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An evaluation of the potential effect of behavioural biases on the investment patterns of individuals

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Declaration

I declare that this research report is my own original work and that all sources have been accurately reported and acknowledged. It is submitted for the degree of Master of Commerce to the University of Witwatersrand, Johannesburg. This research has not been submitted for any degree or examination at this or any other university.

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Abstract

Purpose: A saving and investing crisis exists in South Africa. Only 40% of South Africans have some form of a retirement plan. These savings deficiencies, whilst largely a function of economic inequality, are exacerbated by current economic conditions and inadequate personal financial planning. However, this lack of saving could also be partly attributed to a lack of rationality which manifests as behavioural biases. These behavioural biases cause individuals to make sub-optimal investment decisions. The purpose of this study is to determine the extent to which behavioural biases impact savings patterns of individuals.

Methodology: Data on these biases, demographic information and financial literacy have been collected by means of a survey. 309 participants responded to the survey from June to August 2019. Participants are income-earning South Africans. Various proxies were used in order to quantify the behavioural biases. A factor analysis and MANOVA were performed.

Originality/Value: This research has both theoretical and practical implications. Whilst a growing strand of research exists on behavioural finance in international markets, its application in a South African context is limited, particularly with regards to personal finance. In addition, the research has practical implications in the way fund managers and other investing service providers provide and present information to investors. This is one of the first studies which explores the effect of behavioural biases on individual's financial decision-making processes within a South African context.

Findings: Individuals are risk averse on average but appear not to understand risk from a financial perspective. Investors are short-termist and are prone to the behavioural bias of overconfidence. As investors age and tend towards retirement, the trait of overconfidence declines. Individuals with higher financial literacy tend to invest at a younger age, leading to improved retirement outcomes.

Keywords: Behavioural biases, rationality, savings, investment, investment management, personal finance, factor analysis

Chapter I. Introduction

Up until the late 1990s, most natural persons left investment decisions regarding asset allocation and savings rates to be handled almost entirely by professional financial advisors. However, a trend has emerged in recent years where individuals manage their own investment choices. This act, however, is only beneficial when people make appropriate decisions when they decide whether and how to save their money. Indeed, research has shown that most natural persons make poor choices regarding their investment decisions. Investors are expected to be aware of and adhere to accepted theoretical financial and economic models when making these decisions (Bailey, Nofsinger & O'Neil, 2003). However, this is not always the case.

Behavioural economics and finance continues to attract growing academic and corporate interest (Cronqvist, Thaler & Yu, 2018; Thaler & Sunstein, 2009; Tversky & Kahneman, 1974). The research attempts to explain deviations from accepted models or thought processes using cognitive psychology to understand the decisions made by individuals. Individuals are expected to be rational when making choices, but this rarely occurs. Rather, people tend to act irrationally in a predictable manner (Barber & Odean, 2001; Thaler & Benartzi, 2004; Thaler & Ganser, 2015).

This is in contrast with the accepted belief of economists before the advent of behavioural sciences. Economists believed that individuals occasionally did make errors in judgement and act irrationally. However, they understood this irrationality to be unpredictable and random with irrational decisions cancelling one another out leading to a reversion to the mean of rational behaviour (Sunstein, 2016). Additionally, behavioural finance suggests that the preferences of individuals also have an influence on their choices (Ritter, 2003). Behavioural decision making can be applied to different scenarios from the placement of food in a school cafeteria to the asset allocation of retirement plans (Thaler & Sunstein, 2009).

An example of the application of behavioural finance to the saving and investing decisions of individuals is the Save More Tomorrow Programme. Retirement plans have shifted from defined benefits plans to those which are defined contribution plans. This transfer, coupled with dwindling saving rates in developed countries, has led to retirement saving crises in many countries. Many employers offer their employees attractive retirement plans which often ‘match’ the contributions made by employees, essentially providing employees with free and otherwise inaccessible retirement funds. However, employees are often required to enrol in said plans. Many people fail to do so, mostly as a result of procrastination or short-termism.

The Save More Tomorrow programme solves this problem by auto-enrolling employees into retirement plans offered by their employers (Thaler & Benartzi, 2004).

Most respondents, when replying to an American survey, acknowledged that they did not save enough for retirement at present and would like to save more in the future. However, they did not know how to do so. The Save More Tomorrow programme encourages individuals to make increased contributions that correspond to future pay rises. This results in the individual's take-home pay not decreasing in monetary terms and the least painful method of increasing saving rates. The programme was piloted at a manufacturing company in 1998 and was successful over time in increasing the saving rates of employees at the manufacturing company (Thaler & Benartzi, 2004).

Accepted financial and economic models assume that economic actors are rational and act in their own best interests. Rationality is often defined as having the ability to consider and measure the benefits and costs of a potential decision before determining what action to take (Scott, 2000). Rationality can also be defined as the ability of individuals to update their beliefs and perspectives based on new information according to Bayes' theorem[1] (Barberis & Thaler, 2002). Investors are expected to be knowledgeable and use all available information at their disposal to make well-informed decisions.

Smith (1776) stated in his seminal work *The Wealth of Nations* that, ultimately, all people maximise utility and act in their own self-interest in order to maximise wealth creation. He also posited that markets are controlled by the 'invisible hand'. This 'invisible hand' somehow punishes market participants who make decisions that are irrational and are against the benefit of society. However, this punishment of errant market participants may exist, but it does not necessarily turn economically bad actors into rational human beings(Sunstein, 2016).

Mill (1874) also proposed the concept of the *homo economicus,* a rational human being who makes all decisions based on utility maximisation. This individual is ruthlessly rational in pursuing its goals in its own self-interest. This self-interest is specifically the acquisition and accumulation of wealth. The *homo economicus* perfectly weighs up the situation that they find themself in and make rational and non-emotional decisions in order to fulfil his/her self-interested goal. Human beings acting like *homo economicus* is an essential input to game theory (Von Neumann & Morgenstern, 1947). Game theory assumes that all human beings

[1] Bayes theorem is a statistical method used to calculate conditional probability. It can be used in finance to calculate the risk associated with a financial instrument.

are rational and make decisions solely based on resource (wealth) optimisation and maximisation.

However, research has shown that individuals do not always act in their own best interests and/or they do not always act rationally (Barberis & Thaler, 2002). Investors are often described as "too emotional" and are "misinformed" (Rashes, 2001). *Homo economicus* is merely a figment of our imaginations, and instead we make decisions under the mindset of the *homo sapien* (Thaler & Sunstein, 2009). Additionally, one can argue that the knowledge that investors do have is presented to them in a manner that is confusing and encourages incorrect decisions. For example, most investors do not read the prospectus of a fund or stock prior to making a buy/sell decision (Investment Company Institute, 2006). A non-financial example of this is a person shopping at a supermarket. This person is faced with a plethora of options regarding which goods to buy and often bad purchasing choices may be made because of the sheer number of items available (Thaler & Ganser, 2015).

This is not to say that accepted financial and economic models have no value. They are useful as a starting point in understanding the thought-processes of individuals. However, they must be paired with behavioural factors for useful decisions to be made (Thaler & Ganser, 2015). Accepted financial and economic models should be used as the starting point for financial decision making, whether related to investing or otherwise. It must be noted that a good decision does not necessarily result in an advantageous outcome. Individuals who evaluate their decisions based on the results of said decisions are subject to outcome bias (Baron & Hershey, 1988).

From a theoretical perspective, investors attempt to maximise their return for a given level of risk (Markowitz, 1952). It has been shown that individuals put minimal thought, if any, into crucial retirement investment decisions (Madrian & Shea, 2000). A correlation has been shown to exist between investors' personal characteristics (such as age, gender, and yearly income) and their decisions of whether to invest in a particular fund or investment. Additionally, characteristics of the fund or investment itself have an impact on the saving and investment decisions of individuals (Bailey et al., 2003; Bhandari & Deaves, 2008). Further, investment decisions can be made from a "lifecycle" perspective – the investor will choose a set of investment opportunities based on the current stage of their lifecycle. As an example, an investor saving for retirement will potentially have a different risk profile to someone investing to simply make money over the short term (Basu, Byrne & Drew, 2009).

The “lifecycle” of the individual is not the only aspect which guides their investment decision. Communal factors also have an influence on this thought process (Duflo & Saez, 2002). Many investors do not have in-depth knowledge of investing and therefore depend on the opinions of their peers to make decisions (Banerjee, 1992; Jones, Lesseig, & Smythe, 2005). Conformance to social norms also has an effect on decision making. As an example, an individual is more likely to start investing if his or her peers are also doing so. Research has found that individuals are more incentivised to purchase a share if a contemporary of theirs mentions the stock as opposed as to when investors have no social evidence on the share (Shiller & Pound, 1989).

Demographic information and social aspects do not explain all the variances in investment and saving across the board. Rather, investment decisions are as a result of the interaction of the individual’s personal characteristics, financial knowledge, and behavioural biases (Glaeser & Scheinkman, 2000).

1.2. Statement of the problem

A savings crisis exists globally. According to the American National Retirement Risk Index (based on a survey conducted in 2004), nearly 45% of American households are at risk of being unable to sustain their standard of living into retirement. This number swells even higher when the number of respondents who are reluctant to utilise their home equity or annualise their 401K savings[2] are taken into account (Munnell, Golub-Sass & Webb, 2007).

This saving crisis also exists in South Africa. Research has shown that most individuals in South Africa save a small percentage of their income (10X Investments, 2019). South Africans are not unique in their lack of financial planning. The OECD (2019) suggests that household saving rates have declined in recent years for most industrialised countries. The saving rates in developing countries usually lag behind those of their more developed counterparts (Ogaki, Ostry & Reinhart, 1996). Despite this, South Africans save considerably less as a percentage of their monthly income as compared to their counterparts in other developing countries (Loayza, Schmidt-Hebbel & Servén, 2000; Matemane, 2016).

Individuals who are relatively new to the work-force (between the ages of twenty and thirty) are particularly at risk to these investing deficiencies (Brüggen, Hogreve, Holmlund, Kabadayo & Löfgren, 2017). Millennials entered the workforce during or around the financial crisis of

[2] A 401K savings account is a United States of America specific tax beneficial defined-contribution retirement account.

2008. Their confidence in the stock market's ability to produce long-term inflation-beating returns is low (Kasperkevic, 2016). Additionally, Diekman (2007) suggests that Millennials often possess the traits of overconfidence and entitlement. These characteristics may contribute to the lack of investing for the future.

A major component of investing is retirement savings. South Africans are severely underprepared for retirement (Butler, 2012). Only 40% of South Africans have a form of a retirement plan. Only a small percentage of those who have a retirement plan are satisfied that their preparations will support them into retirement (Nanziri & Olckers, 2019). According to 10X Investments (2018), a licensed retirement fund administrator and investment manager, fifty-three and a half per cent of South Africans in 2018 did not know how much money they would need to retire and a mere six per cent were on track to retire comfortably.

Two causes are often cited for a lack of retirement savings. Firstly, individuals struggle to calculate how much money they require in order to retire comfortably without sacrificing luxuries and perhaps necessities during their working lives (De Villiers & Roux, 2019). This calculation is complex and often requires a significant amount of economic knowledge and computing power. Secondly, individuals often lack the will-power to put away money in the present to provide for the distant future (Thaler & Sunstein, 2009). This is evidence of hyperbolic discounting, where people prefer an immediate reward over a deferred reward. The value of this preference increases with the length of delay for the deferred reward (Ainslie & Haslam, 1992; Laibson, 1997). The lacking in retirement savings suggests that South Africans lack long-term orientation(10X Investments, 2018). A lack of long-term orientation often leads to sub-par economic outcomes (Hofstede, 2011). To compound the problem, South Africans do not have sufficient short-term savings (Mongale Mukuddem-Petersen, Peterson & Meniago, 2013). Even though complex calculations do not often form part of the issue of short-term savings, a lack of discipline (which is amplified with long-term savings) is frequently a cause of this deficiency.

1.3. Purpose

This study is empirical in nature aims to ascertain whether investment deficiencies (in the form of a lack of retirement savings) of individuals are influenced by behavioural biases. Data was collected by means of a questionnaire from June to August 2020. Data on demographic and financial literacy was also collected to ascertain whether these variables have an impact on investment outcomes. Degreed individuals were included in the study as they have the ability to save based on expected salaries.

1.4. Significance of the study

A lack of incorporation of behavioural factors in financial decisions can lead investors to make sub-optimal investment choices (Riaz, Hunjra & Azam, 2012). If behavioural biases are shown to influence investing decisions, particularly the percentage of a person's income allocated to investing, incorporating and considering said behavioural biases into investing decisions will lead to improved investing decisions (Chira, Adams & Thornton, 2008).

