect, the result was not surprising, since preferences can be incomplete, unstable and dynamically

inconsistent over time (Chuang & Schechter, 2015; Hammond, 1976; Ok et al., 2015). However, these preferences were not specifically measured again at Time 2 (only controlled for in the MLR model), since the main purpose of the study was to measure the impact of the treatments on saving intention.

Evidence from the literature regarding which type of commitment treatment (hard versus soft) is most effective to improve behaviour, seems to be inconclusive. Such hard and soft treatments are often experimentally tested with CSDs in poverty or low-income contexts (Bryan et al., 2010; John, 2019; Karlan et al., 2014). Irrespective of its impact, hard commitment treatments seem to be less popular than flexible commitment treatments when offered as a choice in low-income contexts (Ashraf et al., 2006; Bryan et al., 2010). Since no such choice was available in this study, the result of equal treatment effects observed for T_1 and T_2 seems plausible.

Comparing saving intention measurements over time offered more information to differentiate between the impact of the two treatments in the Intent-stratum. The increase in the saving intentions of these participants at Time 2 did not endure to Time 3 for either of the two treatments. The positive saving intention effects at Time 2 reversed and may even suggest that both treatments had negative impacts on saving intention by Time 3. However, when compared with the larger decrease in the saving intentions of control group participants, then T_1 and T_2 seemed to have counteracted other unobservable factors that impacted the saving intention of all participants negatively. With the lowest decrease in saving intention over the 30-day delay period, the soft commitment treatment (T_2) seemed to have the most durable treatment effect in this stratum.

The decrease in saving intention observed from Time 2 to Time 3 could be ascribed to heterogeneity in the properties of participants' saving intentions and their risk perceptions (Sheeran, 2002; Sheeran et al., 2014). Furthermore, the finding that most participants preferred certainty and flexibility (refer to H_2 , Section 5.3), may also explain why the flexible commitment treatment (T_2) had a smaller negative effect over the 30 days for participants who revealed saving intention from the onset of the study.

Saving intention change in the Low/No intent subgroup

The hard commitment treatment (T_1) was more effective to improve saving intention in this subgroup compared to the soft commitment treatment (T_2), which offered more flexibility. This result immediately after the intervention was somewhat unexpected in light of most participants' flexibility preferences observed per H_2 . Nevertheless, it supports prior research that found hard CSDs to be more effective than soft CSDs in the context of financial scarcity (John, 2019).

The results of the Low/No Intent subgroup deviated from the Intent subgroup in three important ways. Firstly, both treatments' effect sizes or impacts on saving intention were larger in this subgroup compared to the Intent stratum immediately after the intervention (Time 2). Secondly, the saving intentions of participants in both treatment groups continued to increase during the 30-day delay period post-intervention. Lastly, while the hard commitment treatment (T_1) was more effective to increase saving intention at Time 2, the soft commitment treatment (T_2) had the largest effect on saving intention at Time 3. Thus, it seems that the treatment effect of T_2 was more durable over the 30-day delay period than T_1 . The saving intentions of control group participants - who received no treatment - followed the same trend from Time 1 to Time 3 but a comparatively smaller increase was observed. This suggests that other, unobserved factors also played a role in increasing the saving intention of all participants in the Low/No Intent stratum. One other possibility might be that mere participation in a saving behaviour study, had a subconscious effect of increasing participants' attention (and intention) to saving.

The key observation that saving intent continued to increase post-intervention can be explained by other, unobserved reasons as discussed earlier with the interpretation of the Intent-stratum results (Fishbein & Ajzen, 2010; Sheeran, 2002; Sheeran et al., 2014). According to Ajzen et al. (2009), implementation intentions such as the self-reflection exercises of the treatments may be effective precisely because they prompt people who are not focused on the intended behaviour to carry it out. This may explain the larger treatment effects found for the Low/No Intent participants who were not focused on saving when the study started.

In summary, the two treatments were appropriate for immediate positive effects on saving intention, irrespective of the subgroups a participant belonged to. However, increased saving intentions did not endure the 30-day delay period for participants in either of the treatment groups of the Intent subgroup. However, the soft, more flexible, commitment treatment (T_2) seemed to have withstood the negative trend a bit better in this subgroup. Both treatments seemed to have been more appropriate, more impactful, and their effects endured longer in the Low/No Intent subgroup. The results of H_3 explain the direct impact of the intervention on saving intention, which is only partly explaining the impact on saving behaviour as per the research question. The results from H_4 complete the findings by explaining whether the increased saving intentions translated into saving actions at Time 3 and address the second part of the saving behaviour construct.

6.2.3 Saving intention and action in saving behaviour (H₄)

An intention-behaviour gap (Sheeran, 2002; Webb & Sheeran, 2006) is the most probable explanation for small effect sizes and the weak positive relationship between saving intention and saving action in both subgroups. Furthermore, the results suggest that the strength and temporal stability of saving intentions may have moderated these relationships (Sheeran, 2002; Conner & Norman, 2022) in both subgroups as discussed next.

Saving activity in the Intent subgroup

The decrease in saving intentions from Time 2 to Time 3 in this subgroup (per the previous section) was considered in the interpretation of the H₄ results. This decrease may partly explain the weak positive relationship between saving intention and saving action in this subgroup at Time 3. Saving intention was therefore also not found to be a statistically significant predictor of saving action at this point. This decrease in saving intention signals temporal instability and a decline in the strength of these intentions (Conner & Norman, 2022; Sheeran, 2002), reducing the likelihood of translation into saving action (Cooke & Sheeran, 2013; Sheeran et al., 1999). In this case, past behaviour was found to be a better predictor of saving action than saving intention (refer to the MLR analysis in Section 4.6.3) which supports existing evidence (Sheeran et al., 1999; Sheeran et al., 2017).

The decline in saving intention strength and its temporal instability (Conner & Norman, 2022; Sheeran, 2002) may have operated as moderators and widened the intention-behaviour gap in this subgroup. The 30-day time interval between the intervention and measuring saving action may also have increased the intention-behaviour gap due to events occurring or new information becoming available to change intention after measurement and before the observation of behaviour (Hulland & Houston, 2021). Similarly, self-reported measures of behaviour as opposed to objective measures may also have widened this gap (Hulland & Houston, 2021).

Saving activity in the Low/No intent subgroup

Similar to the Intent stratum, the relationship between saving intention and saving action at Time 3 was measured as weakly positive. However, this relationship was somewhat stronger in this subgroup, possibly due to the continued increase in saving intention post-intervention (refer to Section 5.5.3). Importantly, saving intention was also found to be a statistically significant contributor (at the 5% level) to saving action (refer to Table 30) in this subgroup. This result deviated from the Intent subgroup and may be attributable to comparably greater temporal stability of saving intentions, which moderated the intention-behaviour relationship in this subgroup (Sheeran, 2002). Stable saving intentions are more likely to translate into

saving action (Cooke & Sheeran, 2013; Sheeran et al., 1999) as a better predictor of future behaviour compared to past behaviour (Sheeran et al., 1999). This was indeed the case according to the results of the MLR analysis (refer to Section 4.6.3). Similar to the Intent subgroup, the delay in the measurement of saving action post-intervention may also have contributed to the small effect size and large intention-behaviour gap.

6.2.4 Primary findings to answer the research question

Overall, the results revealed that the self-reflection intervention was effective to improve saving intentions measured immediately after it was conducted (Time 2). This positive impact was evident for both the hard and soft commitment treatments and for all participants irrespective of their subgroup. A comparable analysis of effect sizes measured at Time 2 was revealing and differed between the treatment groups and subgroups (refer to Section 5.5). At this point, the two types of treatments were equally effective to improve the saving intention of those participants who had intent to save before the intervention. Comparably, the hard commitment treatment was more effective than the soft (more flexible) commitment treatment to improve the saving intention of those who had low, or no, intent to save beforehand. Collectively, these results seemed contradictory to the high preference for flexibility, as opposed to commitment, observed across the sample population before the intervention (refer to Section 5.4). However, the effects of the treatments over time were key to answering the overall research question.

The value of dividing participants into subgroups according to their baseline saving intention became clear when the results of the study's second phase were interpreted. The most insightful findings of this study are in respect of how saving intention changed over time post-intervention, and how this translated into saving action. Otherwise stated, the temporal stability of saving intention seems to have moderated the relationship between saving intention and saving action in both subgroups, albeit in different ways. Firstly, the effects of hard and soft commitment treatments on saving intention changed over time in both subgroups but in opposite directions. Saving intention in the Intent subgroup decreased over the 30-day delay period, while the saving intention in the Low/No Intent subgroup continued to increase during this period. Possibly as a consequence of this continued increase, saving intention was a significant contributor to saving action in the Low/No Intent subgroup. Secondly, the soft, flexible commitment treatment seemed to have a more enduring effect than the hard commitment treatment in both subgroups. The saving intention of participants who received the soft commitment treatment in the Low/No intent subgroup increased the most during the 30 days. On the whole, these changes in saving intention over time affected the intention-action relationships measured per subgroup after the 30-day delay period.

A *lack of temporal stability* in the saving intention of Intent subgroup participants may have moderated the intention-action relationship to explain the small effect of the intervention on the amounts saved (saving action). On the contrary, the moderating effect of *temporal stability* in the saving intention of Low/No Intent participants may have resulted in a comparatively larger effect on saving action (albeit still small) and a smaller intention-action gap measured for this subgroup. These results provided evidence of the indirect impact of the hard and soft commitment treatments on the saving action of subgroups with different saving intentions. Thus, it also completes the evidence of the treatments' impact on *saving behaviour* as a construct that includes both saving intention and saving action.

In summary, the research question was answered with multi-layered evidence. Firstly, the self-reflection intervention specifically designed for this study was effective to improve the saving behaviour of individuals who perceived financial scarcity and participated in this study. Secondly, the intervention on the whole was effective to increase the *saving intention* of both types of participants, those with intent to save and those with low/no intent to save before the intervention. However, the intervention was more effective to improve the *saving intention over time* of those individuals who had Low/No intent to save beforehand. Thirdly, both the hard (T_1) and soft commitment (T_2) treatments increased saving intention immediately after the intervention (Time 2) in both subgroups. However, only the saving intention of participants in the Low/No Intent subgroup endured and continued to increase during the 30-day delay period after the intervention to Time 3. However, the effect size of the soft commitment treatment (T_2) was larger than that of the hard commitment treatment (T_1). Lastly, an intention-action gap in saving behaviour was observed for both subgroups, since increased saving intention translated only weakly into increased amounts saved (saving action). Comparatively, the intention-action gap was smaller in the Low/No Intent subgroup, perhaps partly due to the sustained increase in saving intention. The structure of the study's multi-layered results is summarised in Figure 19.

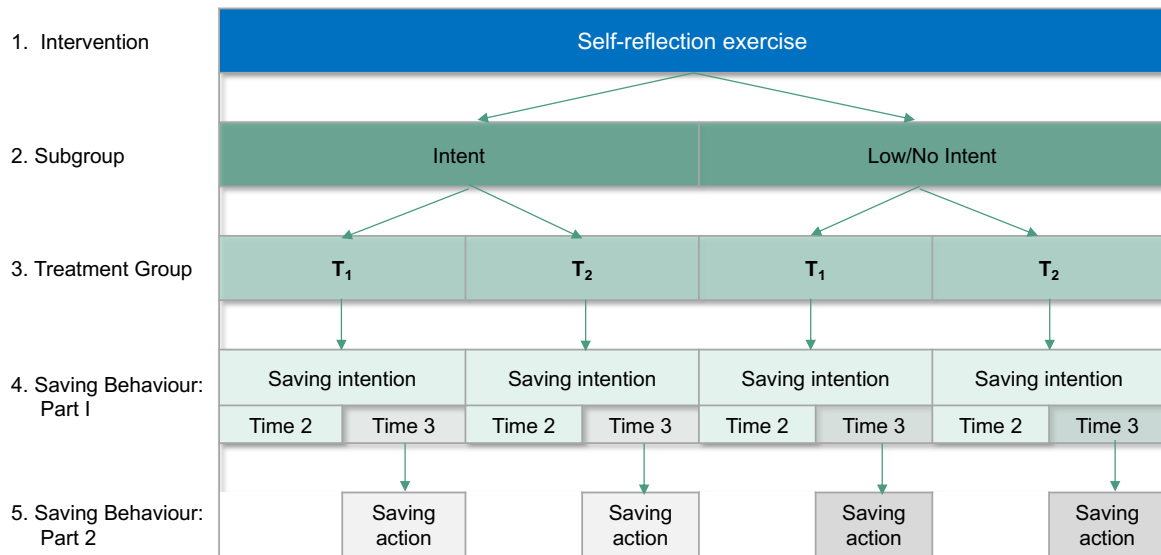


Figure 19: Summary of multi-layered evidence

Source: Author's own

6.2.5 Secondary research findings

Apart from the primary findings, which specifically relate to the overarching research question, some general and methodological observations were made during the study. The subsections following are important to note.