Many choices that are made by individuals are often influenced by stimulus-response compatibility. This concept suggests that the signal a person receives should be consistent with the optimal decision to be made by that person (Kornblum, Hasbroucq & Osman, 1990). When this does not occur, people can make choices that are ultimately not in their best interests. Stimulus-response compatibility can play a role in the financial choices of individuals. Fund managers or other financial institutions may provide stimuli to individuals through harnessing behavioural biases. If the biases are misunderstood or not used appropriately, individuals may be influenced to make choices which are not beneficial to their retirement planning and outcomes.

In this vein, financial institutions could be construed to be "choice architects" who yield significant influence over their clients, the investing public. The way in which information is presented by financial institutions to investors has an impact on the investors' choices. The default choices set have an impact on people's choices (Thaler & Benartzi, 2004). This is discussed in Section 2.1.1.5.

If behavioural biases can be shown to influence the investing decisions of individuals, this research may be used to by fund managers and other financial product providers to provide information and choices to investors that influence sound decision making through harnessing these behavioural biases (Riaz et al., 2012). Additionally, this research sets the stage for further study into whether 'Robo' financial advisors[3] can be used to make investment choices for individuals that would minimise the effects of behavioural biases.

A lack of an appropriate investment allocation of one's income is detrimental to one's financial health. Additionally, research has shown that this lack also contributes to a person's overall well-being (Van Praag, Frijters & Fritters-i-Carbonell, 2003). More worryingly, over-indebtedness and a lack of financial preparedness have a correlation with symptoms of

[3] Robo financial advisors are online or software based financial advisors that provide advice to people based on algorithms with little or no human input on the advisor's side.

depression (Hojman, Miranda & Ruiz-Tagle, 2016) and can have a spill-over effect on other people (Dunn & Mirzaie, 2012). Resultantly, harnessing the understanding that behavioural biases have an impact on financial decision-making will lead to improved financial and overall wellbeing.

1.5. Research question

What are, if any, the behavioural biases impacting personal savings and investment decisions? This research question was addressed empirically by collecting data from respondents via a survey. The survey collected information on behavioural biases as well as on demographic and financial literacy variables.

1.6. Assumptions, limitations, delimitations

An assumption is made that investment and saving decisions fall within the ambit of 'bounded rationality' (Simon, 1972) - that human beings are rational up to a point regarding their financial decisions.

Furthermore, within a South African context, the majority of the population do not have the luxury of making investment and/or saving decisions as they simply do not have sufficient funds available after settling basic household expenses (Du Plessis, 2010). As a result, not all the variations in investing patterns can be explained by behavioural biases and are rather functions of broader socio-economic factors. The focus of this study is on the behavioural biases and not these socio-economic factors.

A further assumption is made that the proxies chosen are appropriate and correctly estimate the effects of the biases on individuals who answer the questionnaire. This risk that the proxies are inappropriate and are correctly estimate the effects of the biases on individuals who answer the questionnaire is mitigated by the fact that all proxies are based on prior literature.

The study also assumes that the proxy for familiarity bias assumes that employees are able to invest in their employer's shares (Huberman, 2001) and if a degreed person is earning a salary, they are in a position to save or invest. Additionally, not every person who receives the questionnaire will choose to respond to it. Therefore, a non-response bias exists (Groves, 2006).

A further limitation is that the respondents to the questionnaire were those to which the researcher had access and therefore had similar behavioural biases and financial literacy to

the researcher. Additionally, the limited respondents may not have been representative of the entire population (Leedy & Ormrod, 2013). This limitation has been somewhat mitigated by the fact that the questionnaire was circulated on social media platforms, such as Twitter. This platform allows ‘tweets’ to be ‘retweeted’ (reshared) and results in reaching individuals who would otherwise not have seen or interacted with a post from the researcher (Palser, 2009). As such, people that the researcher would not normally come into contact with interacted with and participated in the questionnaire.

Chapter l explored the saving crisis in South Africa and how some of these saving defines could be occurring as a result of behavioural finance principles. Chapter 2 introduces and delves into some of the key concepts of behavioural finance. Chapter 3 explains the methodology used in this study.

Chapter II. Literature Review

Personal finance decisions encompass saving and investing. Savings are for the short-term and are often used as a means to accumulate capital for a short-term goal or as cash on hand in case of an emergency. Conversely, investing is long-term orientated and is generally used for preparing for retirement. Prudent personal financial management consists of both savings and investments (Garman & Forgue, 2011). Investing and saving decisions are complex and often involve significant uncertainty which necessitates judgements to be made. This creates room for heuristics and therefore, bias (Thaler & Sunstein, 2009).

A major portion of the investment decision is allocating funds to retirement savings. Retirement funds typically invest in equity (Riley Jr & Chow, 1992). This allows investors to build generational wealth as significant returns are available over medium to long-term horizons (Donaldson, 2008). However, regarding retirement investments, Americans are significantly underprepared for retirement. TD Ameritrade (2019), an American investing services and education service, conducted an online survey investigating the financial health of Americans. 62% of those surveyed stated that they were behind on their retirement savings goals while the number of millennials who were behind their goal was 66%. Of these millennials, 37% attributed their deficiency in retirement savings to high housing costs while 33% attributed it to supporting family members financially. Only twenty per cent of Americans maxed out their retirement specific accounts (401(k) and IRA).

Just like their American counterparts, South Africans are also grossly vulnerable to inadequate preparation for retirement. Only 41% of South Africans had some form of retirement plan in 2018 (10X Investments, 2018). This worrying trend continued into 2019. The number of South Africans who reported not having any sort of retirement plan increased to 46%. More worryingly, 51% of South African women in the same survey reported to not having some sort of a retirement plan as opposed to 46% of the general population. This is worrying because previous studies in South Africa suggest that women lack financial literacy(Nanziri & Olckers, 2019). This is despite the fact that 69% of respondents believe that their living standard would not decrease during retirement (10X Investments, 2019). A significant mismatch exists between the decisions that individuals make in the present and their expectations for the future.

South Africans also struggle with savings (being short-term investment decisions). When surveyed by Nanziri and Olckers (2019), 15% of respondents stated that they would struggle

to meet expenses for a week without a form of income. Additionally, they were dependent on credit, friends, and family to meet short-term funding needs. This phenomenon is further exacerbated by the fact that only relatively high-earning South Africans (households that earn at least R3 500 per month and constitute approximately 20% of the population (Nanziri & Olckers, 2019; Stats SA, 2019)) have access to long-term credit at favourable interest rates (Okurut, 2006; Karley, 2003). As a result, many lower-income earners often resort to loan sharks who levy excessive interest rates on loans given (Mashigo, 2012). These loan payments erode the ability of South Africans to save a proportion of their income.

Macroeconomic indicators also have an impact on the investing decisions of individuals. Factors such a change in the inflation rate, unemployment and a change in interest rates all have an effect of the financial well-being of a person (O'Neill, Sorhaindo, Xiao & Garman, 2005). The financial well-being of a person has an impact on their saving rate (Brüggen et al., 2017).

However, these are not the only reasons for poor investment decisions. Individuals are generally expected to make rational decisions. There is a limit to this as defined by the term 'bounded rationality'. At a certain point, individuals stop making rational decisions and are guided by other motivators. People are unable to consider all available information, whether useful or not when making a decision. Ultimately this results in making decisions that are 'good enough' but not necessarily optimal (Simon, 1972). Human beings are often unable to make appropriate choices under circumstances where uncertainty exists (Chira et al., 2008). Behavioural finance takes these considerations into account and suggests that investors' decision-making processes are based on psychological factors as opposed to those used in accepted financial models. Behavioural Finance proposes alternative explanations for the departure of so-called 'rational decision making'.

2.1. Behavioural biases

Despite a myriad of advancements achieved by mankind, technological or otherwise, human beings are prone to error, making simple mistakes such as misplacing keys and leaving coffee cups on the roofs of cars. This gulf in what can be perceived to be cognitive ability can be explained by the way in which the human brain operates. The way in which our mind works can be split into two distinct systems: the Reflective System and the Automatic System (Chaiken & Trope, 1999; Kahneman, 2011).

The Reflective System is characterised by decisions that are made after thoughtful and careful deliberation. This system is dependent on making considered and methodical choices as

opposed to choices that are made quickly and based on a person's 'gut'. The 'gut' choices that people make are products of our Automatic System. Chosen based rather on instinct rather than on intellect, decisions made under the Automatic System are not usually associated with contemplation. For example, people are more likely to use their Reflective System in deciding what to study after high school but would generally use their Automatic Systems when it comes to grimacing through a period of turbulence whilst on an aeroplane (Thaler & Sunstein, 2009).

A bias, as defined by Hersch Shefrin, is a "predisposition towards error" (Shefrin, 2001). A bias is, therefore, a pre-existing belief or character trait that influences the decisions that people make. Even though biases can occasionally be helpful (Tversky & Kahneman, 1974), often they lead to suboptimal judgements and predictions as indicated by Shefrin's definition. Individuals who make decisions regarding their investments are subject to biases which influence their behaviour (Bailey et al., 2003).

The human brain is consistently exposed to an ever-changing plethora of stimuli. This occurs on a massive scale on a daily basis. In order to process all this information, the brain creates shortcuts that manifest themselves as behavioural biases (Bailey et al., 2003).

In this study, the behavioural biases were measured using proxies. These proxies have been grouped together in the survey under the categories of demographic information, financial information, financial portfolio, financial choices, and non-financial choices. Some of the biases that are relevant to investors are detailed in the rest of this section. These biases were chosen because they stem from heuristics that originate in seminal literature (such as Thaler & Sunstein, 2009; Tversky & Kahneman, 1974).

The remainder of this chapter includes a discussion on the background and grounding in literature of each bias that was chosen in the study.

2.1.1. Overconfidence bias

Individuals assign too much confidence to their projections and forecasts. This also applies to predictions. Events that are predicted by people to occur with certainty do not necessarily happen (Fischhoff, Slovic & Lichtenstein, 1977). Confidence intervals assigned to those forecasts are far too narrow (Barberis & Thaler, 2002). Additionally, people possess a tendency to overrate how well they will perform in completing tasks. This often leads to impulsive choices and not asking for assistance (Chira et al., 2008). For example, 90% of drivers in Sweden consider themselves to be above-average drivers, which is, by definition,

impossible (Svenson, 1981). Research has shown that entrepreneurs seek help less than comparatively experienced managers when making decisions. This characteristic is explained by the overconfidence bias often found in entrepreneurs (Cooper Folta & Woo, 1995).

Overconfidence can be a positive influence on decision making as it can lead to survival amongst entrepreneurs and to optimal investment decisions by individuals. However, the bias can also have negative consequences as it can lead to suboptimal investment decisions where individuals do not recognise their own boundaries (Chira et al., 2008). Overconfidence is found amongst both men and women but has been shown to be more pervasive in the man population (Lundeberg, Fox & Punćcohaŕ 1994). This is particularly evident regarding tasks of a financial nature. Men oftentimes feel a need to be capable and involved in wealth management and generation. They exhibit overconfidence in believing that they have above average abilities in taking sensible risks to maximise wealth (Prince, 1993).

68% of American respondents to a financial readiness questionnaire believed that they could 'catch-up' on retirements savings later in life. This number swells to 72% for millennials (TD Ameritrade, 2019). This, perhaps, is an indicator of overconfidence as the principles of the time value of money dictate that the value over time of a retirement contribution earlier in the life of a person are much more valuable than those made later in life (Skae, 1999). The assumption that a person will be able to catch-up on retirement savings is predicated on the assumption that said person will receive a raise in income. In fact, 47% of respondents to the same TD Ameritrade (2019) survey believed that they could catch-up on retirement savings by receiving a raise in income. This evidences overconfidence as it based on the belief that tomorrow will be better than today even when the evidence suggests otherwise (Weinstein, 1980).

One such area of the application of behavioural sciences, particularly the bias of overconfidence, is entrepreneurship. Knight (1921) postulated that the reasons for the 'supernormal' returns earned by entrepreneurs are a combination of highly uncertain returns and the entrepreneur's ability in clearly recognising opportunities that others could not. Despite this, more recent research has shown that a majority of entrepreneurs do not earn these 'supernormal' returns but rather are compensated with sub-optimal returns after adjusting for inflation (Moskowitz & Vissing-Jørgensen, 2002). Entrepreneurial activities also had a 50% chance of failing within the first six years of operations as recorded in 2008 by the United States Census Bureau (Shane, 2008). While behavioural economics does not fully explain this phenomenon, it does provide drivers for seemingly non-sensical entrepreneurial conduct (Astebro, Herz, Nanda & Weber, 2014).

Overconfidence is one of these drivers. When surveyed, entrepreneurs predicted the chances of success of their ventures being ten out of ten or 100%. This is despite the fact that they attributed much lower odds of survival to other similar businesses in their respective industries (Cooper, Woo & Dunkelberg, 1988).

2.1.2. Familiarity bias

The occurrence of people choosing options which are more well-known to them manifests itself as the familiarity bias (Bailey et al., 2003). This applies to investing and savings as well. When a share or investment has a presence in the investor's state or province, an individual will be more likely to purchase it. A person will also be more likely to purchase a share if a family member or friend works for that company. This is opposed to the many other instruments and fund options which may be available to the investors, and more likely to generate financial returns. The person is merely unaware of or unfamiliar with other options (Huberman, 2001).

2.1.3 Representativeness bias

Representativeness refers to the over reliance on similarity in the judgment of probability (Tversky & Kahneman, 1974). If one item is similar to another, people will assume that the second item is representative to the first. Conversely, if one item is dissimilar to another, people assume that the second item is not representative of the first (Tversky & Kahneman, 1974). Otherwise known as the 'law of small numbers', people who are subject to this bias place too much weight on recent events and under-weight long-term averages (Ritter, 2003). Individuals are likely to make sub-optimal decisions if they assume that if one item is similar to another item, then the items are related. This type of thinking results in individuals overestimating the likelihood of events or relationships. This bias causes people to purchase shares because the company is a good company from an operational perspective. However, the stock may not be a sound investment from other perspectives and may not increase in value over time (Shefrin, 2002). Representativeness can be broken down into two sub-biases namely "base rate neglect" and "sample size neglect". Interestingly, "base rate neglect" seems only to apply when respondents are given some other information about the population. When only presented with the composition of the population, respondents were able to utilise correctly the base rates (probabilities) provided to them (Tversky & Kahneman, 1974).

"Base rate neglect" occurs when a person is presented with specific information and base-rate information. The mind is inclined to ignore the latter and focus on the former (Lovett &

Schunn, 1999). For example, respondents to a study were given personality information about a group of lawyers and engineers. These respondents were then split into two groups. The first group was told that the sample consists of thirty lawyers and seventy engineers while the second group was told that the sample consists of seventy lawyers and thirty engineers. When asked the probability of a particular subject being an engineer or lawyer, respondents under-weighed the compilation of the population presented to them. This shows that respondents overweighed the personality information for that individual and under relied on the probabilistic makeup of the sample (Tversky & Kahneman, 1974).

Second, people often ignore that a sample size can have an influence on the likelihood of a reliable dataset being generated by a particular model. That is, a sample drawn from a large population is more representative than a sample drawn from a smaller population. This manifests itself as "sample size neglect" (Kahneman & Frederick, 2002).

2.1.4. Conservatism bias

People have a behavioural tendency to not make changes and to hold onto the past. This is an example of cognitive dissonance[4] (Festinger, 1957). As a result, they react too slowly, if at all to information or events that have just occurred and are contrary to their initial expectations. For example, when information arises that an investor should sell a particular stock, the investor does not do so because that stock was a well thought-out buy in the past (Ritter, 2003). Additionally, individuals underestimate the likelihood that a sample of data was drawn from a certain population. Often, people overweigh the contribution that selecting an item from two separate batches has on the probability of the item being drawn. As a result, they will estimate a probability that is too low (Edwards, 1968). This is in contrast to the representativeness bias where people place too much weight on the probability that a data set is drawn from a particular population (Barberis & Thaler, 2002).

2.1.5. Status quo bias

This bias is defined as the phenomenon when individuals are faced with multiple choices and instead decide to take no action (Samuelson & Zeckhauser, 1988). Research has shown that as the number of options presented to people increase, their propensity to do nothing increases (Tversky & Shafir, 1992). This bias stems from the endowment effect (see section 2.1.2).

[4] Cognitive dissonance is the behavioural tendency where people hold attitudes and behaviour in harmony with their past knowledge and experiences.

This bias is relevant to the issue of a default option being pre-selected when people have to choose between two or more options. This is evident in an experiment conducted in New Jersey and Pennsylvania beginning in 1988. Both states offered two types of vehicle insurance to motorists, a more expensive plan that had unrestricted rights, and a more cost-effective offering that limited the right to sue. In New Jersey, the cheaper option was made the default choice, with eighty-three per cent of respondents choosing it. However, Pennsylvania set the more expensive option as the default. Despite this, the majority of motorist still chose the default as their insurance plan of choice. This indicates that respondents were subject to the status-quo bias and on average did not significantly deviate from the default option chosen for them (Kahneman, Knetsch & Thaler, 1991).

2.1.6. Gambling and Speculation

Gambling has been ingrained as part of the human psyche and is often present in investing decisions. A person's tendency to gamble is a function of religious, socioeconomic, psychological, and biological factors (Kumar, 2009). This behavioural bias manifests itself in the investing process of individuals. They are likely to display irrationally high appetites for risk. These investors take on large risks to make a small profit where the probability of a negative return on their investment is high. This is opposed to the mean-variance model, where high risk is expected to be compensated with a high return (Markowitz, 1952).

Within the context of an investment decision of a person, gambling exists in the stocks that the individual chooses to invest in. Often these stocks that are gambled on exhibit characteristics of a low stock price, high idiosyncratic skewness, and high idiosyncratic skewness. These stocks can be known as 'lottery stocks.' Research has shown that individual investors have a more of a propensity to invest in these types of stocks while institutional portfolios exhibit a trend of aversion to 'lottery stocks'. Additionally, research has also shown that investors who invest in 'lottery stocks' experience relative underperformance in the long-term (Kumar, 2009).

2.1.7. Anchoring bias

When required to make estimates or guesses, people tend to base their answers based on some arbitrary value and work away from it. This arbitrary value may be suggested by the problem itself or it may represent a partial completion of said problem. Essentially, individuals 'anchor' on the initial value and do not move far enough away from it. As a result, the final answer people give to a problem is dependent on that initial anchoring number. (Tversky & Kahneman, 1974).

For example, a study asked two groups of students to evaluate a mathematical expression that was put on the blackboard within five seconds. The first group was asked to estimate the value of 8 X 7 X 6 X 5 X 4 X 3 X 2 X 1 while the second group was required to determine the value 1 X 2 X 3 X 4 X 5 X 6 X 7 X 8. The estimates given by the first group were much higher (an average of 2 250) than the estimates given by the second group (an average of 512). The correct valuation of this sequence is 40 320. The reason for this is because the students in the first group 'anchored' on the first few terms which had high values giving the total estimates higher values. Conversely, students in the second group also 'anchored' on the first few terms of the sequence which had lower values. As a result, their estimates were considerably lower than those of the first group.

2.1.8. Framing bias

The answer which a person gives to a question is often dependent on how the question is framed. When asked the same thing in two different ways, surveys have shown that respondents will give two different answers to what is essentially two of the same question (Benartzi & Thaler, 2002). For example, a person was advised by a doctor to have an operation and it was framed by the doctor that ninety out of one-hundred people who undergo said operation survive. The patient would be more likely to accept the suggestion of the operation than if the doctor had framed the chances of the operation as ten out of every one-hundred people who have the operation die (Sunstein, 2016).

Individuals are expected to make investment decisions based on risk and return. The higher the risk, the higher the return required to compensate that risk. Conversely, the lower the risk, the lower the return required to compensate an investor for taking on the risk (Markowitz, 1952). The perception of risk is considered to be important when individuals choose to invest and plays a crucial role in the asset allocation process (Riaz et al., 2012).

A trend exists where individuals choose not to make investments as a result of the perceived risk an investment carries. The way in which an investment decision is framed can have an impact on the perceived risk and cause investors to make sub-optimal choices (Singh & Bhowal, 2010). Decision options that are positively framed result in enhanced risk perception while, conversely, choices which are negatively framed result in lower levels of risk perception (Sitkin & Weingart, 1995).

2.1.9 Loss aversion bias

Individuals who are subject to the loss aversion bias make decisions regarding gambling and investing dependent on their current wealth or holding. They will be more likely to risk more on gaining or winning as opposed to losing some of their current holdings. Investors would prefer to avoid a loss about twice as much as they would prefer making a profit (Thaler & Ganser, 2015). The way in which a question is framed will have a significant impact on the decisions made by an individual. If a potential investment is framed as a possible loss-making experience for the investor, said investor will be more risk-averse and will be less likely to make that investment. Conversely, if an investment opportunity is advertised from a perspective of potential gains to made from that investment, a greater chance exists that an individual will make that investment. Additionally, research has shown that investors weigh potential losses twice as much as possible gains (Tversky & Kahneman, 1991).

Evidence of the loss aversion bias appears to exist within a South African context. Bhana (1991) found that dividend announcements signifying a substantial change have an impact on the share price of the announcing company. Of particular interest is that negative changes in dividends had more of an impact than those of a positive nature. This evidences the existence of the loss aversion bias within the South African investment community. Despite this, research has shown that investors in the American S&P 500 index are risk-seeking (Alghalith, Floros & Dukharan, 2012).

2.2. The Endowment Effect

The status-quo bias and the loss aversion bias have their roots in the endowment effect. Thaler (1980) defined the endowment effect as the propensity of people to assign a higher value to what they already possess than to what they do not own or could pay a price to acquire.

For example, in the second half of the twentieth-century credit cards first became a prominent feature in consumers' wallets and were being used more frequently for purchases. Credit cards were a costly mode of payment for the vendor and sellers were therefore charging different prices for payments in cash or by credit card (specifically charging more for purchases paid for using a credit card). Credit card companies did not approve of this and stipulated that a single price was to be charged by vendors for cash and credit cards. A discount could be given for cash. Theoretically, the original pricing model and that imposed by the credit companies have the same economic consequences for the consumer. The consumer is not a *homo economicus* and the pricing models are not equivalent. Customers treated the original credit card price as a surcharge or penalty and therefore had an aversion towards it. Under

the second pricing model (the cash discount) consumers viewed the discount merely as a foregone opportunity cost and were less aggrieved paying the higher price necessitated by paying with a credit card (Thaler, 1980).

2.3. Financial Literacy and Other Demographic Variables

Financial literacy and other demographic variables have been included in the study as control variables. A proposed explanation for a lack of monetary foresight is a deficiency in the financial literacy of South Africans (Nanziri & Olckers, 2019). Financial literacy is imperative regarding participation in investing (Van Rooij, Lusardi & Alessie 2011) and investment returns (Bianchi, 2018). Additionally, it also contributes to the distribution of wealth or a lack thereof (Lusardi, Michaud & Mitchell, 2017). As a result of the role that financial literacy plays in a positive retirement outcome, financial literacy variables as well demographic information relating to financial information have been included. A respondent's financial literacy is measured by five financial literacy multiple choice questions. These five questions measure respondent's understanding of key financial concepts such as the power of compound interest and the benefits of diversification when making investments. Respondents were given a score out of five based on the number of these questions that were answered correctly.

Additionally, other variables were included in questionnaire which measured respondents' attitudes towards money and investing. These variables include the age at which a person begins to invest, what percentage a person saves of their income and an individual's attitude towards saving and investing. These variables provide insights into whether respondents prioritise financial wellbeing through the lens of investing. Additionally, these variables also provide insights into whether individuals' attitudes towards investing translate into actions regarding making healthy financial decisions.

In a similar vein, questions relating to planned retirement age as well as respondents' relationship towards retirement were posed to respondents in the questionnaire. Once again, this gauges how much consideration respondents gave towards their planned retirement age and whether their retirement goals are congruent with the actions they enact in order to obtain these goals (Montalto, Yuh & Hanna, 2000). Other demographic variables, such as age and income have also been included as control variables. These variables have been included as they may explain variances in investing decisions and behavioural biases.

2.4. Summary

People are expected to be rational and conform to accepted financial and economic models when making investing decisions. This is in order to maximise returns. However, the rationality of investors is bounded, and they sometimes make decisions which are not sensible. These insensible decisions are potentially a manifestation of various behavioural biases which can result in sub-optimal investment decisions.