Composition of the sample population

The demographic data revealed that financial scarcity is perceived across a spectrum of income levels. While the sample population was skewed towards the two lowest income groups, participants from higher income groups were also included in this study as motivated in Section 4.2. It is worth noting that 75% of these individuals who perceived financial scarcity and chose to participate in this study were measured with an intent to save (Intent subgroup), and 25% with Low/No Intent ($N = 305$ vs. $N = 100$ respectively) (refer to Figure 6). This signals that most individuals who perceived financial scarcity were motivated to save, supporting similar observations from several studies on saving behaviour in scarcity and poverty contexts (Dalton, et al., 2016; Dupas & Robinson, 2013; Goldberg, 2014; Martin & Hill, 2015; Prina, 2015). Analyses of the specific reasons why these participants intended to save fell outside the scope of this study.

Stratified research design

Stratification of participants into subgroups according to their initial saving intention allowed for multi-layered comparative analyses between pre-defined groups (refer to Figure 19), more precise measures of treatment effects and inferences on the heterogeneity of the sample

population. This is especially important when effect sizes are small, as was the case of saving action (H_4).

Online experimentation with behaviour

One of the benefits of this research design choice was that it allowed for measurement of response times which was revealing regarding participants' level of attention to the study. Appropriate response times were particularly important to ensure the execution quality of the self-reflection exercise as the saving behaviour intervention. All participants with response times that were quicker than three standard deviations of the group average, were considered outliers and subjected to further data quality tests as per the strategy in Section 3.6.8.

6.3 Contributions to literature

The main research aim was to expand literature on intertemporal choice under uncertainty when making saving decisions in the context of financial scarcity. Based on the findings from hypotheses testing and with reference to existing evidence, this study's unique contributions were identified.

6.3.1 Theoretical contributions

A growing body of literature is combining time and uncertainty in decision-making analyses because they are correlated (Ferecatu & Öncüler, 2016; Halevy, 2008; Keren & Roelofsma, 1995; Weber & Chapman, 2005) even though their exact relationship is not clearly understood and requires further research (Liu et al., 2020; Luckman, et al., 2017). Intertemporal choice, present bias and commitment preferences have been studied extensively in saving behaviour literature, while uncertainty and flexibility preferences have comparatively been under-researched. Even fewer studies have empirically tested both commitment and flexibility preferences in the context of saving behaviour.

The primary theoretical contribution of this study was to extend the Behavioural Economic literature on intertemporal choice under uncertainty in saving behaviour. This was in response to calls for a better model to describe intertemporal choices through preference-based and uncertainty-based explanations (Baucells & Heukamp, 2012; Casari, 2009; Casari & Dragone, 2015; Keren & Roelofsma, 1995; Luckman et al., 2017). The study also responded to the need for a better understanding of how time and uncertainty-related biases and preferences operate together and in different contexts (Ferecatu & Öncüler, 2016; O'Donoghue & Rabin, 2015). This was empirically done by measuring commitment preferences (H_1) and flexibility preferences (H_2) before manipulating these preferences in an intervention (H_3) to increase

saving behaviour (H_3 and H_4). The study was purposefully conducted in the context of perceived financial scarcity, where individuals are likely to experience elevated uncertainty.

However, the focus in Behavioural Economic literature to date has been on intertemporal decision-making with regard to saving behaviour in the context of scarcity, with present bias as a popular anomaly of interest. However, the results (refer to Section 6.2.1) suggest that more focus should be placed on understanding the effect of *uncertainty* as a driver not only of certainty-effect bias and flexibility preferences but also of present bias and other present-focused decision models when making saving decisions in the context of financial scarcity, such as this study. On the other hand, since most participants were consistent in their certainty and flexibility preferences in the present and for choices in the future, time delays did not seem to affect these preferences negatively. This suggests that the interaction between time and uncertainty in the context of this study was somewhat one-directional, with uncertainty influencing the intertemporal choice to a greater extent than the other way around. Altogether, this is contributing to literature with a better understanding of the interaction between time and uncertainty (Ferecatu & Önçüler, 2016; O'Donoghue & Rabin, 2015) in the context of saving decision-making when financial scarcity is perceived.

Figure 20 explains the overall contribution of this multi-dimensional study to literature. The findings are interconnected and echo literature on the interaction of time and uncertainty in decision-making (Ferecatu & Önçüler, 2016; Halevy, 2008; Keren & Roelofsma, 1995; Weber & Chapman, 2005). This 4x4 matrix in Figure 20 was derived from revealed commitment and flexibility preferences (H_1 and H_2), experimental treatments on saving intention (H_3) and the subsequent outcome on saving behaviour (H_4). This matrix may also serve as a guide to choosing the most appropriate saving treatment for an individual who perceives financial scarcity, based on measures of their baseline preferences and savings intention. This guidance is important because commitment can be harmful when inappropriate CSDs, which are either too hard or too soft for an individual's level of sophistication, are selected (John, 2019).

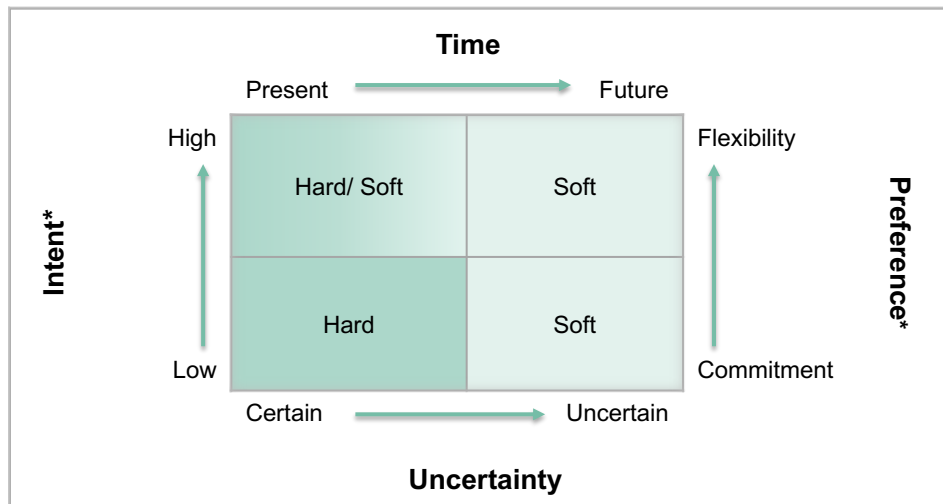


Figure 20: Commitment and flexibility matrix for selecting appropriate saving interventions

Source: Author's own

Note:

*Baseline level of intent and preferences measured before the intervention.

This means, for example, that when an action or behaviour is required immediately but the intention is low, hard commitment treatments may be more effective in this context. On the other hand, when an action or behaviour is only required in the future, a soft (or more flexible), intervention that will increase the temporal stability of intention would be more appropriate. A self-reflection exercise as a form of implementation-intention or 'wise' intervention such as the intervention conducted in this study should be considered to achieve this purpose. This evidence can be generalised to another intertemporal choice under uncertainty contexts apart from saving behaviour under conditions of financial scarcity. Thus, this evidence offers some explanation of how time and uncertainty, commitment and flexibility preferences all operate together in decision-making.

6.3.2 Methodological contributions

The norm in economic literature on flexibility preferences has been to predict this preference in decision-making through econometric models (Ahn & Sarver, 2013; Jones & Ostroy, 1984; Krishna & Sadowski, 2014; Saito, 2015) and limited experimental studies have been conducted to empirically test this construct to date (Casari, 2009). Thus, this study made a methodological contribution to the experimental economics literature by *experimentally* testing individuals' flexibility preferences in the context of saving behaviour.

The second methodological contribution relates to Behavioural Economic literature on saving behaviour. This study tested *saving behaviour* by way of separate *Saving Intention* and *Saving Action* variables to measure both the direct impact of the intervention on saving intention and the indirect impact on taking saving action. While intention has received a lot of attention in

studies driven by the TPB, most behavioural economic studies are focused on the outcome or behaviour. For this reason, evidence from social psychology literature on types of interventions to increase intention and reduce possible intention-behaviour gaps was used as guidance. Since this study experimented with treatments to increase saving intention, a greater emphasis was placed on the internal, psychological processes before taking saving action, as opposed to the large body of behavioural economic studies that experiment with tools (CSDs) to increase saving behaviour.

Furthermore, the self-reflection intervention was designed for social psychology literature on 'wise Interventions' (Chen, Chavez, Ong & Gunderson, 2017; Hall, Zhao & Shafir, 2014; Walton & Wilson, 2018) and implementation intentions (Hulland & Houston, 2021; Legrand et al., 2017). This was purposefully done in an attempt to increase the temporal stability of saving intentions to enhance its impact on saving action as suggested by Webb and Sheeran (2006). To the best of the researcher's knowledge, this intervention design was a novel approach to address the problem of inadequate saving behaviour in Behavioural Economic literature.

6.4 Implications for business

The secondary purpose of the study was to inform financial advisors and saving product developers in practice on appropriate behavioural interventions to improve saving behaviour under conditions of financial scarcity. To this end, some practical observations were made which resulted in the recommendations to business as presented here.

6.4.1 Saving consumer segmentation

The results from this study offer demographic information on individuals who perceive financial scarcity in South Africa. These individuals are very sensitive to financial shocks and need to manage their limited resources and mental 'bandwidth' carefully. The constant trade-offs they need to make between options suggest that a simple saving intervention would increase its likelihood of adoption and its effectivity to improve the saving behaviour of customers in this segment.

Demographic information, together with specific evidence on participants' preferences during saving decision-making, was useful to profile this group for customer segmentation purposes beyond merely their income groups. Participants were overly focused on the present and preferred certainty and flexibility which may signal that they perceived both the present and the future as uncertain. Business practitioners should use such insights to offer appropriate advice and assurances to this customer market to stimulate and sustain their saving behaviour despite the continuous uncertainty they perceive. For example, soft commitment options in saving plans that allow for a level of flexibility without severe penalties or complete liquidation

may be more appropriate for this customer segment. The matrix in Figure 20 may also be helpful to select the most appropriate type of interventions to explore in practice.

6.4.2 Cost-effective saving intervention

Saving interventions designed for the financially constrained should be both affordable and effective. This is important because savings products and other CSDs tailored to this market can be valuable to generate income and reduce poverty (Dupas & Robinson, 2013) while increasing financial institutions' client pool (Prina, 2015). Thus, this study was specifically designed to provide empirical evidence on a cost-effective saving intervention for consideration in the design of products and advice offered to individuals who perceive financial scarcity.

Cost-effective interventions are particularly important where customers experience financial scarcity and high transaction fees can be a deterrent to saving via a CSD such as a saving product (Allen et al., 2016; Dupas et al., 2017; Prina, 2015). For this reason, the saving intervention was designed to be implemented at a low cost to avoid fee escalations to customers already experiencing financial scarcity. The online self-reflection exercises can be easily replicated since the intervention instrument is not constrained by a specific location or other physical requirements to be conducted. In summary, financial institutions, organisations tasked with socio-economic development and saving product developers should consider behavioural design elements and interventions such as this to drive uptake and maintain usage of their saving solutions.

6.5 Limitations of the research

As an explanatory, quantitative research study conducted in a specified context, there are limitations to the generalisability of the results to other contexts. Additional limitations due to the research design and scope of the study are described below.

6.5.1 Time horizon

A longitudinal research study was performed as data collection was done in two phases and at three different times during the period of February 2022 to April 2022. Behaviours are inherently subject to change and as a result no inferences could be made on the longevity of the observed behaviours into the future (Williams, 2007).

6.5.2 Interpretation based on cultural and language differences

The surveys were presented in English, which was not necessarily the participants' home language, since South Africa has 11 official languages. The possibility that meanings and

nuances might have been lost due to cultural and language differences was recognised and mitigated as far as possible during the pilot-testing process as described in section 3.5.1.

6.5.3 Selection bias

Online data collection presents the challenges of selection bias towards individuals with access to, and knowledge of, technology to participate in the study. This may have contributed to the high number of educated participants in the sample population.

6.5.4 Self-reported data and social desirability bias

Self-reported behaviour may be subject to memory, self-presentation or social desirability bias and may even contribute to an intention-behaviour gap (Sheeran et al., 2017). In this study, the value of the priming self-reflection questions was in the mental process itself and not in the self-reported answers (which was not analysed qualitatively and considered in the results). Objective measures of saving action such as savings balances on external bank statements would have been the strongest source of evidence on saving behaviour after the intervention. However, the time and resources available to the researcher did not allow the opportunity to obtain evidence from such an external source.

6.5.5 H_4 Sample size: Low/No Intent stratum

According to Green (1991), a minimum sample size of 66 (refer to Formula 3 and Section 4.6.1) was required to ensure 80% statistical power and the generalisability of this stratum's results. As a general rule, at least 50 participants are required for a correlation or regression analysis, which increases with the number of independent variables added (Harris, 1985). This stratum's sample size of $N = 51$ after attrition during the 30-day delay period was therefore on the boundary of what is considered acceptable for the regression and correlation analyses. Consequently, the possibility of a low-powered regression model was acknowledged and taken into account on the inferences made from the regression results of the Low/No Intent stratum.