Chapter III – Methodology

This study used a quantitative model to test the research question: what are, if any, the behavioural biases impacting investing and saving patterns among individuals? A factor analysis was used to determine which behavioural biases have an effect on the investing patterns of individuals. Additionally, descriptive statistics were used to analyse the data. Finally, a multivariable analysis of variance (MANOVA) was performed to investigate the relationship between the behavioural biases and the demographic information variables.

3.1. Population and sampling

Data was gathered from respondents using a questionnaire, with the questions designed to identify the biases discussed previously. The population to be surveyed was South African and of working age (being between 18 and 64 years in age). They had to be able to save (by earning some form of a salary). An assumption is made that if a degreed person is earning a salary, they are in a position to save or invest. As a result, only degreed individuals were included in the analysis as this better enables them to be able to earn an income that would allow them to be saving and investing a portion of said income. This broad population was used in order to ascertain the general population's behavioural biases. As a result of the population consisting of South Africans, care was taken to ensure that the participants were not all from one demographic group. A random sample of the population was asked to respond to the questionnaire. The randomness of the selection of the sample was ensured by circulating the questionnaire in places with a diverse demographic composition such as at places of work and on social media. This sample only included respondents who earn some form of a salary in addition to having some form of degree.

Literature suggests that the minimum sample size for factor analysis range from three to twenty times the number of questions in the Questionnaire. The questionnaire contains 28 questions, and therefore the minimum number of responses would be 84 replies. Comrey and Lee (1992) suggest that a sample size of 300 can be classified as a good sample size. 309 valid responses that conformed to the criteria required were received (the criteria for a respondent to be included in the study are discussed in Section 3.2 *Coding of the questionnaire and data cleaning*). This is a greater number than the 84 responses required to perform a factor analysis and greater than three-hundred, suggesting that the sample size is appropriate (Comrey & Lee, 1992).

3.2 Bias Proxies

This study measured the magnitude of behavioural biases using proxies. The proxies used for each bias are as follows:

3.2.1. Overconfidence (Weinstein, 1980)

The overconfidence bias is often measured by obtaining the confidence interval of estimations people provide for an unlikely event. Participants were asked how likely they consider the event of it snowing in Johannesburg this year. This is an event in the future that cannot be predicted with 100% confidence, much like portfolio returns. Whilst the respondents' answer (Yes/No) is irrelevant, the researcher will use the confidence level as a proxy for overconfidence. Respondents are likely to assign too high a confidence interval when estimating this data (Weinstein, 1980). The score of respondents will be the percentage they provide for the question. Barber and Odean (2001) suggested that gender can be used as proxy for overconfidence. Their research showed that men are generally more overconfident than women. The survey will collect the genders of respondent. Using the other proxy for overconfidence, the claim that gender can be a proxy for overconfidence can be verified or disputed.

3.2.2 Familiarity Bias (Foad, 2010)

Two variables will be collected for the familiarity bias, namely *familiarity1* and *familiarity2*. Individuals are more familiar with the company that they work for than with other companies which are mostly unrelated to them. These employees erroneously consider shares of their employer (if listed) to be safer than a diversified portfolio. Companies that also offer employer matching on share investment incentives offer a tacit endorsement of their own stock (Foad, 2010). The familiarity bias can be measured as a function of what percentage of a respondent's portfolio is invested in the equity of his or her employer. The variable, *Familiarity1* will be quantified by awarding a point for each percentage of employer stock that is in the respondent's portfolio.

Familiarity2 will be gathered by asking respondents what percentage of their equity portfolios are invested in domestic equity (Foad, 2010). Respondents will be more subject to familiarity bias if they have a high proportion of their equity investments in South African shares. A point will be awarded for each percentage of South African stock that is in the respondent's portfolio.

3.2.3. Representativeness Bias (Tversky & Kahneman, 1974)

Tversky and Kahneman (1974) conducted research where respondents to a study were introduced to a fictional character, Linda. Linda was described as a 31- year old, single, outspoken, and very bright. She majored in philosophy. As a student she was deeply concerned with issues of discrimination and social justice and also participated in anti-apartheid demonstrations. When asked whether it more likely that Linda is (a) a bank teller or (b) a bank teller that is active in the feminist movement (amongst other options), respondents exhibiting base rate neglect are more likely to choose (b). It seems, given the previous information provided on Linda's background, that the statement would be true. However, the probability of two states occurring at once is by definition lower than the probability of just one state occurring. As such, the likelihood of Linda being a bank teller and being active in the feminist movement is less than the likelihood of Linda only being a bank teller (Barberis & Thaler, 2002).

Sample rate neglect is a sub-bias of representativeness and is the behavioural bias that manifests itself where people place certainty on an outcome while ignoring the size of the sample. To test this, two sets of coin tosses will be presented to the respondent. In the first set, a coin is tossed 26 time and yields three heads and three tails (set A). The second set comprises of 1000 coin tosses generating 500 tails and 500 heads (set B). Respondents will ask if either set is equally statistically sound or whether one set is sounder than the other. Respondents prone to sample size neglect will not recognise that set B is more representative than set A.

Base rate neglect and sample size neglect respectively can be used as proxies for representativeness bias. Respondents will be ranked as either a zero, one, or two. One point will be awarded for each of the above questions where individuals who answered the survey were subject to the representativeness bias (Tversky & Kahneman, 1974).

3.2.4 Conservatism Bias (Edwards, 1968)

Individuals filling out the survey were posed a question: two urns are presented, one with seven red balls and three blue balls (urn one), the other with three red balls and seven blue balls (urn two). Twelve balls are drawn at random with each ball replaced back into the urn it came from after each draw. This process yields eight reds and four blues. Respondents will be asked to estimate what the probability is that the balls come from the first urn. The correct answer is 97%. The percentage is high because of the majority of balls in urn one are red balls. Those respondents who are prone to conservatism bias will estimate a lower number. This is a result of respondents overestimating the effect of the base rate of 50% which resulted

from the presence of two urns. One point will be given for each percentage under the 97 percentile (as the correct answer mathematically is 97%) so that individuals with high proclivity for the bias have a higher score.

3.2.5 Status Quo Bias (Tversky & Shafir, 1992)

Respondents were asked to make a choice between different bets on two occasions. The bets will be presented in the form of the probabilities to win an amount of money. The two options on both occasions will be marked as “a)” and “b)” respectively. On the first occasion the best choice is clear as the expected value (probability multiplied by the amount to be won) of the betting options will be much greater than that of the second option. The second bet will not offer a clear best option because the expected value will be in a similar range. In addition to betting options, a choice will be given to pay an amount of money to buy another gambling choice Respondents are expected to choose the same option (either “a)” and “b)”) as they did on the first occasion and not the additional choice if they are susceptible to the status quo bias.

3.2.6 Gambling and Speculation Bias (Kumar, 2009)

Kumar (2009) suggests that the higher the weighting of speculative stocks in a person’s portfolio, the higher the propensity of said person to gamble and speculate. As such, participants in the survey are asked what percentage, in their opinion, of their equity portfolio is invested in high risk shares. One survey analysis point will be awarded to the participant for every percentage they have invested in risky shares. An expectation exists that the percentage of risky stocks in a person’s portfolio is a function of that person’s age (Riley Jr & Chow, 1992). A factor analysis allows the researcher to determine if collinearity exists between the variables of age and perceived riskiness of portfolio.

3.2.7 Anchoring Bias (Tversky & Kahneman, 1974)

Respondents will be given a number at the top of the question, being either a ‘10’ or a ‘60’. They will be asked to estimate what percentage of United Nations countries are African. Individuals who are given a ‘10’ will estimate a lower percentage than those that are given the ‘60’. One analysis point will be awarded for every percentage point estimated that differs from the stated number. It must be noted that the closer the analysis points are to zero, the more susceptible the respondent is to the anchoring bias.

3.2.8. Framing Bias (Benartzi & Thaler, 2002)

When required to choose between different investment option, the level of risk plays a pivotal role in which option to select. In the given options in the questionnaire, respondents are, in essence, asked to choose between high-, medium-, and low risk-options. In the first table, the investment options are arranged in order of risk, from lowest to highest. In the second able, the same ordering methodology is applied. However, in the first table, option C is positioned to appear very risky as its returns are more uncertain than those of the options around it. This is in contrast to table 1, where option C (also known as program 2) is positioned as the second most risky option. Respondents will be more likely to choose option C in table 2 over table 1. After both tables, respondents will be asked to rank, using a five-point Likert scale (Allen & Seaman, 2007), how likely they will be in choosing Option C/Program 2 as their only retirement fund. Respondents will be allocated a score of between 1 and 5 for each choice they make. A '5' will be allocated for 'very likely' and a '1' for 'Very unlikely' with the other numbers allocated to the choices in order. The score for the framing bias will be the score for the first choice less the score for the second choice (Benartzi & Thaler, 2002).

3.2.9 Loss Aversion Bias (Samuelson, 1963)

Respondents will be posed with a gamble. They will bet R100 and have a 50% chance of winning or losing. Respondents will be asked how much the pay-out must be to accept such a gamble. Those who are subject to loss-aversion bias will choose an amount above R100. The score of respondents will be a point for every Rand over R100 that they require in pay-out.

3.3. Instrumentation and data collection

A structured questionnaire consisting of thirty-three questions was used to gather demographic data and to measure proclivity for various biases. Electronic copies, as well as hard copies of the questionnaire, were available to recipients. Appendix A contains an example of the questionnaire. Electronic questionnaires were circulated by means of WhatsApp Messenger, Twitter, Facebook, and LinkedIn. Of interest is that the questionnaire was circulated on a financial independence themed Facebook group. This provided noteworthy insights into the financial behaviour of individuals who save a large proportion of their income as well as the behavioural biases affecting said individuals. These results are discussed in section 4.1.3.

Data specifically relating to behavioural biases was collected. In addition, data relating to demographics and financial literacy was also obtained. This was to be used for descriptive statistics as well as control variables.

Data regarding financial literacy can be gathered using multiple-choice questions. These multiple-choice questions specifically address key financial concepts and the ability of respondents to apply these concepts to practical scenarios (Lusardi, Michaud & Mitchell, 2011).

Coding of the questionnaire and data cleaning

All questionnaire responses that were not fully completed were removed from the data analysis. In addition, all responses where a majority of responses were 'rather not say' were removed from the data analysis too. The main reason for these removals was too keep the most interesting responses which could grant insight into behavioural biases, demographic information and financial wellbeing.

Question number 1 asked respondents if they earn some form of income. If the answer to the question was 'no', that response was excluded from the study because that respondent did not form part of the population to be sampled. Similarly, if the response to question 2, which asked if respondents lived in South Africa or were South African citizens, was 'no', that response was also excluded from the study because that respondent did not form part of the population to be sampled.

3.4. Procedure

A pilot study was carried out prior to the main study (as per the guidance of Leedy & Ormrod, 2013). The questionnaire was sent out to five respondents. These respondents provided feedback needed to make minor adaptations to the questions in the questionnaire. These changes mainly made the questionnaire more readable and understandable. Respondents to the questionnaire were assured that the research was carried out for academic purposes and that they would remain anonymous. Both electronic and manual responses to the questionnaire were collected from June until September 2019. Electronic responses were collected using "Qualtrics", an online questionnaire administration service often used by universities. The benefits of using electronic questionnaires include shortened response times, more efficient use of resources normally employed for data capturing, and the ability for data to be collected into a central database (Ilieva, Baron & Healey, 2002). No incentive was offered for the completion of the questionnaire.

3.5. Analysis plan

The questionnaires collected data on a number of variables. These variables were split among three categories, namely, demographic, financial literacy and behavioural biases. The demographic and financial literacy variables will be used to present the data using descriptive statistics as well as for control variables. The statistical tool R version 3.5.3 (2019-03-11) and Microsoft Excel were used to analyse the data collected from the questionnaires. A score was be given to respondents for financial literacy and for the behavioural biases (the proxies for each bias are contained in section 3.2.). The score for financial literacy is calculated based on how many of the financial literacy-based questions the respondent answered correctly.

Factor analysis is used to analyse a large number of variables as this method groups variables that are highly correlated into principal factors that reflect underlying themes in the data. This allows for simplification of the analysis of the data (Leedy & Ormrod, 2013). Factor analysis is appropriate in this study as it explains the variance amongst variables using the smallest number of explanatory constructs.

3.5.1. Factor Analysis

Latent variables are variables that cannot be accessed directly. The behavioural biases variables to be collected are representative of underlying trends in the data. These underlying trends are known as 'latent variables' or factors (Tabachnick, Fidell & Ullman, 2007). Factor analysis identifies these 'latent variables' and determines the relationships between them. As discussed in Section 1.3, the purpose of this study is to determine whether behavioural biases influence savings patterns of individuals. To this end, the factor analysis will determine whether the underlying variables (the biases) are driving the observable measures (the savings patterns). Factor analysis is appropriate for this objective as this methodology is often used in exploring interrelationships (Ford, MacCallum & Tait, 1986) with the intention of describing and classifying the data as opposed to extrapolating findings (Groth & Bergner, 2006).

The questionnaire in this study collected data on various biases as discussed in the literature review section. The correlation coefficients for each pair of variables were tabulated in an R-matrix. This was done using a correlation matrix of the data as opposed to the raw data itself. Previous literature provides precedent for performing the factor analysis based on the correlation matrix and not off the raw data (Dimi, Padia & Maroun, 2014; Field, Miles & Field, 2012; Lemma & Negash, 2011). This matrix was reduced into a smaller set of dimensions

using factor analysis to identify clusters of interrelating variables. These groupings were determined by examining the factor loadings with savings pattern variables (Dimi et al., 2014).

The extraction of factors was determined by their eigenvalues. Eigenvalues are a measure of the amount of variation explained by the factor which in the case of this study, are the biases. Factors with an eigenvalue of more than 1 are extracted based on Kaiser's criterion (Field et al., 2012). The Eigenvalues of the factor loadings for each bias were analysed. For a sample size of greater than 300 (as the sample size for this study is 309), it is suggested that a significant factor is a factor whose loading is greater than 0.298 (Field, Miles, & Field, 2012).

The factors were rotated using the orthogonal and oblique rotation approach. Orthogonal rotation keeps the factors independent of each other while oblique rotation allows factors to correlate. Both methods were used as it may be likely that the biases are related to each other (Field, 2013). Additionally, Pedhazur and Schmelkin(1991) suggest that is always advisable to perform both oblique and orthogonal rotation techniques. The *oblimin* method was used to rotate the factor obliquely while the *varimax* method was used to rotate factors orthogonally.

Before performing the factor analysis, Cronbach's alpha coefficients were calculated to determine the internal consistency of the questionnaire(Field et al., 2012). The Cronbach's alpha was used as a measure to ensure reliability. The value of Cronbach's alpha in this study is 0.84. This value suggests that that the questionnaire used was acceptable(Kline, 1999). Bartlett's test was also performed. Bartlett's test provides an indication of whether equal variances exist in the data, For the data in this study, the result of the Bartlett's test is statistically significant at the 1% level, as $x^2(561) = 24610.99$. The Kaiser-Meyer-Olkin (KMO) scores for each of the variables and overall was 0.5, once again indicating that the data from the questionnaire is appropriate for a factor analysis. As a result of the above tests, a factor analysis is appropriate for this study (Field et al., 2012).

3.5.2. MANOVA

Multivariate analysis of variance ('MANOVA') was used to ascertain how the behavioural biases (independent variables) relate to the demographic information and financial literacy (dependent variables) (Thompson, 2007). MANOVA is an appropriate test when there are a large number of dependent variables, as in the case in this study (Field et al., 2012).

The variables to be included in the matrix and groupings of variables are:

- Age
- Education Level
- Gender
- Dependents
- Marital status
- Physical health
- Overconfidence
- Income level
- Saving Rate
- Framing
- Familiarity
- Gambling
- Disposition
- Investing start age
- Planned retirement age
- Financial literacy
- Representativeness
- Status quo
- Conservatism
- Anchoring

3.6. Validity and Reliability

3.6.1. Face validity

The likelihood that questions will be misinterpreted has been lowered as a pilot study was undertaken. A random sample of 5 people filled in the questionnaire. Those who participated in the pilot study are from both genders and come from different cultural backgrounds (as suggested by Leedy & Ormrod, 2013). This inclusivity of individuals from diverse backgrounds has been enhanced by the fact that the questionnaire was circulated on social media platforms, such as Twitter. This platform allows 'tweets' to be 'retweeted' (reshared) and results in reaching individuals who would otherwise not have seen or interacted with a post (Palser, 2009). As such, people that the researcher would not normally come into contact with interacted with and participated in the questionnaire.

3.6.2. Content validity

The questionnaire used in this study provides adequate coverage of behavioural biases. All the questions asked have precedent in previous literature. Additionally, the pilot questionnaire

indicated that the content in the questionnaire is relevant to the questionnaire based on answers given by respondents. Cronbach's alpha was determined to ensure the validity of the questionnaire. Factor analysis was performed with the input of supervisors and after consultation with a qualified and experienced econometrician. The method and results will also be reviewed by the econometrician.

3.6.3. Construct validity

Previous research by Richard Thaler (1985), Daniel Kahneman and Amos Tversky (1974) has shown that a relationship exists between individuals' investment decisions and the manifestation of various behavioural biases. Additionally, all questionnaire questions and behavioural biases are based on pre-existing literature. The biases that have been included in this study are those biases that appear in seminal literature(Bailey et al., 2003; Barberis & Thaler, 2002; Thaler & Sunstein, 2009; Tversky & Kahneman, 1974)

As correlation coefficients fluctuate from sample to sample, and more fluctuation exists in smaller samples, the reliability of factor analysis depends on sample size. The number of respondents is therefore important in ensuring the reliability of the study. The rules on sample size for factor analysis relate to the number of variables that are being analysed. Nunnally (1978) suggests having ten times as many responses as variables. In addition to this, the researcher will consider the Kaiser-Meyer-Olkin (KMO measures of sample size. If values below 0,5 are calculated, more data will be collected, or variables may be omitted. The KMO calculated for this study is 0.5 and therefore factor analysis is a suitable methodology for this study (Gujarati, 2009).

3.7. Summary

Chapter III provided information regarding the methodology used in this study. In particular, a questionnaire was used to collect data from a random sample of South African degreed respondents. Descriptive statistics and a factor analysis were used to analyse the data as well as MANOVAs and ANOVAs. Chapter IV will analyse and interpret the results of the study.

Chapter IV. Analysis and Interpretation of Results

Descriptive statistics, a factor analysis, MANOVAs and ANOVAs were used to analyse the data collected via questionnaire in this study. 471 responses were received to the questionnaire of which three hundred and nine responses were useable in terms of analysis. 72 responses were not used because respondents responded 'no' to earning an income or being a South African. The remaining responses which were unusable were those responses which had blank answers or those responses that had more than one answer of 'rather not say'.

4.1. Descriptive statistics

4.1.1. Discrepancy between risk aversion and financial risk

The question that tested for risk-aversion required respondents to provide a value which they were required to receive wagering R100 at a 50% chance of success. The theoretical value that a risk-neutral person would require to receive in this wager is R200. This is because R100 divided by 50% is R200. On average, respondents required a payoff of R350, a number which suggests that the sample was uncomfortable with taking on risk as it higher than R200. Theory suggests that the lower the number provided, the more comfortable a respondent was with taking on risk (Weinstein, 1980).

However, when surveyed regarding the framing bias, respondents were asked to choose different retirement income options with varying risk profiles. This risk is expressed in the variability of cash flows with riskier options having a wider payout gap between the good and bad market conditions. However, the risk aspect was not initially obvious and is does not fall within the ambit of risk aversion. Respondents on average (61% of respondents) seemed to prefer a retirement income option which was framed as being riskier. This outcome is in contrast with the original findings on risk aversion where individuals appeared to be risk averse. However, the original risk aversion question was in the context of pure risk in terms of a bet or wager, but this question viewed risk from a financial standpoint. This result suggests that respondents are generally risk-averse but do not understand risk from a financial perspective, making them susceptible to poor choices regarding investing and retirement asset allocations. This suggests a deficiency in financial literacy, as respondents did not understand financial risk, a key element of financial literacy (Lusardi & Mitchell, 2011).

This evidences that framing has a significant impact on the financial choices made by individuals in the sample of incoming earning South African. This then means that individuals'

decisions are likely to be impacted by the way savings products are framed by financial advisors and online platforms.

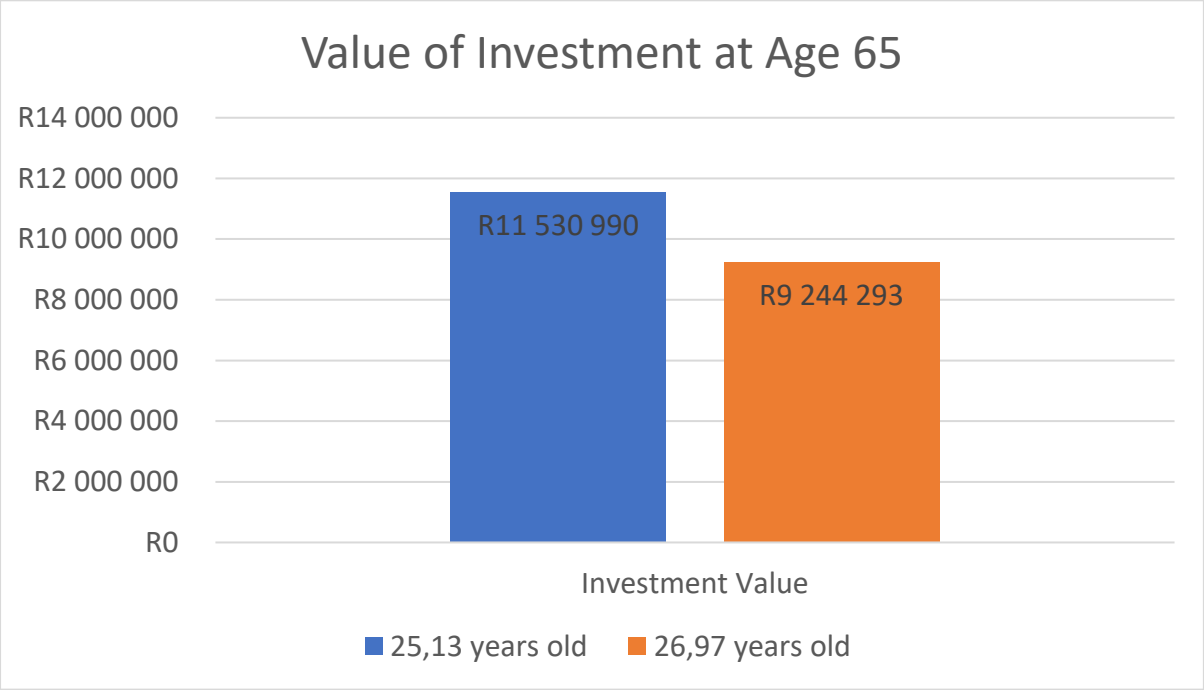
4.1.2. Overall financial literacy

On average, respondents appeared to be financially literate with a rather impressive average financial literacy score of 4.56 out of 5, a result suggesting that over 90% of respondents were financially literate. Financial literacy tested the respondents' understanding of key financial concepts such as diversification, the time value of money, and the compounding effect of interest (Nanziri & Olckers, 2019). It must be noted that this may be function of the sample and not representative of the population at large. The discrepancy between the high average financial literacy score and the apparent lack of understanding of financial risk could be explained by the fact that the questionnaire did not test the respondents' understanding of risk. Rather, the understanding of financial risk was considered an element of the framing bias and the relationship between the framing bias and respondents' propensity to gambling. This is consistent with Sitkin and Weingart (1995) who posited that a negatively framed risk can result in inferior risk perception. This finding relates to the framing bias which was discussed in Section 4.1.1.

Interestingly, the average saving age, being the age at which a person started saving and investing, for the general population was 27 years old. However, the average saving age for those respondents with a perfect financial literacy score was 25 years old, a difference of almost 2 years (due to rounding). This suggests that financial literacy has a large impact on when a person begins to save and invest.

While seemingly insignificant, the age at which individuals begin to save or invest has a noteworthy impact on retirement outcomes. If a person were to invest R1000 a month from these starting ages up to retirement at age 65. those who started investing at 25 would have R2.2 million more in retirement savings which equates to a difference of almost 25%. A key contributor to this statistic is the concept of the time value of money. Respondents with perfect financial literacy skills as measured in this study showed a clear grasp of this concept and base their decisions on the compound growth of money over time. This resulted in these respondents beginning to save or invest earlier. The extra two years invested provides more growth than perhaps expected. *Graph 1* details the significant difference in retirement savings that starting to invest two years can cause.

Graph 1: Values of investments after starting to invest at different ages



The graph shows the difference in retirement outcome after starting to invest less than two years apart.