6.6 Suggestions for future research

Based on the findings of the study discussed in this chapter, several areas were identified for further research. Firstly, reasons for the results of the saving intervention could be explored by using a qualitative enquiry on available data. The self-reflective questions of the intervention was framed to prompt participants' saving intentions in the context of financial resource scarcity. Answers to these questions may offer rich insights into participants' context, financial constraints and decision-making processes within these constraints. This may also provide valuable feedback on how the saving intervention, in particular, can be improved.

Secondly, behavioural biases versus preferences can be investigated among populations beyond those who perceived financial scarcity. Individuals need to be aware of their biases to adjust their behaviour, yet most people are not 'sophisticated' in this respect (Giné et al., 2018; O'Donoghue & Rabin, 2015). On the other hand, individuals are generally aware of the likes and dislikes which influence their choices and behaviour. This suggests that more research focus should perhaps be placed on understanding conscious preferences as opposed to biases in decision-making to drive positive behaviour change.

Thirdly, future research should test if a lack of commitment preference could be a direct consequence of uncertainty experienced. To the best of the researcher's knowledge, commitment preferences have not yet been studied from the perspective of identifying forces that may work against commitment. To date, the research focus in Behavioural Economic literature has mostly been on identifying and promoting drivers of commitment.

The fourth possible route for future research could involve an exploration of flexibility preferences when saving, as most participants revealed high flexibility preferences. Future research should explore all the reasons for this apart from financial uncertainty, for example contextual factors such as environmental uncertainty, the prevailing socio-economic climate or psychological uncertainty experienced.

A fifth suggestion for future research would be to replicate the intervention among individuals who do not perceive financial scarcity in the same context and to compare the results with the findings of this study. This would be revealing in terms of the replicability and effectivity of the particular saving intention intervention. Other suggestions to test diversity or heterogeneity would be to replicate the intervention in different behavioural contexts and geographical locations.

The possibility of social-desirability bias in the measurement of saving action was acknowledged and can be eliminated in future studies by obtaining savings account bank statements at baseline and 30 days post the intervention. This would require a data collection partnership with a banking institution to access confidential customer information.

Lastly, future research should design and test interventions that increase the temporal stability of intentions. This is based on identifying the temporal stability of intentions as a possible moderator of the intention-behaviour gap observed, especially among individuals with low/no behavioural intention. Successful interventions that reduce the gap between intention and action over time will generalise to other behaviours with long-term outcomes that also require commitment such as recycling, taking pro-environmental action, exercise and maintaining physical and mental health.

6.7 Conclusion

This research has provided insights into preferences and saving decision-making among individuals who perceive financial scarcity. An intervention was conducted to increase saving intentions directly and to measure its impact on saving activity after a delay period of 30 days. The findings were then quantitatively analysed to identify which treatment(s) were most effective to increase saving intention and saving action, the two key elements of saving behaviour.

Within the context of financial scarcity, the findings revealed different results based on an individual's initial savings intention before the intervention. If an individual intended to save, either one of the two treatments was effective in immediately increasing their saving intention even further. However, this effect decreased over time (30 days) and resulted in a large intention-behaviour gap in their saving behaviour. On the other hand, if an individual had low or no intent to save before the intervention, the hard commitment treatment had the largest immediate and positive effect on their saving intention. This treatment effect endured and even continued to increase during the 30 days after the intervention. The saving actions taken by participants in this subgroup were comparatively larger than that of the Intent subgroup, albeit still immaterial.

These findings expanded the theory on intertemporal choice under uncertainty in respect of how time and uncertainty, and the opposing preferences for commitment and flexibility, operate together. This study also contributed to the Behavioural Economic literature on saving behaviour with a greater emphasis on the saving intention before taking the action to save. These results may be useful to the financial product and service providers who wish to increase the saving behaviour of customers who experience financial scarcity. The results provided insights into how to select, and possibly design, appropriate interventions to achieve this objective.

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Appendices

Appendix 1: Ethical clearance

**Gordon
Institute
of Business
Science**
University
of Pretoria

24 February 2022

Mama Landman

Dear Mama

Please be advised that your application for Ethical Clearance has been approved.

You are therefore allowed to continue collecting your data.

Please note that approval is granted based on the methodology and research instruments provided in the application. If there is any deviation change or addition to the research method or tools, a supplementary application for approval must be obtained

We wish you everything of the best for the rest of the project.

Kind Regards



GIBS Doctoral Research Ethical Clearance Committee

Appendix 2: Experimental protocol

| No. | Control | Purpose |
|-----|---|-----------------------------------|
| 1 | <p>Record keeping: A “project log” was kept to record all decisions made before, during and after the intervention.</p> | Transparency |
| 2 | <p>Pilot testing: The baseline survey and information used during the experimental treatments were pilot tested to ensure clarity and consistent interpretation.</p> | Data quality |
| 3 | <p>Experimental design: No changes were made to the experimental design once the pilot-tested instrument was published online and data collection started formally.</p> | Data integrity |
| 4 | <p>High-frequency checks: Performed during the process of online data collection to identify and address problems that may impact the study negatively on a timely basis.</p> | Data quality |
| 5 | <p>Step-by-step data analyses: Data from the intervention task and the endline survey data was analysed soon after the intervention was conducted and prior to Phase Two. Once Phase Two was complete, the final analysis was performed.</p> | Data quality Valid inferences |
| 6 | <p>Data cleaning: Identified discrepancies between answers and instrument design, and followed a pre-determined action plan when discrepancies were encountered. Double-checked data entries (uploads) in SPSS.</p> | Data accuracy |
| 7 | <p>Audit analyses: Accuracy of statistical analyses were sense-checked and controlled throughout the study.</p> | Data accuracy Valid inferences |
| 8 | <p>Confidentiality & anonymity: Maintained at all times and only obtained anonymised data from online platforms.</p> | Ethics |
| 9 | <p>Security: Data was stored on multiple media with security controls and electronic back-ups were made to prevent data loss.</p> | Data security |

Appendix 3: Instrument amendments based on pilot testing

The following table provides a summary of the amendments made to the data collection instrument based on responses and feedback from the four pilot rounds. Ethical Clearance (Appendix 1) was obtained for the final instrument (Appendix 4 and 5).

| Section | Instrument Item | Details of amendments made |
|---------|-------------------------------------|--|
| Part 1 | Informed Consent | Expanded to be more descriptive about the overall study |
| | Screening | Screening moved to be done earlier in the process – before the survey commences with demographic questions |
| Part 2 | Demographics | Four questions were added and one question was removed to include the most appropriate control variables and to reduce risk of “variable omission bias”. The 4 new questions required participants to (1) self-assess their financial literacy [PFL] and to report their (2) employment status, (3) type of dependents and (4) number of dependents |
| | Baseline Survey | <ol style="list-style-type: none"> 1. The number of Hypothetical Choice questions were increased to better measure the Independent Variables (Present bias, Commitment, Certainty-effect bias, Flexibility) to answer H₁ and H₂. The amounts used in these questions were piloted and increased based on pilot feedback and responses. 2. Wording clarified in the questions that measure the two Dependent variables (Saving Intention and Saving Action) 3. Order of questions were moved around to start with Hypothetical Choice questions first. |
| | Intervention (Appendix 5) | <ol style="list-style-type: none"> 1. A prompting question was added at the start of the experiment 2. Format of some questions were changed to “drop-down” boxes for choice selection instead of text entry. This was necessary to collect more meaningful data as text entries are difficult to complete on mobile devices and generally unpopular (resulting in short, rushed answers) |
| | Endline Survey | Wording of Saving Intention questions were clarified and amended to match the Baseline Survey questions exactly. |
| Part 3 | Phase Two | <ol style="list-style-type: none"> 1. Added three-item measurement scale to measure Saving Intent to this exercise as well. This was needed to measure and explain the change/lack of change in the dependent variable over time. 2. Expanded the number of questions that offer feedback from prior responses to make this second phase more worth-while and meaningful for participants to complete (30 days after the intervention). |

Appendix 4: Data collection instrument

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Part 1: Informed Consent Form

Informed Consent

This academic research study explores the *short-term saving decisions* of South-African residents. It is entirely up to you whether you would like to take part in this survey.

If you consent to participate, you will be asked to answer a few general questions, to make choices about money, and to actively think about your personal saving decisions (Phase One). During Phase Two of this survey, you will be able to self-assess your saving behaviour against the decisions you've made in Phase One.

It is important that you read the instructions carefully - it will clarify what you need to do in every part of the survey. If you have questions or feel that any of the information is unclear, you are welcome to contact the researcher directly.

There is no time pressure to complete the study but it is estimated to take between 20-25 minutes to complete Phase One and 10 minutes for Phase Two. Data collected during this survey experiment is anonymous - there are no personal identifiers to link you to this research.

The Gordon Institute of Business Science (GIBS), University of Pretoria, South Africa, reviewed and provided ethical approval for this research. For any questions or further information, please use the following contact details:

Researcher: Marna Landman

Email: marna.landman@gmail.com

RSA contact number: 082 992 0000

Research supervisor: Professor Marianne Matthee

Email: mattheem@gibs.co.za

RSA contact number: 082 459 1313

Informed Consent Form:

Please note:

1. If you decide at any time during the survey that you no longer wish to participate in this study, you can close your browser.
2. Once you have completed the entire survey, you will need to contact the researcher if you want to withdraw your data from the study.

Once you have decided to take part in this research, please tick the box below to proceed:

- I consent to the processing of my **anonymous** personal information for the purposes of this research study. I understand that such information will be treated as strictly confidential and handled in accordance with the provisions of the Protection of Personal Information (POPI) Act, 2013.

Part 1: Pre-screening of participants

Introduction

Thank you for your interest and participation in this study.

As an introduction to the rest of the survey, you will be asked a few questions on how you feel about your current financial situation.

Please note that your answers to these questions may disqualify you from further participation in this study, in which case you will be re-directed to the finish-line. This route will spare you the time and effort to complete the rest of the survey.

Otherwise, you will automatically proceed to the survey after you have completed the next 4 questions.

Instructions: For each of the next 4 questions, please select a number on a scale from 1 to 7 that best describes how you feel:

1. How satisfied do you feel with your current financial situation?

| | | | | | | | | |
|-----------------------------|---|---|---|---|---|---|---|-----------------------|
| Not at all satisfied | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Very satisfied |
|-----------------------------|---|---|---|---|---|---|---|-----------------------|

2. To what extent do you feel like you can spend as much money as you want to?

| | | | | | | | | |
|-------------------|---|---|---|---|---|---|---|-------------------|
| Not at all | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Definitely |
|-------------------|---|---|---|---|---|---|---|-------------------|

3. How financially free do you feel overall these days?

| | | | | | | | | |
|-------------------|---|---|---|---|---|---|---|------------------|
| Not at all | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Very much |
|-------------------|---|---|---|---|---|---|---|------------------|

4. Do you feel you have enough income every month to cover unexpected or emergency expenses that may arise?

| | | | | | | | | |
|-------------------|---|---|---|---|---|---|---|-------------------|
| Not at all | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Definitely |
|-------------------|---|---|---|---|---|---|---|-------------------|

Part 2: Phase One - Questions, Tasks and Surveys

Questions were tested through four pilot iterations to improve the phrasing and clarity of questions as follows:

| No. | Questions |
|-----|--|
| 1. | <p>Demographic questions:</p> <ol style="list-style-type: none">1. Age in years (18-24,25-35,36-49,50-65,>65)2. Education level (Primary, Secondary, Tertiary)3. Self-assessed financial literacy4. Gender (Male, Female, etc.)5. Location (Province)6. Employment status (full-time, part-time etc.)7. Income level (Bands in R)8. Type of dependents9. Number of dependents |
| 2. | <p>Baseline survey:</p> <p>Instructions: The second part of the survey will require you to make some choices about money and to answer questions about your saving decisions.</p> <p>Saving money generally means that you are spending less than your income over a period of time.</p> <p>In this survey, all questions about your saving decisions specifically refer to:</p> <ul style="list-style-type: none">• saving money in any form (for example: in cash, in a stokvel/savings group, in a bank account or other financial product, etc.),• over the short-term (next 12 months),• to voluntarily build a savings-buffer as a “safety net” for unexpected or emergency expenses,• that is available and freely accessible for personal use at short notice. |

2.1 Hypothetical choice questions:

Instructions: Each of the next questions requires you to choose between options A or B. There are no right or wrong answers to these questions, just select the best option for you if you should **receive** or **win** an **imaginary amount**.

(a) If you had to choose, which of the following amounts would you prefer to receive:

- A. R3,000 right now, **OR**
- B. R3,300 in 3 months from now?

(b) If A. was selected in (a): Would you prefer:

- A. R3,000 right now, **OR**
- B. R3,600 in 3 months from now?

If B. was selected in (a): Would you prefer:

- A. R3,000 right now, **OR**
- B. R3,150 in 3 months from now?