4.1.3. Characteristics of individuals who have a high savings rate

As previously mentioned in section 3.1 *Scoping and limitations*, data was collected via questionnaire from various forums such as Facebook groups and Twitter from individuals who save or invest a high proportion of their income (a high proportion of their income was considered to be 30% or more of their gross income in this study), These people are of particular interest to this study as they represent the zenith of personal financial wellbeing. 74 out of 309 participants (24%) reported to saving and investing more than 30% of their income. Information summarising the contrast between the general population and those who save or invest a high percentage of their income is presented in the table below *Graph 2: Income of high savers.*

Individuals in this study who saved or invested more than 30% of their income had an average income rating of 5.11 suggesting that they earn between R423 301 and R555 600 on average. The general population of respondents had an average income rating of 4.87 implying that they received a gross amount of income of between R305 851 and R423 300 annually. The difference between the two groups is an income rating of 0.24. It can be inferred that the maximum difference between these two groups is R249 749. However, it is clear that those

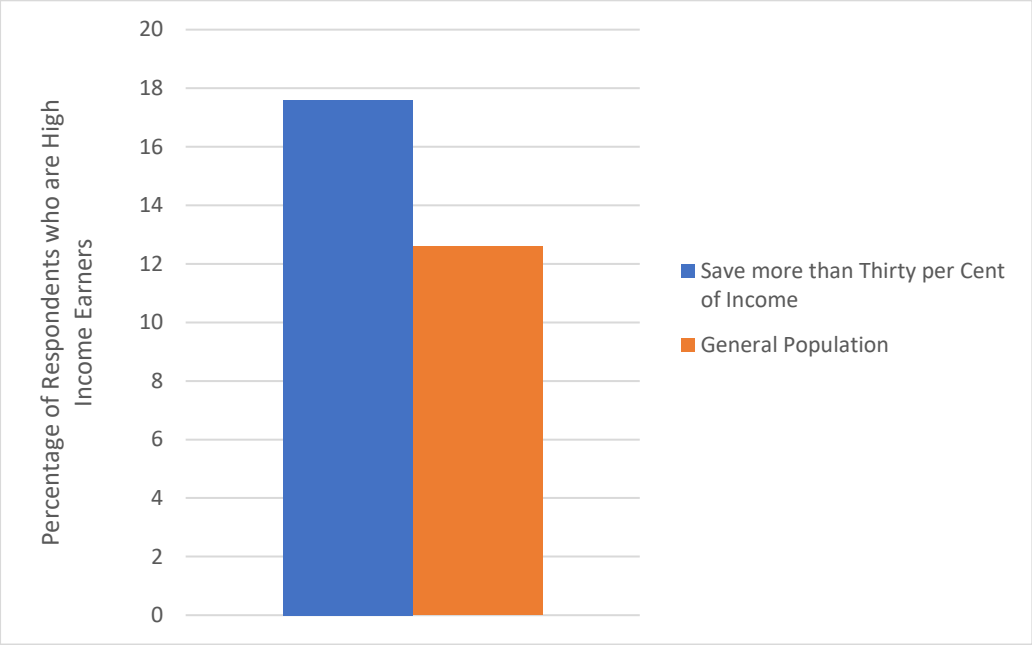
that saved or invested more than 30% of their income earned more on average than the rest of the general population surveyed.

Further substantiating the finding that respondents who save or invest more than 30% of their income earn more income than their counterparts is the number of respondents who earn R1 500 001 per annum and are therefore categorised as having an income level of 8. Thirteen out of the seventy-four respondents (17.6%) with a saving or investing rate of 30% or more self-reported to earning an annual income of R1 500 001 or more per annum. This is in contrast with the general population surveyed in this study where only thirty-nine out of three-hundred and nine (12.6%) respondents reported earning an annual income of R1 500 001 or more.

Individuals who responded to saving more than 30% of their income had less dependents on average with a dependents score of 1.53 as opposed to the 1.95 of the general population. These respondents were able to save a higher proportion of their income because they had to support less people and likely had a higher disposable income.

Additionally, individuals who saved more than 30% of their income appeared to be slightly more educated than the rest of the general population. Those who saved more than 30% of their income had an average education score of 3.01, equating to an honour's degree or equivalent. The general population had an average education score of 2.82, equating to an undergraduate degree. This higher level of education of allowed individuals to save more on average, as the higher education level gave them a higher amount of earnings from which to save.

Graph 2: Income of high savers



This graph shows that the population that saves more of their income contains individuals who earned in the highest income bracket.

These findings on the earnings of high savers and investors are consistent with prior literature. Huggett and Ventura (2000) suggest that a linear relationship exists between the income of a household and said household's saving and investing rate. This was true in the United States of America. The results of this study may be indicative that a similar relationship exists in South Africa in 2019.This result must be considered in conjunction with the fact that many South Africans do not earn enough income in order to invest and underscores the socio economic circumstances of the population as a key contributor to the low levels of savings in the country. For those who have surplus income and are able to invest, policies must be put in place to 'nudge' individuals into making optimal investing decisions. One such policy is the Save More Tomorrow plan which auto-enrols individuals into fixed contribution retirement plans(Thaler & Benartzi, 2004).

Table 1: Respondents who saved or invested more than 30% of their income

	Respondents who saved or invested more than 30% of their income	General population sampled
Number of Respondents	74	304
Income rating	5.11	4.87
Income bracket	R423 301 - R555 600	R305 851 - R423 300
Number of respondents in income rating 8	13	39
Percentage of respondents in income rating 8	17.57%	12.62%
Average number of dependents	1.53	1.95
Average education level (score)	2.82	3.01
Average education level (degree level)	Undergraduate degree	Honours degree or equivalent

Information related to individuals who save a high percentage of their incomes.

4.2. Factor Analysis

Initially, factor loadings for 33 variables (the number of questions in the questionnaire) were tabulated. These factors have not been rotated, and they do not provide much useful information. However, they do provide information on the loadings of each variable in relation to each of the other variables. All the values in the far-right column (labelled as h2), being the communalities, are one because the same number of factors as variables have been extracted. being 33 of each. The uniqueness of a factor is calculated as one minus the communality of that factor. As a result of all the communalities being one, all the uniqueness values are zero. If the number of factors to be extracted was less than the number of variables, the communalities would not all be one.

Kaiser's criterion suggests that factors should be retained if they have an eigenvalue of greater than one. In this study, thirteen factors had eigenvalues greater than 1 after the initial rotation. The first few numbers with higher eigenvalues explain much more of the variance than those with lower eigenvalues.

13 factors were then extracted from the 33 variables. The eigenvalues for the factors extracted as well as the proportion of variance explained and cumulative proportion of variance

explained has not changed from when 33 factors were extracted (Tabachnick et al., 2007). However, the communalities have changed and are no-longer all one(Field et al., 2012). *Table 2* provides information regarding the communality for each factor. The average communality is 0.68. This exceeds Kaiser's criterion of 0.6 for samples of greater than 250 observations. Additionally, 20 variables out of 34 (59%) have commonalities of above 0.6. Once again, this suggests that the extraction of thirteen factors is appropriate (Field et al., 2012).

Table 2: Communalities

	Initial
Demo1	0.59
Demo2	0.64
Demo3	0.59
Demo4	0.72
Demo5	0.74
Demo6	0.96
Demo7	0.96
Demo8	0.73
Demo9	0.51
Over1	0.63
Endow1	0.34
Endow2	0.89
SavAllc1	0.64
Endow2.5	0.83
Endow3	0.88
Endow4	0.55
ND1	0.51
ND2	0.54
LT1	0.72
LT2	0.54
LT3	0.68
LT4	0.56
FL1	0.55
FL2	0.54
FL3	0.53
FL4	0.56
FL5	0.62
FL6	0.96
Rep1	0.53
Rep2	0.76

Rep3	0.80
Rep4	0.76
Anchor1	0.96
Anchor2	0.96

The communalities for the factor analysis

The following table summarises the information relating to the 13 factors whose eigenvalues exceed one as well as information relating to all 33 initial factors:

Table 3: Overall factor analysis information

	Initial Eigenvalues			Rotation Sums of Squared Loadings			
Factor	Total	% of Variance	Cumulative %	% of Variance	Cumulative %	Total	% of Variance
1	3.32	10.00	10.00	13.099	13.099	4.092	8.524
2	2.93	8.88	18.88	7.156	20.256	2.625	5.469
3	2.25	6.82	25.7	5.196	25.451	2.407	5.015
4	2.03	6.15	31.85	4.601	30.053	2.153	4.485
5	1.91	5.79	37.64	4.226	34.279	2.061	4.293
6	1.83	5.55	43.18	2.999	37.278	1.840	3.834
7	1.67	5.06	48.24	2.900	40.177	1.551	3.231
8	1.44	4.36	52.61	2.673	42.850	1.445	3.010
9	1.34	4.06	56.67	2.102	44.952	1.407	2.932
10	1.26	3.82	60.48	2.002	46.954	1.399	2.914
11	1.14	3.45	63.94	1.569	48.524	1.146	2.388
12	1.11	3.36	67.3	1.528	50.052	1.126	2.347
13	1.02	3.09	70.39	1.474	51.526	.877	1.828
14	0.97	2.94	73.33	1.186	52.712	.877	1.827
15	0.94	2.85	76.18	.995	53.707	.772	1.609
16	0.90	2.73	78.91				
17	0.86	2.61	81.52				
18	0.79	2.39	83.91				
19	0.76	2.3	86.21				
20	0.71	2.15	88.36				
21	0.69	2.09	90.45				
22	0.68	2.06	92.52				
23	0.60	1.82	94.33				
24	0.55	1.67	96.00				
25	0.53	1.61	97.61				
26	0.45	1.36	98.97				
27	0.38	1.15	100.12				

28	0.33	1	101.12				
29	0.30	0.91	102.03				
30	0.25	0.76	102.79				
31	0.04	0.12	102.91				
32	0.01	0.03	102.94				
33	0	0	0				

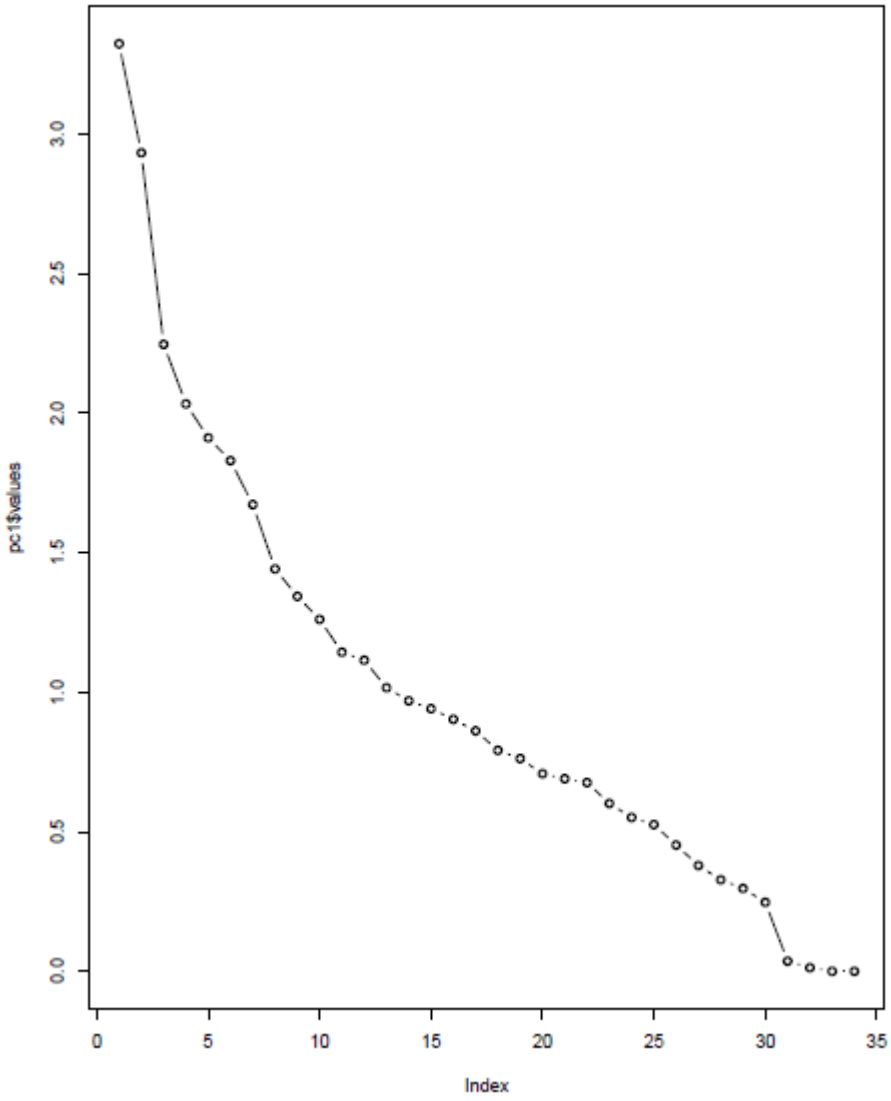
Information relating to the factor analysis. Please note that the cumulative percentage of variance of the initial eigenvalues does not add up to exactly one hundred per cent because of rounding conventions.