(c) If A. was again selected in (b): Would you prefer:

- A. R3,000 right now, **OR**
- B. R4,500 in 3 months from now?

If B. was again selected in (b): Would you prefer:

- C. R3,000 right now, **OR**
- D. R3,060 in 3 months from now?

(d) Which of the following amounts would you prefer to receive:

- A. R3,000 in 12 months, **OR**
- B. R3,300 in 15 months?

(e) If A. or B. was selected in c):

- A. R3,000 in 12 months, **OR**
- B. R4,500 in 15 months?

If B. was again selected in c): Would you prefer:

- A. R3,000 in 12 months, **OR**
- B. R3,060 in 15 months?

(f) Which option would you prefer to win (*choose one*):

- Guaranteed R300
- 75% chance of R402 (thus 25% chance of R0)
- 67% chance of R450 (thus 33% chance of R0)
- 50% chance of R600 (thus 50% chance of R0)
- 25% chance of R1,200 (thus 75% chance of R0)

(g) Would you prefer:

- A. R3,000 now for sure (100% certainty), **OR**
- B. R3,300 now with 80% certainty?

(h) Which amount would you prefer to win:

- A. R3,000 now with 20% certainty, **OR**
- B. R3,300 now with 15% certainty?

(i) What would you prefer to win:

- A. R3,000 with 100% certainty in 3 months, **OR**
- B. R3,300 with 80% certainty in 3 months?

(j) Which one of the following would you prefer:

- A. To receive R3,300 in 15 months from now
- B. To be given a choice in 12 months from now to receive either:
R3,000 immediately **OR** R3,300 in 3 months?

(k) Which one of the following would you prefer:

- A. To receive R3,250 in 15 months from now
- B. To be given a choice in 12 months from now to receive either:
R3,000 immediately **OR** R3,300 in 3 months?

(l) Which one of the following would you prefer:

- A. To receive R3,300 in 16 months from now
- B. To be given a choice in 12 months from now to receive either:
R3,000 immediately **OR** R3,300 in 3 months?

(m) Which one of the following would you prefer:

- A. To receive R3,300 in 15 months from now
- B. To be given a choice in 12 months from now to receive either:
R3,000 immediately **OR** R3,250 in 3 months?

(n) Which one of the following would you prefer:

- A. To receive R3,300 in 15 months from now
- B. To be given a choice in 12 months from now to receive either:
R2,950 immediately **OR** R3,250 in 3 months?

(o) Which one of the following would you prefer:

- A. To receive R3,300 in 15 months from now
- B. To be given a choice in 12 months from now to receive either:
R3,000 immediately **OR** R3,300 in 4 months?

2.2 Baseline saving action:

(a) The amount of money I have saved in the past month (30 days) to build a savings-buffer or an emergency fund is: _____

(b) I have saved this particular amount of money in the past 30 days, because (*select one*):

- | | |
|--------------------------|---|
| <input type="checkbox"/> | It is the amount I budget to save every month |
| <input type="checkbox"/> | I have arranged a monthly debit order to save this amount |
| <input type="checkbox"/> | I save what I can afford, the amount is different every month |
| <input type="checkbox"/> | I save what is left of my income at the end of the month |
| <input type="checkbox"/> | I don't need to build short-term savings |
| <input type="checkbox"/> | I don't want to build short-term savings |
| <input type="checkbox"/> | Other (<i>please specify</i>) _____ |

2.3 Baseline saving intention:

(a) I plan to save money on a regular basis to build a savings-buffer or emergency fund:

1__ : __2__ : __3__ : __4__ : __5__ : __6__ : __7__
extremely likely >> extremely unlikely

(b) I will make an effort to save money on a regular basis to build a savings-buffer or emergency fund:

1__ : __2__ : __3__ : __4__ : __5__ : __6__ : __7__
I definitely will >> I definitely will not

(c) I intend to save on a regular basis to build a savings-buffer or emergency fund:

1__ : __2__ : __3__ : __4__ : __5__ : __6__ : __7__
Strongly agree >> Strongly disagree

(Adapted from Ajzen, 2013)

3. Intervention: refer to Appendix 5

4. Endline saving intention:

(a) I plan to save money on a regular basis to build a savings-buffer or emergency fund:

1__ : __2__ : __3__ : __4__ : __5__ : __6__ : __7__
extremely likely >> extremely unlikely

(b) I will make an effort to save money on a regular basis to build a savings-buffer or emergency fund:

1__ : __2__ : __3__ : __4__ : __5__ : __6__ : __7__
I definitely will >> I definitely will not

(c) I intend to save on a regular basis to build a savings-buffer or emergency fund:

1__ : __2__ : __3__ : __4__ : __5__ : __6__ : __7__
Strongly agree >> Strongly disagree

(Adapted from Ajzen, 2013)

Part 3: Phase Two – Post-hoc survey

Introduction:

In Phase One of the survey, you have completed a set of questions to actively think about your saving decisions. You will now have the opportunity to review some of your previous responses and to assess them compared to your current saving behaviour.

It will benefit you to take your time when answering the questions in Phase Two, and to complete them in detail and as specifically as possible.

There are no time limits to your responses – take as much time as you need to answer each question. Your responses are anonymous, confidential and stored securely at all times.

Instructions:

For each of the next 3 questions, please select a number on a scale from 1 to 7 that best describes how you think about saving.

Once you have answered a question, your response from the original survey that you have completed before, will also be shown.

1. I *plan* to save money on a regular basis to build a savings-buffer or emergency fund:

| | | | | | | | | | |
|-----------------------------|---|---|---|---|---|---|---|---|-------------------------------|
| Extremely likely | <table border="1"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr></table> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Extremely unlikely |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | | | |

Next screen:

Feedback on your responses:

Your previous rating: ...*(rating will be inserted)*

Your current rating: ...*(rating will be inserted)*

Please compare your ratings and select the right option:

My current rating is a lower number, which means it is now more likely that I plan to save

My current rating is a higher number, which means it is now less likely that I plan to save

There is no difference between my ratings

Please explain why your current rating is different (if applicable):

| |
|--------------|
| |
|--------------|

2. I will make an effort to save money on a regular basis to build a savings-buffer or an emergency fund:

| | | | | | | | | |
|-------------------|---|---|---|---|---|---|---|-----------------------|
| I definitely will | 1 | 2 | 3 | 4 | 5 | 6 | 7 | I definitely will not |
|-------------------|---|---|---|---|---|---|---|-----------------------|

Next screen:

Feedback on your responses:

Your previous rating: ... (rating will be inserted)

Your current rating: ... (rating will be inserted)

Please compare your ratings and select the right option:

My current rating is a lower number - I will make more effort to save than before

My current rating is a higher number - I will make less effort to save than before

There is no difference between my ratings

Please explain why your current rating is different (if applicable):

3. I intend to save money on a regular basis to build a savings-buffer or emergency fund:

| | | | | | | | | |
|------------------|---|---|---|---|---|---|---|---------------------|
| I strongly agree | 1 | 2 | 3 | 4 | 5 | 6 | 7 | I strongly disagree |
|------------------|---|---|---|---|---|---|---|---------------------|

Next screen:

Feedback on your responses:

Your previous rating: ... (rating will be inserted)

Your current rating: ... (rating will be inserted)

Please compare your ratings and select the right option:

My current rating is a lower number, which means my intent to save is stronger than before

My current rating is a higher number, which means my intent to save is weaker than before

There is no difference between my ratings

Please explain why your current rating is different (if applicable):

4. What do I need (T_1) /want (T_2) to save for in the next 12 months?

My previous response: [...previous answer will be provided here...]

Self-assessment:

In the past 30 days I have saved for:

(Please select):

What I previously said I needed to save for

Something else (please describe)

5. Which tools do I need (T_1)/want (T_2) to start using, or use better, to build a savings-buffer or emergency fund?

My previous response: [...previous answer will be provided here...]

Self-assessment:

In the past month (30 days) I have started using, or used the following available tools better:

(Please select):

All of the tools I have identified before

None of the tools I have identified before

Some if the tools I have identified before

If you have not started to use, or used all the tools you have identified before, please explain why not:

6. How can I continue (T₁)/make it easier for myself (T₂) to build a savings-buffer or an emergency fund under all circumstances?

My previous response: [...previous answer will be provided here...]

Self-assessment:

In the past 30 days:

(Please select):

My circumstances made it easier for me to save than usual

My circumstances made it harder for me to save than usual

My circumstances were the same as usual

Other (please describe)

7. To build a short-term savings-buffer or emergency fund, I can realistically afford to save R_____ per month (T₁) /other period (T₂).

My previous response: [...previous answer will be provided here...]

Self-assessment:

I have reviewed my previous response and this amount is:

(Please select):

100% correct

More than the amount I actually saved in the past month (30 days)

Less than the amount I actually saved in the past month (30 days)

If the amount you have reported before needs to be adjusted, please explain why:

8. I plan to save R_____ in the next month (or 30 days) to build a savings-buffer or emergency fund.

My previous response: [...previous answer will be provided here...]

Self-assessment:

The amount I have saved in the past month (30 days) is:

(Please select):

- This exact amount
- More than this amount
- Less than this amount

The actual amount I have saved as a savings-buffer or emergency fund is: R_____

(Please provide the Rand amount in numbers)

9. I saved the amount I have reported, because:

Next screen:

Feedback on your responses:

Your previous reasons were: *(reasons will be inserted)*

Your current reasons are: ... *(reasons will be inserted)*

Please compare your reasons for saving the amounts you reported and explain why they are different:

Appendix 5: Intervention Instrument

| | Treatment Group 1 (Self-reflection task: Hard commitment) | Treatment Group 2 (Self-reflection task: Soft commitment) |
|----------|--|---|
| 4 | <p style="text-align: center;">Take a moment to pause and think about...</p> <p>... an example of a time in your life when you saved an amount of money for a specific purpose...and were able to achieve that savings goal in the end.</p> <p>Do you know <i>what</i> made it possible for you to save that amount?</p> <p>Can you recall <i>how</i> you saved the money?</p> <p style="text-align: center;"><i>(No answers required; screen will automatically move to questions in 30 seconds)</i></p> | <p style="text-align: center;">Take a moment to pause and think about...</p> <p>...an example of a time in your life when an amount you saved became very useful in some unexpected way...perhaps even helping you in a time of need.</p> <p>Do you know <i>what</i> made it possible for you to save that amount?</p> <p>Can you recall <i>how</i> you saved the money?</p> <p style="text-align: center;"><i>(No answers required; screen will automatically move to questions in 30 seconds)</i></p> |
| | <p>1. Why do I have to be a saver?</p> <p><i>(Select maximum 3 reasons)</i></p> <ul style="list-style-type: none"> <input type="checkbox"/> To become financially independent <input type="checkbox"/> To buy things that I like <input type="checkbox"/> To avoid debt <input type="checkbox"/> To be seen as a financially responsible person <input type="checkbox"/> To improve my financial well-being and peace of mind <input type="checkbox"/> To avoid asking family and friends for loans <input type="checkbox"/> To be able to invest or to buy an asset <input type="checkbox"/> To be part of a stokvel/ savings group <input type="checkbox"/> To set an example for my children <input type="checkbox"/> Other (please specify) | <p>1. Why is it important to me to be a saver?</p> <p><i>(Select all that apply)</i></p> <ul style="list-style-type: none"> <input type="checkbox"/> To become financially independent <input type="checkbox"/> To buy things that I like <input type="checkbox"/> To avoid debt <input type="checkbox"/> To be seen as a financially responsible person <input type="checkbox"/> To improve my financial well-being and peace of mind <input type="checkbox"/> To avoid asking family and friends for loans <input type="checkbox"/> To be able to invest or to buy an asset <input type="checkbox"/> To be part of a stokvel/ savings group <input type="checkbox"/> To set an example for my children <input type="checkbox"/> Other (please specify) |

| | |
|---|---|
| <p>2.What do I need to save for in the next 12 months?</p> <p><i>(Describe your goals in as much detail as possible)</i></p> | <p>2.What do I want to save for in the next 12 months?</p> <p><i>(Describe your goals in as much detail as possible)</i></p> |
| <p>3.To build a short-term savings-buffer or emergency fund, I can realistically afford to save R_____ per month.</p> <p><i>(Please provide a Rand amount in numbers)</i></p> | <p>3.To build a short-term savings-buffer or emergency fund, I can realistically afford to save R_____</p> <p><i>(please estimate a Rand amount in numbers)</i> <i>(select one period)</i></p> <p><input type="checkbox"/> every week</p> <p><input type="checkbox"/> every 2nd week</p> <p><input type="checkbox"/> every month</p> <p><input type="checkbox"/> every year</p> <p><input type="checkbox"/> Other (please specify)</p> |
| <p>4. What tools do I have available to build a savings-buffer or emergency fund? <i>(Select maximum 3 items)</i></p> <p><input type="checkbox"/> I have an income or salary</p> <p><input type="checkbox"/> I have time to make saving decisions</p> <p><input type="checkbox"/> I have a safe place to store my savings (account, stokvel, etc.)</p> <p><input type="checkbox"/> I am motivated to save money</p> <p><input type="checkbox"/> I have a debit order or automatic reminder to save</p> <p><input type="checkbox"/> I have a trusted financial advisor</p> <p><input type="checkbox"/> I have self-control to save money</p> <p><input type="checkbox"/> I budget to save money every month</p> <p><input type="checkbox"/> Other (please specify)</p> | <p>4.What tools do I have available that can help me to build a savings-buffer or emergency fund? <i>(Select all that apply)</i></p> <p><input type="checkbox"/> I have an income or salary</p> <p><input type="checkbox"/> I have time to make saving decisions</p> <p><input type="checkbox"/> I have a safe place to store my savings (account, stokvel, etc.)</p> <p><input type="checkbox"/> I am motivated to save money</p> <p><input type="checkbox"/> I have a debit order or automatic reminder to save</p> <p><input type="checkbox"/> I have a trusted financial advisor</p> <p><input type="checkbox"/> I have self-control to save money</p> <p><input type="checkbox"/> I budget to save money every month</p> <p><input type="checkbox"/> I have freedom to decide what amount/ when/ how I want to save</p> <p><input type="checkbox"/> Other (please specify)</p> |

| | |
|---|--|
| <p>5.Which of the following tools do I need to start using, or use better, to build a savings-buffer or emergency fund?</p> <p><i>(Select maximum 3 items)</i></p> <p><input type="checkbox"/> My income or salary</p> <p><input type="checkbox"/> I have time to take time to make saving decisions</p> <p><input type="checkbox"/> A safe place to store my savings (account, stokvel, etc.)</p> <p><input type="checkbox"/> Motivation to save money</p> <p><input type="checkbox"/> A debit order or automatic reminder to save</p> <p><input type="checkbox"/> A trusted financial advisor</p> <p><input type="checkbox"/> Self-control to save money</p> <p><input type="checkbox"/> A budget to save money every month</p> <p><input type="checkbox"/> Other (please specify)</p> | <p>5.Which of the following tools do I want to start using, or use better, to build a savings-buffer or emergency fund?</p> <p><i>(Select all items that apply)</i></p> <p><input type="checkbox"/> My income or salary</p> <p><input type="checkbox"/> I have time to take time to make saving decisions</p> <p><input type="checkbox"/> A safe place to store my savings (account, stokvel, etc.)</p> <p><input type="checkbox"/> Motivation to save money</p> <p><input type="checkbox"/> A debit order or automatic reminder to save</p> <p><input type="checkbox"/> A trusted financial advisor</p> <p><input type="checkbox"/> Self-control to save money</p> <p><input type="checkbox"/> A budget to save money every month</p> <p><input type="checkbox"/> Give myself freedom to decide what amount/ when/ how I want to save</p> <p><input type="checkbox"/> Other (please specify)</p> |
| <p>6.Why would the tools I have selected above be useful to ensure that I build a savings-buffer or emergency fund for myself?</p> <p><i>(Please motivate in as much detail as possible)</i></p> | <p>6.Why would the tools I have selected above be useful to build a savings-buffer or emergency fund for myself?</p> <p><i>(Please motivate in as much detail as possible)</i></p> |
| <p>7.Under what circumstances will I find it impossible to build a savings-buffer or emergency fund?</p> <p><i>(Select maximum 3 items)</i></p> <p><input type="checkbox"/> When my income is reduced</p> <p><input type="checkbox"/> When my living expenses increase</p> <p><input type="checkbox"/> When I have no specific savings goals</p> <p><input type="checkbox"/> When I lack motivation to save</p> <p><input type="checkbox"/> When I lend money to friends or family</p> <p><input type="checkbox"/> When I am on holiday</p> <p><input type="checkbox"/> If I'm not reminded to save</p> <p><input type="checkbox"/> When I don't save automatically</p> <p><input type="checkbox"/> Other (please specify)</p> | <p>7.Under what circumstances will I find it hard to build a savings-buffer or emergency fund?</p> <p><i>(Select all that apply)</i></p> <p><input type="checkbox"/> When my income is reduced</p> <p><input type="checkbox"/> When my living expenses increase</p> <p><input type="checkbox"/> When I have no specific savings goals</p> <p><input type="checkbox"/> When I lack motivation to save</p> <p><input type="checkbox"/> When I lend money to friends or family</p> <p><input type="checkbox"/> When I am on holiday</p> <p><input type="checkbox"/> If I'm not reminded to save</p> <p><input type="checkbox"/> When I don't save automatically</p> <p><input type="checkbox"/> Other (please specify)</p> |

| | |
|--|---|
| <p>8. How will I continue to build a savings-buffer or emergency fund under all circumstances? <i>(Please share a few of your ideas)</i></p> | <p>8. How can I make it easier for myself to build a savings-buffer or emergency fund under all circumstances? <i>(Please share a few of your ideas)</i></p> |
| <p>9. I plan to save R_____ in the next month (or 30 days) to build a savings-buffer or emergency fund. <i>(Please provide a Rand amount in numbers)</i></p> | <p>9. I plan to save R_____ in the next month (or 30 days) to build a savings-buffer or emergency fund. <i>(Please provide an estimated Rand amount in numbers)</i></p> |

Appendix 6: Demographics profile of participants

| Demographic | Category | Frequency | Percent |
|-----------------------|-------------------------------|------------|-------------|
| Age Group | 18-24 years | 126 | 31% |
| | 25-34 years | 196 | 48% |
| | 35-40 years | 39 | 10% |
| | 41 years and older | 44 | 11% |
| | Total | 405 | 100% |
| Highest Qualification | Secondary School (Part/Full) | 120 | 29% |
| | Tertiary Certificate/Degree | 254 | 63% |
| | Advanced Degree | 16 | 4% |
| | Professional Qualification | 15 | 4% |
| | Total | 405 | 100% |
| PFL | Very low to Low | 23 | 6% |
| | Somewhat low | 34 | 9% |
| | Neutral | 91 | 23% |
| | Somewhat high | 152 | 39% |
| | High to Very High | 88 | 23% |
| | Sub-total | 388 | 100% |
| | Missing data | 17 | |
| | Total | 405 | |
| Gender | Male | 190 | 47% |
| | Female | 215 | 53% |
| | Total | 405 | 100% |
| Number of dependents | 0 | 90 | 22% |
| | 1 | 84 | 21% |
| | 2 | 62 | 15% |
| | 3 | 60 | 15% |
| | 4 | 51 | 13% |
| | 5 | 25 | 6% |
| | 6 and more | 33 | 8% |
| | Total | 405 | 100% |
| Employment Status | Student-full time /Apprentice | 39 | 9% |
| | Employed-full time | 251 | 62% |
| | Employed-part time | 76 | 19% |
| | Unemployed-by choice | 9 | 2% |
| | Unemployed-seeking | 24 | 6% |
| | Self-employed | 6 | 2% |
| | Total | 405 | 100% |
| Income Group | Less than R5000 p/m | 105 | 26% |
| | R5000-R14999 p/m | 154 | 38% |
| | R15000-R24999 p/m | 91 | 22% |
| | R25000-R49999 p/m | 47 | 12% |
| | R50000 p/m and more | 7 | 2% |
| | Total | 404 | 100% |
| | Prefer not to say | 1 | |
| Total | 405 | | |

Appendix 7: Hypothetical choice decision paths (H₁)

| Path | | Question 1 | Question 2 | Question 3 | Question 4 | Question 5 | Question 6 | Question 7 | Question 8 | Question 9 | Question 10 |
|------|--------|------------------------------|--------------------------------|--------------------------------|-------------------------------------|-----------------------------------|--------------------------------|-------------------------------------|--------------------------------|-------------------------------------|-------------------------------------|
| | A B | Now R3,000/ 3mnths R3,300 | Now R3,000/3mnths R3,600 | Now R3,000/3mnths R4,500 | 12mnths R3,000/15mnths R4,500 | 12mnths R3,000/ 15mnths R3,600 | Now R3,000/3mnths R3,150 | 12mnths R3,000/15mnths R3,150 | Now R3,000/3mnths R3,060 | 12mnths R3,000/15mnths R3,060 | 12mnths R3,000/15mnths R3,300 |
| | | 10% | 20% | 50% | 50% | 20% | 5% | 5% | 2% | 2% | 10% |
| 1 | | A (1) | A (1) | A (1) | A (1) | | | | | | A (1) |
| 2 | | A (1) | A (1) | A (1) | A (1) | | | | | | B (0) |
| 3 | | A (1) | A (1) | A (1) | B (0) | | | | | | A (1) |
| 4 | | A (1) | A (1) | A (1) | B (0) | | | | | | B (0) |
| 5 | | A (1) | A (1) | B (0) | A (1) | | | | | | A (1) |
| 6 | | A (1) | A (1) | B (0) | A (1) | | | | | | B (0) |
| 7 | | A (1) | A (1) | B (0) | B (0) | | | | | | A (1) |
| 8 | | A (1) | A (1) | B (0) | B (0) | | | | | | B (0) |
| 9 | | A (1) | A (1) | N/a | N/a | | | | | | A (1) |
| 10 | | A (1) | A (1) | N/a | N/a | | | | | | B (0) |
| 11 | | A (1) | B (0) | | | A (1) | | | | | A (1) |
| 12 | | A (1) | B (0) | | | B (0) | | | | | A (1) |
| 13 | | A (1) | B (0) | | | B (0) | | | | | B (0) |
| 14 | | A (1) | B (0) | | | N/a | | | | | B (0) |
| 1 | | B (0) | | | | | A (1) | A (1) | | | A (1) |
| 2 | | B (0) | | | | | A (1) | A (1) | | | B (0) |
| 3 | | B (0) | | | | | A (1) | B (0) | | | B (0) |
| 4 | | B (0) | | | | | B (0) | | A (1) | A (1) | A (1) |
| 5 | | B (0) | | | | | B (0) | | A (1) | A (1) | B (0) |
| 6 | | B (0) | | | | | B (0) | | A (1) | B (0) | A (1) |
| 7 | | B (0) | | | | | B (0) | | A (1) | B (0) | B (0) |
| 8 | | B (0) | | | | | B (0) | | B (0) | A (1) | A (1) |
| 9 | | B (0) | | | | | B (0) | | B (0) | A (1) | B (0) |
| 10 | | B (0) | | | | | B (0) | | B (0) | B (0) | A (1) |
| 11 | | B (0) | | | | | B (0) | | B (0) | B (0) | B (0) |
| 12 | | B (0) | | | | | N/a | | A (1) | A (1) | B (0) |
| 13 | | B (0) | | | | | N/a | | A (1) | N/a | A (1) |
| 14 | | B (0) | | | | | N/a | | B (0) | N/a | A (1) |

Appendix 8: Results of Mann-Whitney U Tests

8.1 Present bias and commitment preference (H_1)

Hypothesis Test Summary

| | Null Hypothesis | Test | Sig. ^{a,b} | Decision |
|---|--|---|---------------------|-----------------------------|
| 1 | The distribution of Commit Preference Score is the same across categories of Present biased. | Independent-Samples Mann-Whitney U Test | .491 | Retain the null hypothesis. |

a. The significance level is .050.

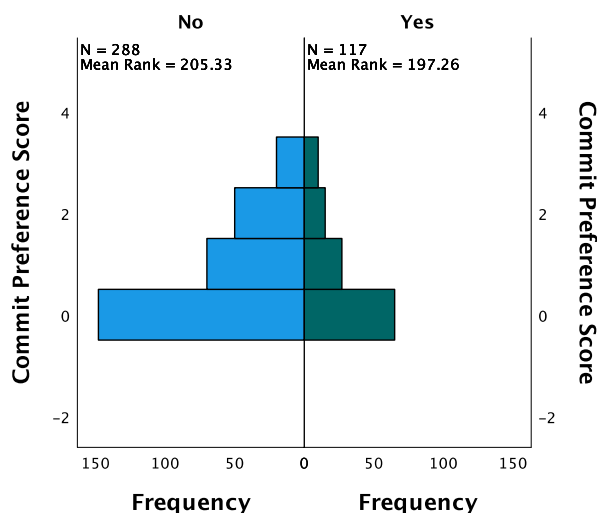
b. Asymptotic significance is displayed.