The factor residuals provide further information regarding whether the extraction of thirteen factors was appropriate or not. If the factor analysis model perfectly fit the data, the correlation matrix produced from the original data and the one produced from the factor analysis model would be identical. However, the model is rarely a perfect fit for the data and differences do exist. The differences between the model and original data can be assessed by comparing the original correlation matrix with that of the model. The factor residuals detail the difference between the original correlation matrix produced from the raw data and the correlation matrix produced from the factor analysis model.

The values of the residuals should therefore be small. Small values, with respect to residuals, are often considered to be values that are lower than the correlations in the original correlation matrix produced from the raw data. If the model is imperfect, the values of the residuals would be the same as the values of the original correlation matrix. Resultantly, a gauge of the fit of the model is the addition of all the squared residuals divided by the sum of the squared original correlation matrix (it is necessary to square both the values from the residuals and from the correlation matrix as these values can be both positive and negative. Summing negative and positive values would create a distortion in the best fit value) (Field et al., 2012). The best fit value for the data in this study is 0.85. which is acceptable. This suggests that the extraction of thirteen factors from this study's data is appropriate.

Another indicator of how well the model fits the original data is the average of the residuals. This value provides an insight into the average difference between the original correlations and the reproduced correlations produced by the model. Once again, it is necessary to the square the residuals first to avoid distortions stemming from calculating averages using both negative and positive values. The square root of the average of the residuals squared for the data in this study for the extraction of thirteen factors is 0.054. This is acceptable and once again suggests that it is appropriate to extract thirteen factors from the thirty-three variables(Field et al., 2012). The below scree plot also indicates that thirteen factors should be extracted as the graph plateaus in that region:

Graph 3: Scree plot



The scree plot indicates that thirteen factors should be extracted from the data.

Rotation improves the interpretability of the factors and is performed after the extraction of the factors from the variables. Rotation provides insight into which variables relate to which factors by maximising the loading of each variable onto a particular factor while simultaneously minimising the loadings of variables onto all of the other factors. Rotation of the factors adjusts how the variance amongst the variables is distributed, but cannot influence the existence of more or less variance amongst the variables compared to before the rotation. Correspondingly, the rotation attempts to equalise the eigenvalues across the factors. However, rotation is unable to alter the sum of all the eigenvalues. Four factors were extracted from the data using R. Relationships between variables are determined by assessing which

variables load onto the same factors. Significant loadings were considered to be those with values of 0.3 or higher (Field et al., 2012; Tabachnick et al., 2007). Once the factors have been extracted, they are rotated.

4.2.1. Orthogonal rotation

Orthogonal rotation rotates the data but keeps the factors independent of one another. *Table 5* portrays the post-rotation factor loadings as well as the communality and uniqueness of each variable.

First factor

All six variables relating to financial literacy, being the five component questions asked to respondents regarding financial literacy as well as the total financial literacy, have high loadings on the first factor (being RC2). The loadings of these variables range from 0.37 to 0.94. Importantly, the total financial literacy variable (FL6) has the highest loading of 0.94. This suggests that the underlying theme of RC2 is overall financial literacy. No behavioural biases loaded highly onto this factor. However, the percentage of a person's income with which one supports family members has a loading of negative 0.4. This suggests that people with higher understandings of financial concepts in this study provide less monetary support to extended family members. This result may also suggest that respondents in this study who supported extended families are those who come from backgrounds of poor financial education.

Second factor

Both health variables, which depicts the respondent's overall self-perceptions of overall health(Demo6 and Demo7) have high positive loading on the second factor (RC1) with values of 0.69 and 0.70 respectively. Gambling (ND2) and income (Demo8) also have positive loadings on RC1 with values of 0.53 and 0.37 respectively. Conversely, the variables of total framing bias (Endow3), retirement relationship (LT3), saving relationship (LT1) and one of the component framing variables (Endow2) have negatives loading with the factor RC1. This factor seems to suggest that people in this study who earn higher incomes and are healthier are prepared to take on elevated levels of financial risk because their circumstances allow them to do so.

People in this study who are prepared to accept more risk place less importance on their relationship with saving and retirement. These individuals are prepared to gamble on their future and seem to fall prey to short-termism. They are prepared to take on risk concerning

themselves with their future financial position. In addition, they are more likely to choose a more riskily framed retirement option over one with lower perceived risk. This is consistent with the negative loading for framing on this factor. Individuals with low scores on this factor may be in need of a 'nudge' to make decisions with a more long-term time horizon in mind (Thaler & Sunstein, 2009). One such 'nudge' may be automatic enrolment into an equivalent of the Save More Tomorrow programme (Thaler & Benartzi, 2004) as discussed in Chapter 1.

Third factor

The variables number of dependents (Demo4), income (Demo8), age (Demo1) and the age at which respondents began saving (LT2) have strong positive loadings on the third factor (RC3) with values of 0.76. 0.64. 0.64 and 0.39 respectively. Only marriage (Demo5) has a strong negative loading onto the factor with a value of negative 0.81.

Older people generally tend to earn more income and have more dependents. The relationship between income, age, number of dependents and saving age could be explained by the generational differences with respect to saving attitudes. Those respondents who could be classified as 'baby boomers' often had job security for an extended period of time and expected that their place of employment would provide for them in old age(Taylor, Pilkington, Feist, Dal Grande, & Hugo, 2014). This explains the relatively late age of starting to invest. Additionally, access to financial institutions has increased significantly in the last decade allowing younger investors easier access to saving vehicles.

Fourth factor

Both anchoring bias variables (Anchor1 and Anchor2), as well as gender (Demo3) have strong positive loadings on the fourth factor (RC4) with loadings of 0.92, 0.92, and 0.44 respectively. No factors have strong negative loadings onto RC4. This suggests that scores for the anchoring bias and gender move concurrently in the same direction. Since women are allocated higher scores than men, this suggests that women are more susceptible to the anchoring bias. This suggests that women are more susceptible to the way in which investing opportunities is presented to them. Particularly, they tend to 'check back' on empirical evidence provided and decisions based on that evidence when making investing decisions. Fund managers and other financial service provided have a duty to provide accurate and comparable information to prospective investors.

Table 4: Anchoring scores

	Men	Women

Average anchoring score	13.39	21.33
Percentage increase on average man's score	-	59.27

Women, on average, have a higher anchoring score than men.

The finding that women are more susceptible to anchoring bias is supported by descriptive statistics. Women on average had an anchoring score of just over twenty-one while men had an average score of under fourteen. The average woman's score represents a an almost 60% increase on the average man's score. *Table 4* provides a more detailed view of the average anchoring scores for men and women.

Table 5: Rotated data (orthogonal)

	RC2	RC1	RC3	RC4	H2	U2	com
Demo1	0.04	0.12	0.64	-0.01	0.42	0.58	1.1
Demo2	0	0.19	0.05	0.05	0.043	0.96	1.3
Demo3	-0.16	-0.2	-0.15	0.44	0.281	0.72	2
Demo4	-0.11	0.11	0.76	-0.02	0.609	0.39	1.1
Demo5	-0.05	-0.18	-0.81	0.09	0.705	0.29	1.1
Demo6	0.02	0.69	-0.05	-0.13	0.494	0.51	1.1
Demo7	0.04	0.7	-0.03	-0.14	0.51	0.49	1.1
Demo8	0.03	0.37	0.64	-0.15	0.568	0.43	1.7
Demo9	-0.4	0.08	0.12	0.15	0.203	0.8	1.6
Over1	-0.03	-0.03	0.16	0.11	0.041	0.96	1.9
Endow1	0.13	-0.19	-0.08	-0.06	0.064	0.94	2.4
Endow2	0.27	-0.52	0.11	-0.13	0.365	0.64	1.7
SavAlloc1	0.27	0.3	-0.22	0	0.215	0.79	2.8
Endow2.5	0.27	-0.06	0.15	-0.23	0.154	0.85	2.7
Endow3	0.02	-0.48	-0.03	0.09	0.238	0.76	1.1
Endow4	0.07	-0.23	0.05	-0.06	0.065	0.94	1.4
ND1	0.1	-0.11	0.21	-0.1	0.076	0.92	2.6
ND2	0.04	0.53	-0.03	-0.08	0.291	0.71	1.1
LT1	-0.2	-0.5	0.07	-0.01	0.295	0.71	1.4
LT2	-0.14	-0.09	0.39	-0.03	0.18	0.82	1.4
LT3	-0.02	-0.49	-0.17	0.07	0.279	0.72	1.3
LT4	0.04	-0.1	0.28	0.02	0.09	0.91	1.3
FL1	0.45	0.02	0.05	0.07	0.207	0.79	1.1
FL2	0.62	0.11	-0.14	0.07	0.422	0.58	1.2

FL3	0.61	0.04	0	0.13	0.395	0.6	1.1
FL4	0.59	0.07	0.1	-0.01	0.364	0.64	1.1
FL5	0.37	-0.05	0.01	-0.06	0.144	0.86	1.1
FL6	0.94	0.09	-0.02	0.08	0.894	0.11	1
Rep1	-0.06	0.15	0.02	-0.19	0.061	0.94	2.1
Rep2	0.09	0.1	-0.02	0.04	0.02	0.98	2.4
Rep3	-0.07	-0.18	-0.02	-0.17	0.068	0.93	2.3
Rep4	-0.12	-0.23	-0.03	0	0.067	0.93	1.5
Anchor1	0.08	0.08	0.02	0.92	0.859	0.14	1
Anchor2	0.07	0.07	0	0.92	0.85	0.15	1

Data from the factor analysis after orthogonal rotation.

4.2.2 Oblique rotation

Oblique rotation rotates the factors and allows the factors to interact with each other. *Table 6* summarises the factor loadings after rotation as well as the communality and uniqueness of each variable. All factor loadings with an absolute value of less than 0.3 have been removed from the table for ease of use. Additionally, the factor loadings for each relevant variable on each factor have been sorted in descending order for the same reason.

First factor

The six financial literacy variables have high loadings on the first factor (being RC2) with loadings of these variables ranging from 0.37 to 0.94. Importantly, the total financial literacy variable (FL6) has the highest loading of 0.94. This suggests that the underlying theme of RC2 is overall financial literacy. No behavioural biases loaded highly onto this factor. However, the percentage of a person's income with which one supports family members has a loading of negative 0.4. This one again implies that people with higher understandings of financial concepts provide less monetary support to extended family members. This result may once again suggest that people who are required to provide financial assistance to their extended families are those who come from backgrounds of poor financial education.

Second factor

As with orthogonal rotation, both health variables (Demo6 and Demo7) have high value loading on the second factor (TC3) with identical values of 0.70 respectively. However, the signs of the factor loadings in oblique rotation are negative in contrast to the positive signs for orthogonal rotation. Gambling (ND2) also has a high negative loading onto the factor with a score of 0.53. Interestingly, income, which had a high loading on the second factor using

orthogonal rotation, does not have high loading on this factor using oblique rotation. The saving allocation variable (SavAlloc1) also loads onto this factor with a loading of negative 0.32. Two framing variables (Endow2 and Endow3) have high positive loadings onto factor TC3 with values of 0.55 and 0.47. Saving relationship (LT1) and retirement relationship (LT3) also have positive loadings onto the second obliquely rotated factor with values of 0.49 and 0.45 respectively. Once again this suggests that the signs have reversed from orthogonal rotation to oblique rotation. However, this is not the case for retirement relationship (LT3) where the sign has remained the same.

Third factor

As is the case with orthogonal rotation, the number of dependents (Demo4), income (Demo8), age (Demo1) and the age at which respondents began to save or invest (LT2) have strong positive loadings onto the third factor (TC1) with values of 0.78, 0.68, 0.65 and 0.38 respectively. The values of the loadings are similar to those of orthogonal rotation. Additionally, in oblique rotation marriage (Demo5) has a strong negative loading of 0.84 whereas in orthogonal rotation the variable has a negative loading of 0.81. The relationship produced by these factor loadings is explained in section 4.2.1. Orthogonal rotation *third factor*.