Independent-Samples Mann-Whitney U Test Summary

| | |
|-------------------------------|-----------|
| Total N | 405 |
| Mann-Whitney U | 16176.000 |
| Wilcoxon W | 23079.000 |
| Test Statistic | 16176.000 |
| Standard Error | 976.407 |
| Standardized Test Statistic | -.688 |
| Asymptotic Sig.(2-sided test) | .491 |

Independent-Samples Mann-Whitney U Test

Present-biased



8.2 Certainty-effect bias and flexibility preference (H₂)

Hypothesis Test Summary

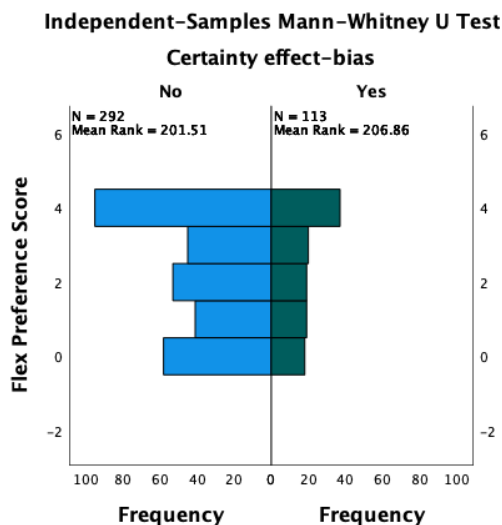
| | Null Hypothesis | Test | Sig. ^{a,b} | Decision |
|---|---|---|---------------------|-----------------------------|
| 1 | The distribution of Flex Preference Score is the same across categories of Certainty-effect bias. | Independent-Samples Mann-Whitney U Test | .671 | Retain the null hypothesis. |

a. The significance level is .050.

b. Asymptotic significance is displayed.

Independent-Samples Mann-Whitney U Test Summary

| | |
|-------------------------------|-----------|
| Total N | 405 |
| Mann-Whitney U | 16934.500 |
| Wilcoxon W | 23375.500 |
| Test Statistic | 16934.500 |
| Standard Error | 1027.534 |
| Standardized Test Statistic | .425 |
| Asymptotic Sig.(2-sided test) | .671 |



Appendix 9: Descriptive statistics – Intent strata (H₃)

| Demographic | Category | T ₁ Frequency | % | T ₂ Frequency | % | Control Frequency | % |
|-----------------------|------------------------------|-----------------------------|-------------|-----------------------------|-------------|----------------------|-------------|
| Age Group | 18-24 yrs | 32 | 31% | 25 | 26% | 35 | 34% |
| | 25-34 yrs | 53 | 51% | 48 | 49% | 52 | 50% |
| | 35-40 yrs | 9 | 9% | 13 | 13% | 7 | 7% |
| | > 40 yrs | 9 | 9% | 12 | 12% | 10 | 10% |
| | Total | 103 | 100% | 98 | 100% | 104 | 100% |
| Highest Qualification | Secondary School (Part/Full) | 24 | 23% | 24 | 24% | 30 | 29% |
| | Tertiary Certificate/Degree | 74 | 72% | 68 | 69% | 61 | 59% |
| | Advanced Degree | 3 | 3% | 2 | 2% | 9 | 9% |
| | Professional Qualification | 2 | 2% | 4 | 4% | 4 | 4% |
| | Total | 103 | 100% | 98 | 100% | 104 | 100% |
| PFL | Very low to Low | 7 | 7% | 5 | 5% | 4 | 4% |
| | Somewhat low | 3 | 3% | 10 | 10% | 12 | 12% |
| | Neutral | 25 | 24% | 20 | 21% | 25 | 24% |
| | Somewhat high | 39 | 38% | 41 | 42% | 34 | 33% |
| | High to Very High | 24 | 23% | 18 | 18% | 25 | 24% |
| | Total | 98 | 95% | 94 | 96% | 100 | 96% |
| | Missing data | 5 | 5% | 4 | 4% | 4 | 4% |
| Total | 103 | 100% | 98 | 100% | 104 | 100% | |
| Gender | Male | 45 | 44% | 52 | 53% | 47 | 45% |
| | Female | 58 | 56% | 46 | 47% | 57 | 55% |
| | Total | 103 | 100% | 98 | 100% | 104 | 100% |
| Location | Free State | 1 | 1% | 3 | 3% | 5 | 5% |
| | Gauteng | 63 | 61% | 58 | 59% | 58 | 56% |
| | Kwa-Zulu Natal | 10 | 10% | 10 | 10% | 12 | 12% |
| | Limpopo | 3 | 3% | 3 | 3% | 3 | 3% |
| | Mpumalanga | 1 | 1% | 3 | 3% | 6 | 6% |
| | North-West Province | 2 | 2% | 1 | 1% | 1 | 1% |
| | Western Cape | 14 | 14% | 17 | 17% | 13 | 13% |
| | Eastern Cape | 9 | 9% | 3 | 3% | 6 | 6% |
| | Total | 103 | 100% | 98 | 100% | 104 | 100% |
| Number of dependents | 0 | 21 | 20% | 21 | 21% | 22 | 21% |
| | 1 | 26 | 25% | 19 | 19% | 21 | 20% |
| | 2 | 15 | 15% | 15 | 15% | 14 | 13% |
| | 3 | 13 | 13% | 12 | 12% | 18 | 17% |
| | 4 | 14 | 14% | 12 | 12% | 15 | 14% |
| | 5 | 8 | 8% | 6 | 6% | 8 | 8% |
| | 6 and more | 6 | 6% | 13 | 13% | 6 | 6% |
| | Total | 103 | 100% | 98 | 100% | 104 | 100% |
| Employment Status | Student-full /Apprentice | 7 | 7% | 8 | 8% | 13 | 13% |
| | Employed-full time | 74 | 72% | 66 | 67% | 66 | 63% |
| | Employed-part time | 13 | 13% | 15 | 15% | 19 | 18% |
| | Unemployed-by choice | 1 | 1% | 2 | 2% | - | 0% |
| | Unemployed-seeking | 7 | 7% | 4 | 4% | 6 | 6% |
| | Self-employed | 1 | 1% | 3 | 3% | - | 0% |
| | Total | 103 | 100% | 98 | 100% | 104 | 100% |
| Income Group | Less than R5k p/m | 18 | 17% | 19 | 19% | 30 | 29% |
| | R5k-R14.9k p/m | 39 | 38% | 36 | 37% | 41 | 39% |
| | R15k-R24.9k p/m | 29 | 28% | 28 | 29% | 19 | 18% |
| | R25k-R49.9k p/m | 16 | 16% | 12 | 12% | 11 | 11% |
| | R50k and more p/m | 1 | 1% | 2 | 2% | 3 | 3% |
| | Total | 103 | 100% | 97 | 99% | 104 | 100% |
| | Prefer not to say | - | - | 1 | 1% | - | 0% |
| Total | 103 | 100% | 98 | 100% | 104 | 100% | |

Appendix 10: Regression results – Intent strata (H₃)

Descriptive Statistics

| | Mean | Std. Deviation | N |
|------------------------|------|----------------|-----|
| Total Intent at End | 1.54 | .751 | 305 |
| Treat1 Dummy | .34 | .474 | 305 |
| Treat2 Dummy | .32 | .468 | 305 |
| Total Intent at Base | 1.66 | .771 | 305 |
| Commitment Score | .76 | .939 | 305 |
| Flexibility Score | 2.22 | 1.513 | 305 |
| Perceived Fin Literacy | 4.68 | 1.223 | 292 |
| Age Group | 3.00 | .898 | 305 |

Model Summary^b

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|-------|-------------------|----------|-------------------|----------------------------|
| 1 | .744 ^a | .554 | .543 | .508 |

a. Predictors: (Constant), Age Group, Perceived Fin Literacy, Treat1 Dummy, Commitment Score, Total Intent at Base, Treat2 Dummy, Flexibility Score

b. Dependent Variable: Total Intent at End

ANOVA^a

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|-------|------------|----------------|-----|-------------|--------|--------------------|
| 1 | Regression | 90.801 | 7 | 12.972 | 50.350 | <.001 ^b |
| | Residual | 73.167 | 284 | .258 | | |
| | Total | 163.968 | 291 | | | |

a. Dependent Variable: Total Intent at End

b. Predictors: (Constant), Age Group, Perceived Fin Literacy, Treat1 Dummy, Commitment Score, Total Intent at Base, Treat2 Dummy, Flexibility Score

Coefficients^a

| Model | Unstandardized Coefficients | | Standardized Coefficients | T | Sig. | 95.0% Confidence Interval for B | | Correlations | | | Collinearity Statistics | |
|------------------------|-----------------------------|------------|---------------------------|--------|-------|---------------------------------|-------------|--------------|---------|-------|-------------------------|-------|
| | B | Std. Error | Beta | | | Lower Bound | Upper Bound | Zero-order | Partial | Part | Tolerance | VIF |
| 1 (Constant) | .672 | .200 | | 3.360 | .001 | .278 | 1.066 | | | | | |
| Treat1 Dummy | -.204 | .072 | -.129 | -2.823 | .005 | -.346 | -.062 | -.093 | -.165 | -.112 | .755 | 1.325 |
| Treat2 Dummy | -.208 | .073 | -.129 | -2.830 | .005 | -.352 | -.063 | -.047 | -.166 | -.112 | .752 | 1.330 |
| Total Intent at Base | .650 | .040 | .667 | 16.306 | <.001 | .571 | .728 | .707 | .695 | .646 | .938 | 1.066 |
| Commitment Score | .021 | .045 | .027 | .478 | .633 | -.067 | .110 | .005 | .028 | .019 | .498 | 2.008 |
| Flexibility Score | .046 | .028 | .093 | 1.651 | .100 | -.009 | .101 | .112 | .097 | .065 | .493 | 2.029 |
| Perceived Fin Literacy | -.094 | .025 | -.153 | -3.728 | <.001 | -.143 | -.044 | -.303 | -.216 | -.148 | .939 | 1.065 |
| Age Group | .082 | .034 | .098 | 2.447 | .015 | .016 | .148 | .073 | .144 | .097 | .972 | 1.029 |

a. Dependent Variable: Total Intent at End

Collinearity Diagnostics^a

| Model | Dimension | Eigenvalue | Condition Index | Variance Proportions | | | | | | | | |
|-------|-----------|------------|-----------------|----------------------|--------------|--------------|----------------------|------------------|-------------------|------------------------|-----------|-----|
| | | | | (Constant) | Treat1 Dummy | Treat2 Dummy | Total Intent at Base | Commitment Score | Flexibility Score | Perceived Fin Literacy | Age Group | |
| 1 | 1 | 5.537 | 1.000 | .00 | .01 | .01 | .00 | .00 | .00 | .00 | .00 | .00 |
| | 2 | 1.003 | 2.349 | .00 | .24 | .25 | .00 | .00 | .00 | .00 | .00 | .00 |
| | 3 | .797 | 2.636 | .00 | .00 | .01 | .00 | .26 | .06 | .00 | .00 | .00 |
| | 4 | .309 | 4.236 | .00 | .70 | .68 | .05 | .01 | .01 | .00 | .00 | .00 |
| | 5 | .164 | 5.816 | .00 | .04 | .03 | .72 | .01 | .01 | .06 | .04 | .04 |
| | 6 | .105 | 7.272 | .00 | .00 | .00 | .05 | .58 | .77 | .11 | .02 | .02 |
| | 7 | .070 | 8.924 | .00 | .00 | .00 | .00 | .02 | .03 | .26 | .76 | .76 |
| | 8 | .017 | 18.010 | .99 | .01 | .01 | .18 | .12 | .12 | .56 | .17 | .17 |

a. Dependent Variable: Total Intent at End

Casewise Diagnostics^a

| Case Number | Std. Residual | Total Intent at End | Predicted Value | Residual |
|-------------|---------------|---------------------|-----------------|----------|
| 67 | 3.383 | 3 | .95 | 1.717 |
| 72 | 3.525 | 3 | 1.54 | 1.789 |
| 167 | 4.068 | 4 | 2.27 | 2.065 |
| 186 | 3.206 | 4 | 2.04 | 1.627 |
| 288 | -3.112 | 1 | 2.58 | -1.580 |
| 299 | 3.073 | 4 | 2.77 | 1.560 |

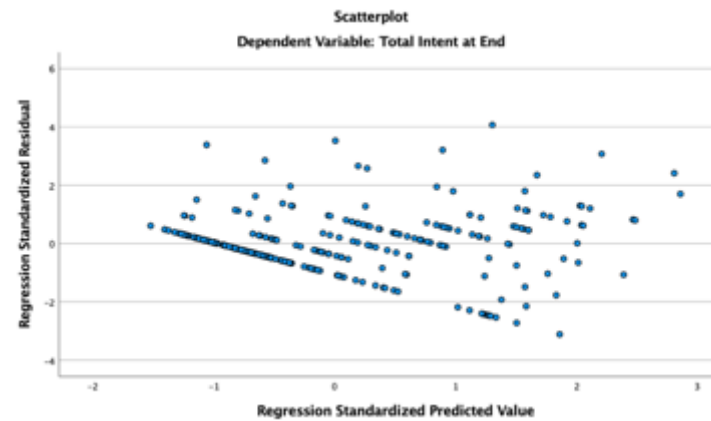
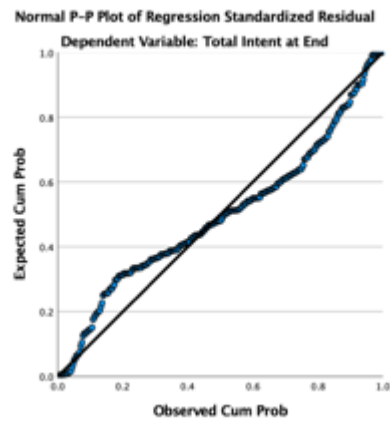
a. Dependent Variable: Total Intent at End

Residuals Statistics^a

| | Minimum | Maximum | Mean | Std. Deviation | N |
|-----------------------------------|---------|---------|-------|----------------|-----|
| Predicted Value | .69 | 3.14 | 1.55 | .558 | 292 |
| Std. Predicted Value | -1.521 | 2.857 | .007 | .999 | 292 |
| Standard Error of Predicted Value | .054 | .139 | .083 | .015 | 292 |
| Adjusted Predicted Value | .68 | 3.07 | 1.54 | .557 | 292 |
| Residual | -1.580 | 2.065 | .003 | .505 | 292 |
| Std. Residual | -3.112 | 4.068 | .006 | .996 | 292 |
| Stud. Residual | -3.178 | 4.160 | .006 | 1.012 | 292 |
| Deleted Residual | -1.648 | 2.159 | .003 | .522 | 292 |
| Stud. Deleted Residual | -3.231 | 4.285 | .007 | 1.021 | 292 |
| Mahal. Distance | 2.306 | 20.748 | 6.989 | 3.080 | 292 |
| Cook's Distance | .000 | .098 | .004 | .011 | 292 |
| Centered Leverage Value | .008 | .071 | .024 | .011 | 292 |

a. Dependent Variable: Total Intent at End

Charts



Appendix 11: Descriptive statistics – Low/No Intent strata (H₃)

| Demographic | Category | T ₁ Frequency | % | T ₂ Frequency | % | Control Frequency | % |
|-----------------------|------------------------------|-----------------------------|-------------|-----------------------------|-------------|----------------------|-------------|
| Age Group | 18-24 yrs | - | - | 10 | 30% | 15 | 42% |
| | 25-34 yrs | 9 | 29% | 15 | 45% | 15 | 42% |
| | 35-40 yrs | 13 | 42% | 3 | 9% | 3 | 8% |
| | > 40 yrs | 9 | 29% | 5 | 15% | 3 | 8% |
| | Total | 31 | 100% | 33 | 100% | 36 | 100% |
| Highest Qualification | Secondary School (Part/Full) | 12 | 39% | 12 | 36% | 18 | 50% |
| | Tertiary Certificate/Degree | 18 | 58% | 19 | 58% | 14 | 39% |
| | Advanced Degree | - | - | 1 | 3% | 1 | 3% |
| | Professional Qualification | 1 | 3% | 1 | 3% | 3 | 8% |
| | Total | 31 | 100% | 33 | 100% | 36 | 100% |
| PFL | Very low to Low | 2 | 6% | 1 | 3% | 4 | 11% |
| | Somewhat low | 2 | 6% | 1 | 3% | 6 | 17% |
| | Neutral | 6 | 19% | 8 | 24% | 7 | 19% |
| | Somewhat high | 15 | 48% | 11 | 33% | 12 | 33% |
| | High to Very High | 5 | 16% | 10 | 30% | 6 | 17% |
| | Total | 30 | 97% | 31 | 94% | 35 | 97% |
| | Missing data | 1 | 3% | 2 | 6% | 1 | 3% |
| Total | 31 | 100% | 33 | 100% | 36 | 100% | |
| Gender | Male | 14 | 45% | 19 | 58% | 13 | 36% |
| | Female | 17 | 55% | 14 | 42% | 23 | 64% |
| | Total | 31 | 100% | 33 | 100% | 36 | 100% |
| Location | Free State | 1 | 3% | - | - | 1 | 3% |
| | Gauteng | 19 | 61% | 17 | 52% | 20 | 56% |
| | Kwa-Zulu Natal | - | - | 3 | 9% | 2 | 6% |
| | Limpopo | 3 | 10% | 1 | 3% | 2 | 6% |
| | Mpumalanga | 1 | 3% | 1 | 3% | - | - |
| | North-West Province | - | - | - | - | 1 | 3% |
| | Western Cape | 7 | 23% | 6 | 18% | 8 | 22% |
| | Eastern Cape | - | - | 5 | 15% | 2 | 6% |
| | Total | 31 | 100% | 33 | 100% | 36 | 100% |
| Number of dependents | 0 | 11 | 35% | 6 | 18% | 9 | 25% |
| | 1 | 3 | 10% | 7 | 21% | 8 | 22% |
| | 2 | 5 | 16% | 6 | 18% | 7 | 19% |
| | 3 | 8 | 26% | 5 | 15% | 4 | 11% |
| | 4 | 4 | 13% | 4 | 12% | 2 | 6% |
| | 5 | - | - | 1 | 3% | 2 | 6% |
| | 6 and more | - | - | 4 | 12% | 4 | 11% |
| | Total | 31 | 100% | 33 | 100% | 36 | 100% |
| Employment Status | Student-full /Apprentice | 2 | 6% | 1 | 3% | 8 | 22% |
| | Employed-full time | 15 | 48% | 17 | 52% | 13 | 36% |
| | Employed-part time | 9 | 29% | 11 | 33% | 9 | 25% |
| | Unemployed-by choice | 3 | 10% | 1 | 3% | 2 | 6% |
| | Unemployed-seeking | 2 | 6% | 1 | 3% | 4 | 11% |
| | Self-employed | - | - | 2 | 6% | - | - |
| | Total | 31 | 100% | 33 | 100% | 36 | 100% |
| Income Group | Less than R5k p/m | 11 | 35% | 9 | 27% | 18 | 50% |
| | R5k-R14.9k p/m | 12 | 39% | 12 | 36% | 14 | 39% |
| | R15k-R24.9k p/m | 4 | 13% | 10 | 30% | 1 | 3% |
| | R25k-R49.9k p/m | 3 | 10% | 2 | 6% | 3 | 8% |
| | R50k and more p/m | 1 | 3% | - | - | - | - |
| | Total | 31 | 100% | 33 | 100% | 36 | 100% |
| | Prefer not to say | - | - | - | - | - | - |
| Total | 31 | 100% | 33 | 100% | 36 | 100% | |

Appendix 12: Regression results – Low/No Intent strata (H₃)

Descriptive Statistics

| | Mean | Std. Deviation | N |
|----------------------|------|----------------|-----|
| Total Intent at End | 4.40 | 1.580 | 100 |
| Treat1 Dummy | .31 | .465 | 100 |
| Treat2 Dummy | .33 | .473 | 100 |
| Total Intent at Base | 5.04 | .937 | 100 |
| Commitment Score | .86 | 1.054 | 100 |
| Flexibility Score | 2.50 | 1.494 | 100 |
| Income Group | 1.96 | .974 | 100 |

Model Summary^b

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|-------|-------------------|----------|-------------------|----------------------------|
| 1 | .538 ^a | .289 | .243 | 1.375 |

a. Predictors: (Constant), Income Group, Commitment Score, Treat1 Dummy, Total Intent at Base, Treat2 Dummy, Flexibility Score

b. Dependent Variable: Total Intent at End

ANOVA^a

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|-------|------------|----------------|----|-------------|-------|--------------------|
| 1 | Regression | 71.524 | 6 | 11.921 | 6.308 | <.001 ^b |
| | Residual | 175.742 | 93 | 1.890 | | |
| | Total | 247.266 | 99 | | | |

a. Dependent Variable: Total Intent at End

b. Predictors: (Constant), Income Group, Commitment Score, Treat1 Dummy, Gender, Total Intent at Base, Treat2 Dummy, Flexibility Score

Coefficients^a

| Model | Unstandardized Coefficients | | Standardized Coefficients | T | Sig. | 95.0% Confidence Interval for B | | Correlations | | | Collinearity Statistics | |
|----------------------|-----------------------------|------------|---------------------------|--------|-------|---------------------------------|-------------|--------------|---------|-------|-------------------------|-------|
| | B | Std. Error | Beta | | | Lower Bound | Upper Bound | Zero-order | Partial | Part | Tolerance | VIF |
| 1 (Constant) | -.391 | .957 | | -.409 | .684 | -2.292 | 1.509 | | | | | |
| Treat1 Dummy | -1.216 | .356 | -.358 | -3.415 | <.001 | -1.924 | -.509 | -.123 | -.334 | -.299 | .696 | 1.436 |
| Treat2 Dummy | -.908 | .351 | -.272 | -2.589 | .011 | -1.605 | -.212 | -.033 | -.259 | -.226 | .694 | 1.440 |
| Total Intent at Base | .906 | .159 | .537 | 5.702 | <.001 | .590 | 1.221 | .412 | .509 | .499 | .862 | 1.160 |
| Commitment Score | .179 | .179 | .120 | 1.000 | .320 | -.177 | .535 | .028 | .103 | .087 | .535 | 1.871 |
| Flexibility Score | .058 | .128 | .054 | .451 | .653 | -.196 | .312 | .042 | .047 | .039 | .522 | 1.915 |
| Income Group | .307 | .148 | .189 | 2.071 | .041 | .013 | .602 | .050 | .210 | .181 | .913 | 1.095 |

a. Dependent Variable: Total Intent at End

Collinearity Diagnostics^a

| Model | Dimension | Eigenvalue | Condition Index | Variance Proportions | | | | | | |
|-------|-----------|------------|-----------------|----------------------|--------------|--------------|----------------------|------------------|-------------------|--------------|
| | | | | (Constant) | Treat1 Dummy | Treat2 Dummy | Total Intent at Base | Commitment Score | Flexibility Score | Income Group |
| 1 | 1 | 4.697 | 1.000 | .00 | .01 | .01 | .00 | .01 | .00 | .01 |
| | 2 | 1.016 | 2.150 | .00 | .22 | .22 | .00 | .01 | .00 | .00 |
| | 3 | .744 | 2.512 | .00 | .05 | .00 | .00 | .31 | .04 | .00 |
| | 4 | .285 | 4.057 | .00 | .59 | .68 | .00 | .00 | .07 | .00 |
| | 5 | .178 | 5.141 | .00 | .04 | .06 | .01 | .09 | .07 | .79 |
| | 6 | .067 | 8.383 | .04 | .05 | .01 | .15 | .49 | .77 | .06 |
| | 7 | .013 | 19.036 | .95 | .04 | .03 | .84 | .10 | .05 | .14 |

a. Dependent Variable: Total Intent at End

Casewise Diagnostics^a

| Case Number | Std. Residual | Total Intent at End | Predicted Value | Residual |
|-------------|---------------|---------------------|-----------------|----------|
| 41 | -3.026 | 1 | 5.16 | -4.160 |

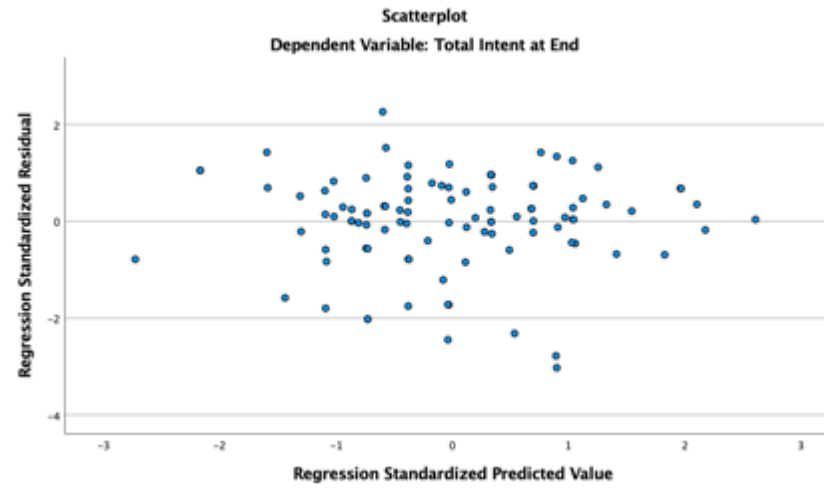
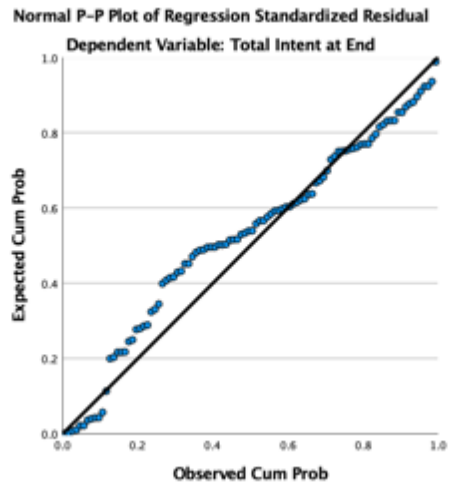
a. Dependent Variable: Total Intent at End

Residuals Statistics^a

| | Minimum | Maximum | Mean | Std. Deviation | N |
|-----------------------------------|---------|---------|-------|----------------|-----|
| Predicted Value | 2.08 | 6.61 | 4.40 | .850 | 100 |
| Std. Predicted Value | -2.728 | 2.607 | .000 | 1.000 | 100 |
| Standard Error of Predicted Value | .252 | .514 | .358 | .064 | 100 |
| Adjusted Predicted Value | 2.25 | 6.61 | 4.40 | .855 | 100 |
| Residual | -4.160 | 3.113 | .000 | 1.332 | 100 |
| Std. Residual | -3.026 | 2.264 | .000 | .969 | 100 |
| Stud. Residual | -3.148 | 2.310 | -.002 | 1.007 | 100 |
| Deleted Residual | -4.504 | 3.238 | -.005 | 1.438 | 100 |
| Stud. Deleted Residual | -3.313 | 2.366 | -.007 | 1.025 | 100 |
| Mahal. Distance | 2.325 | 12.851 | 5.940 | 2.533 | 100 |
| Cook's Distance | .000 | .130 | .011 | .021 | 100 |
| Centered Leverage Value | .023 | .130 | .060 | .026 | 100 |

a. Dependent Variable: Total Intent at End

Charts



Appendix 13: Regression Results – Intent Strata (H₄)

Descriptive Statistics

| | Mean | Std. Deviation | N |
|-----------------------|---------|----------------|-----|
| Saving Amount at P2 | 1672.45 | 2042.942 | 216 |
| Saving Amount at Base | 2274.75 | 3434.285 | 216 |
| Intent to Save at P2 | 1.90 | 1.246 | 216 |
| Income Group | 2.50 | .979 | 216 |

Model Summary^b

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|-------|-------------------|----------|-------------------|----------------------------|
| 1 | .406 ^a | .165 | .153 | 1879.989 |

a. Predictors: (Constant), Income Group, Intent to Save at P2, Saving Amount at Base

b. Dependent Variable: Saving Amount at P2

ANOVA^a

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|-------|------------|----------------|-----|--------------|--------|--------------------|
| 1 | Regression | 148042444.824 | 3 | 49347481.608 | 13.962 | <.001 ^b |
| | Residual | 749284246.713 | 212 | 3534359.654 | | |
| | Total | 897326691.537 | 215 | | | |

a. Dependent Variable: Saving Amount at P2

b. Predictors: (Constant), Income Group, Total Intent at P2, Saving Amount at Base

Coefficients^a

| Model | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | 95.0% Confidence Interval for B | | Correlations | | | Collinearity Statistics | |
|-----------------------|-----------------------------|------------|---------------------------|--------|-------|---------------------------------|-------------|--------------|---------|-------|-------------------------|-------|
| | B | Std. Error | Beta | | | Lower Bound | Upper Bound | Zero-order | Partial | Part | Tolerance | VIF |
| 1 (Constant) | 331.865 | 407.027 | | .815 | .416 | -470.473 | 1134.203 | | | | | |
| Saving Amount at Base | .154 | .038 | .258 | 4.045 | <.001 | .079 | .228 | .302 | .268 | .254 | .967 | 1.034 |
| Intent to Save at P2 | -171.420 | 102.943 | -.105 | -1.665 | .097 | -374.342 | -31.502 | -.106 | -.114 | -.105 | .999 | 1.001 |
| Income Group | 526.092 | 133.230 | .252 | 3.949 | <.001 | 263.466 | 788.718 | .301 | .262 | .248 | .967 | 1.035 |

a. Dependent Variable: Saving Amount at P2

Collinearity Diagnostics^a

| Model | Dimension | Eigenvalue | Condition Index | Variance Proportions | | | |
|-------|-----------|------------|-----------------|----------------------|-----------------------|--------------------|--------------|
| | | | | (Constant) | Saving Amount at Base | Total Intent at P2 | Income Group |
| 1 | 1 | 3.102 | 1.000 | .01 | .03 | .02 | .01 |
| | 2 | .603 | 2.267 | .01 | .91 | .05 | .00 |
| | 3 | .234 | 3.643 | .03 | .05 | .77 | .17 |
| | 4 | .060 | 7.165 | .95 | .00 | .15 | .82 |

a. Dependent Variable: Saving Amount at P2

Casewise Diagnostics^a

| Case Number | Saving Amount | | | |
|-------------|---------------|-------|-----------------|----------|
| | Std. Residual | at P2 | Predicted Value | Residual |
| 43 | 3.124 | 7500 | 1626.26 | 5873.745 |
| 68 | 3.754 | 8500 | 1443.00 | 7056.996 |
| 142 | 4.486 | 10000 | 1565.87 | 8434.130 |
| 150 | 3.638 | 10000 | 3160.27 | 6839.733 |
| 202 | 5.248 | 12000 | 2134.13 | 9865.875 |
| 214 | 3.426 | 10000 | 3558.82 | 6441.181 |

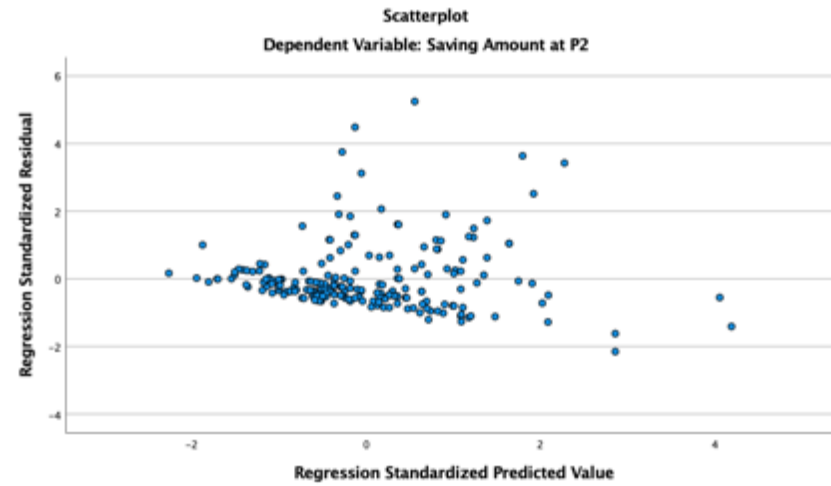
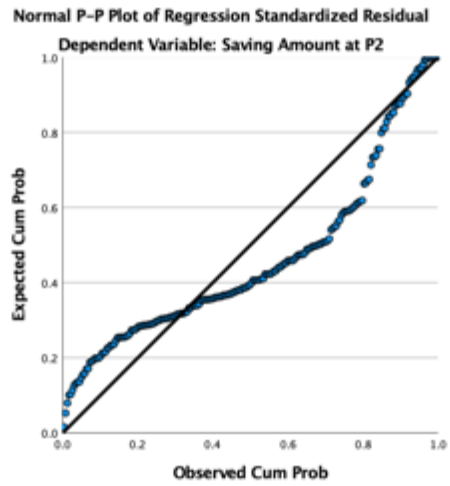
a. Dependent Variable: Saving Amount at P2

Residuals Statistics^a

| | Minimum | Maximum | Mean | Std. Deviation | N |
|-----------------------------------|-----------|-----------|---------|----------------|-----|
| Predicted Value | -206.20 | 5148.64 | 1672.45 | 829.801 | 216 |
| Std. Predicted Value | -2.264 | 4.189 | .000 | 1.000 | 216 |
| Standard Error of Predicted Value | 145.280 | 935.018 | 233.277 | 105.282 | 216 |
| Adjusted Predicted Value | -231.53 | 6000.51 | 1679.14 | 860.618 | 216 |
| Residual | -4042.460 | 9865.875 | .000 | 1866.827 | 216 |
| Std. Residual | -2.150 | 5.248 | .000 | .993 | 216 |
| Stud. Residual | -2.232 | 5.288 | -.002 | 1.004 | 216 |
| Deleted Residual | -4353.793 | 10018.480 | -6.685 | 1910.343 | 216 |
| Stud. Deleted Residual | -2.253 | 5.662 | .004 | 1.027 | 216 |
| Mahal. Distance | .289 | 52.187 | 2.986 | 5.566 | 216 |
| Cook's Distance | .000 | .211 | .006 | .021 | 216 |
| Centered Leverage Value | .001 | .243 | .014 | .026 | 216 |

a. Dependent Variable: Saving Amount at P2

Charts



Appendix 14: Regression Results – Low/No Intent Strata (H₄)

Descriptive Statistics

| | Mean | Std. Deviation | N |
|-----------------------|---------|----------------|----|
| Saving Amount at P2 | 1238.63 | 1565.955 | 51 |
| Saving Amount at Base | 1374.96 | 1429.573 | 51 |
| Total Intent at P2 | 3.52 | 1.555 | 51 |

Model Summary^b

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|-------|-------------------|----------|-------------------|----------------------------|
| 1 | .348 ^a | .121 | .084 | 1498.560 |

a. Predictors: (Constant), Total Intent at P2, Saving Amount at Base

b. Dependent Variable: Saving Amount at P2

ANOVA^a

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|-------|------------|----------------|----|-------------|-------|-------------------|
| 1 | Regression | 14818041.897 | 2 | 7409020.949 | 3.299 | .045 ^b |
| | Residual | 107792762.025 | 48 | 2245682.542 | | |
| | Total | 122610803.922 | 50 | | | |

a. Dependent Variable: Saving Amount at P2

b. Predictors: (Constant), Total Intent at P2, Saving Amount at Base

Coefficients^a

| Model | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | 95.0% Confidence Interval for B | | Correlations | | | Collinearity Statistics | |
|-----------------------|-----------------------------|------------|---------------------------|--------|-------|---------------------------------|-------------|--------------|---------|-------|-------------------------|-------|
| | B | Std. Error | Beta | | | Lower Bound | Upper Bound | Zero-order | Partial | Part | Tolerance | VIF |
| 1 (Constant) | 1914.697 | 542.426 | | 3.530 | <.001 | 824.077 | 3005.317 | | | | | |
| Saving Amount at Base | .255 | .149 | .233 | 1.704 | .095 | -.046 | .555 | .195 | .239 | .231 | .984 | 1.017 |
| Total Intent at P2 | -291.874 | 137.388 | -.290 | -2.124 | .039 | -568.111 | -15.638 | -.260 | -.293 | -.288 | .984 | 1.017 |

a. Dependent Variable: Saving Amount at P2

Collinearity Diagnostics^a

| Model | Dimension | Eigenvalue | Condition Index | Variance Proportions | | |
|-------|-----------|------------|-----------------|----------------------|-----------------------|--------------------|
| | | | | (Constant) | Saving Amount at Base | Total Intent at P2 |
| 1 | 1 | 2.531 | 1.000 | .02 | .06 | .02 |
| | 2 | .386 | 2.561 | .05 | .93 | .07 |
| | 3 | .083 | 5.508 | .93 | .01 | .91 |

a. Dependent Variable: Saving Amount at P2

Casewise Diagnostics^a

| Case Number | Saving Amount | | | |
|-------------|---------------|-------|-----------------|----------|
| | Std. Residual | at P2 | Predicted Value | Residual |
| 34 | 5.250 | 10000 | 2132.31 | 7867.694 |

a. Dependent Variable: Saving Amount at P2

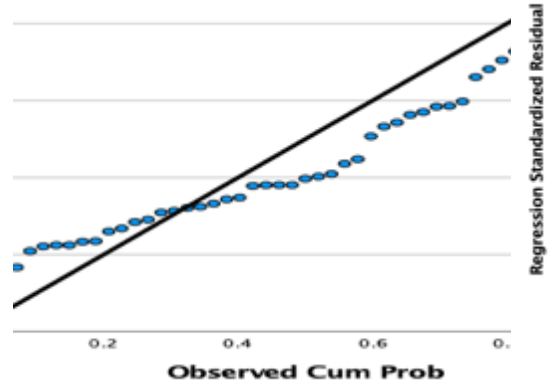
Residuals Statistics^a

| | Minimum | Maximum | Mean | Std. Deviation | N |
|-----------------------------------|-----------|----------|---------|----------------|----|
| Predicted Value | 320.90 | 2192.47 | 1238.63 | 544.390 | 51 |
| Std. Predicted Value | -1.686 | 1.752 | .000 | 1.000 | 51 |
| Standard Error of Predicted Value | 217.820 | 610.546 | 352.838 | 88.070 | 51 |
| Adjusted Predicted Value | 154.47 | 2285.55 | 1238.08 | 563.298 | 51 |
| Residual | -1728.513 | 7867.694 | .000 | 1468.283 | 51 |
| Std. Residual | -1.153 | 5.250 | .000 | .980 | 51 |
| Stud. Residual | -1.197 | 5.475 | .000 | 1.018 | 51 |
| Deleted Residual | -1862.827 | 8555.567 | .547 | 1584.755 | 51 |
| Stud. Deleted Residual | -1.203 | 8.840 | .067 | 1.412 | 51 |
| Mahal. Distance | .076 | 7.319 | 1.961 | 1.633 | 51 |
| Cook's Distance | .000 | .874 | .027 | .122 | 51 |
| Centered Leverage Value | .002 | .146 | .039 | .033 | 51 |

a. Dependent Variable: Saving Amount at P2

Charts

-P Plot of Regression Standardized Residuals
Dependent Variable: Saving Amount at P2



Scatterplot
Dependent Variable: Saving Amount at P2