Fourth factor

As is the case with orthogonal rotation, the two anchoring bias variables (Anchor1 and Anchor2), and gender (Demo3) have strong positive loadings on the fourth factor (TC4) with loadings of 0.92. 0.92. and 0.41 respectively. Similarly, no factors have strong negative loadings onto factor RC4 (a factor which was loaded positively with anchoring and gender biases). Section 4.2.1. explains the relationship between the variables loaded onto this factor.

Table 6: Rotated data (oblique)

	Item	TC2	TC3	TC1	TC4	h2	u2
FL6	28	0.94				0.894	0.11
FL2	24	0.62				0.422	0.58
FL3	25	0.61				0.395	0.6
FL4	26	0.59				0.364	0.64
FL1	23	0.45				0.207	0.79
Demo9	9	-0.41				0.203	0.8
FL5	27	0.38				0.144	0.86
Endow2.5	14					0.154	0.85
Demo7	7		-0.7			0.51	0.49
Demo6	6		-0.7			0.494	0.51

Endow2	12		0.55			0.365	0.64
ND2	18		-0.53			0.291	0.71
LT1	19		0.49			0.295	0.71
Endow3	15		0.47			0.238	0.76
LT3	21		0.45			0.279	0.72
SavAlloc1	13		-0.32			0.215	0.79
Endow4	16					0.065	0.94
Rep4	32					0.067	0.93
Endow1	11					0.064	0.94
Demo2	2					0.043	0.96
Rep2	30					0.02	0.98
Demo5	5			-0.84		0.705	0.29
Demo4	4			0.78		0.609	0.39
Demo8	8			0.68		0.568	0.43
Demo1	1			0.65		0.42	0.58
LT2	20			0.38		0.18	0.82
LT4	22					0.09	0.91
ND1	17					0.076	0.92
Over1	10					0.041	0.96
Anchor1	33				0.92	0.859	0.14
Anchor2	34				0.92	0.85	0.15
Demo3	3				0.41	0.281	0.72
Rep3	31					0.068	0.93
Rep1	29					0.061	0.94

Data from the factor analysis after orthogonal rotation.

4.3. MANOVA

Two independent MANOVAs were performed. The first MANOVA assigns the demographic information variables as the dependent variables and the bias proxies as the independent variables. The second MANOVA performed the test in the opposite direction, assigning the bias proxies as dependent variables and demographic information as the independent variable. Two MANOVAs were performed as this is an exploratory study and the direction of the relationship between behavioural biases and demographic information (whether behavioural biases are the independent or dependent variables) is uncertain. All tables relating section 4.3. can be found in *Appendix B.*

4.3.1. First MANOVA

Multivariate tests

The first MANOVA performed assigned demographic information variables to be the dependent variable and bias proxies to be the independent variable. The equation for the first MANOVA is:

Design: Intercept + OVERCONF + RISKAVE + SAVALL + STATQUO3 + SAMRNEG + Fram1_r + Fam_r + Fram2_r + savrel_r + retrel_r + conserv_r + anchor_r + baserneg_r + FINLIT1 + FINLIT2 + FINLIT3 + FINLIT4 + FINLIT5 + FINLITTOT + FRAMTOT + GAM.

To test for significance the p-value from the MANOVA test-table is compared with the alpha value which, in this study, is 0.05 for a 95% confidence interval (Field et al., 2012).

The multivariate test suggests that some of the behavioural biases explain differences in the demographic information, a statistically significant difference existed at the 5% level in the demographic information of a respondent based on the variable of saving allocation (SAVALL). While not strictly a behavioural bias, a person's saving rate often provides an indication of overall financial health. Additionally, the demographic information exhibit significant differences based on the sample rate neglect (SAMRNEG). and retirement relationship (retrel_r), The anchoring bias (anchor_r) also had a statistically significant impact on the demographic information variables. Lastly, there was also a statistically significant difference in demographic variables bias on gambling (GAM). *Table 7* provides further statistical details regarding the first MANOVA performed.

Univariate analyses of variance (ANOVAs)

Univariate analyses of variance (ANOVA) were performed after the multivariate analysis of variance (MANOVA) to further investigate the impact of the behavioural bias variables on individual demographic variables. The MANOVA only suggests that the behavioural biases had an impact on demographic variables. However, it does not suggest which demographic variables are affect by which behavioural biases. An ANOVA is useful in this regard. A significance level of 10% was used (Field et al., 2012).

Table 8 provides information on the relationship between behavioural biases and demographic variables. Overconfidence has a statistically significant effect on the demographic variables of dependents (DEP); marriage (MAR) and support allocation (SUPALL). This relationship suggests that individuals who are married, have dependents and support other family members have optimistic expectations about the future as they expect to be able to earn an income to allow them to support their families and dependents. People who do not have this

hopeful attitude towards the future do not attempt to support family. However, overconfidence does not explain the variation in gender, in contrast of the findings of Barber and Odean (2001).

Saving Allocation (SAVALL) (the proportion of income that a person saves for the future) has a statistically significant effect on the demographic variables of education (EDU), marriage (MAR) and number of dependents (DEP). These findings suggest that as people grow older, obtain degrees, get married and have dependents, their propensity to save more of their income increases. Perhaps this is because as people age and retirement draws closer, retirement shifts from being a long-term goal to a short-term goal (Hofstede, 2011). Saving becomes more urgent as people tend towards retirement. This is supported by the fact that the behavioural bias of a person's relationship with their retirement age has a significant impact on their age (retrel_r) as a person tends towards retirement, they generally begin to contemplate retirement more and give more thought towards their planned age of retirement. This is evidence of short-termist behaviour as individuals only start to make decisions when the outcome of the decision falls within the immediate future (Hofstede, 2011). These individuals tend not to make long-term plans and their retirement outcomes are sub-optimal as a result.

Additionally, Saving Allocation (SAVALL) has a statistically noteworthy influence on the demographic variables of saving age (the age at which respondents reported that they began saving) (SAVAGE) and retirement age (the age at which respondents reported that they plan to retire) (RETAGE). Once again, as respondents start to plan for their retirements and start considering the age at which they will retire, their planned retirement age increases as they become more realistic. This evidences a lesser degree of overconfidence as these individuals lack optimism. They do not necessarily believe that the future will be better than the present (Weinstein, 1980). Individuals who have a higher savings starting age must compensate for poor savings rates in their younger years and therefore save a greater proportion of their income than those who started saving earlier in life. This again highlights the importance of educating youth on financial literacy so that they can have an appropriate saving allocation earlier in their lives (Nanziri & Olckers, 2019). This is highlighted by the fact that the 10X report (2019) suggests that older South Africans have a deficiency of retirement savings. Perhaps in a South African context, this result could also be explained as a result of younger individuals contributing to the financial upkeep of their aging parents who are insufficiently prepared for retirement. As they age, the earn more income and the bulk of their discretionary income is no longer earmarked for supporting their family members.

The behavioural bias familiarity (Fam_r) has a statistically significant impact on the demographic variable of self-perceived health (HEALTH). This relationship perhaps suggests that individuals who feel in good health are prepared to take greater risks by not investing in assets that are familiar to them (a high familiarity score indicates that a respondent is less prone to the familiarity behavioural bias).

The demographic variables of support allocation (SUPALL) (the financial support a person provides to extended family) and saving age (SAVAGE) are statistically significantly influenced by a respondents relationship towards savings (a high score indicates a weak relationship with saving.) A person who does not value saving and investing one's income will most likely value providing significant financial support to family and begin saving at a much later age. Given the importance of beginning to save early as discussed in Section 4.1.2, this once again highlights the importance of financial literacy education (Lusardi & Mitchell, 2011). It must be noted that regardless of how educated a person is, if they have to support multiple dependents, parents, children, or otherwise, they will struggle to save.

Individuals with a high number of dependents struggle to save. The general population surveyed, on average, saved 16% and 20% of their income. However, those respondents with two or more dependents saved only eleven to 15% of their income. Once again, this evidences that those who find themselves supporting more dependents in their extended families will struggle to save for retirement.

4.3.2. Second MANOVA

Multivariate tests

Bias proxies were assigned to be the dependent variable while demographic information was assigned to be the independent variable in the second MANOVA performed. The equation for the second MANOVA is:

Intercept + AGE + EDU + GEN + DEP + MAR + HEALTH + INC + SUPALL + SAVAGE + RETAGE.

The multivariate test suggests that some of the demographic information variables explain differences in behavioural biases. There was a statistically significant difference in the behavioural biases information of a respondent based on the demographics of age (AGE),

gender (GEN), and health (HEALTH). Additionally, a statistically significant difference occurred in the behavioural biases based on the demographic variables of income (INC) and support allocation (SUPALL).

Univariate analyses of variance (ANOVAs)

Univariate analyses of variance (ANOVA) were performed after the multivariate analysis of variance (MANOVA) to further investigate the impact of the demographic information variables on behavioural bias variables. A significance level of 10% was used(Field et al., 2012).

The demographic variable of age (AGE) has a statistically significant effect on the behavioural biases of an individual's saving's rate, and the respondent's relationship with savings (saverel_r) and retirement (retrel_r). Once again, this suggests that as respondents age, the grow closer to retirement and start to consider their impending retirement more significantly. Once again, this evidences a lack of overconfidence masquerading in the form of short-termism. Respondents do not believe that tomorrow will be better than today and begin to plan in a more pedantic manner. As a result, individuals begin to have a stronger relationship both with the importance of saving and with their forthcoming retirement date. Additionally, they begin to save more of their income for retirement has they begin to realise how much capital is required for a comfortable retirement.

In addition to this, age (AGE) has a statistically significant impact on the behavioural biases of propensity to gambling (GAM), the framing bias (FRAMTOT) , and the financial literacy bias related to diversification (FINLIT5). Individuals seem to struggle with understanding risk from a financial standpoint (as opposed to non-financial risk) as per Section 4.1.2. However, this discrepancy seems to become less pronounced with age. Even though individuals still take risk as evidenced by the relationship with gambling, they understand diversification and financial risk better and make risk decisions from a more educated perspective.

As individuals grow older, they begin to be supported financially by their assets in retirement. Resultantly, they are required to have a sound understanding of key financial concepts to ensure asset-based income that will last their entire retirement. Therefore, the relationship between age and the understanding of diversification and financial risk is beneficial. However, the understanding of key investing theories later in life is detrimental to retirement outcomes. A favourable financial position upon retirement is oftentimes dependent on diligent allocation of income to investing over many years and the investment of this income into inflation beating

assets. The identification of these key assets is a function of an understanding financial risk and diversification.

The gender of respondents has a statistically noteworthy impact on the behavioural biases of propensity to gamble (GAM) and overall financial literacy (FINLITTOT). This suggests that there is a marked difference in the risk appetite and financial literacy of men and women. Men seem to be more financially literate than women and are prepared to take on more risk. This is consistent with the findings of Barber and Odean (2001) who suggests than menhave a greater risk appetite than women. This also suggests that women would benefit from increased financial education and 'nudges' for them to make better financial choices.

5. Conclusion

A saving and investing crisis exists worldwide as well as in South Africa. Individuals are not adequately prepared for retirement and lack ample short-term savings too. This crisis stems from a number of factors such as the historic wrongs of apartheid, a lacking in financial literacy and high costs of living. Socio economic factors also pay a significant role in addition to short-termism, where people under-estimate for the future. A portion of this financial crisis can be attributed to behavioural biases. Individuals are prone to bounded rationality where individuals cease to be guided by rational decision making and are guided by alternative motivators. A behavioural bias is a heuristic which allows for decision making to be a less cognitively intensive activity.

This study investigated the behavioural biases that have an impact on the investing patterns of individuals. Behavioural biases stemming from seminal behavioural finance literature were explored and data related to these biases was collected from respondents via a questionnaire.

Data relating to demographic information and behavioural biases was collected. The magnitude of the existence of these behavioural biases was collected by means of proxies, once again rooted in seminal literature. Data related to the level of financial literacy of respondents was also collected. Data was collected from a random sample of working age South Africans who were in a position to save. Having a degree was used as a proxy for being able to save. Care was taken to ensure that respondents to the questionnaire did not come from the same demographic group. Three hundred and nine useable responses to the questionnaire were collected.

Respondents to the questionnaire seemed to have varying attitudes to risks of a financial nature and risk that were presented from purely a statistical perspective. Individuals seemed to be risk averse when posed with a risk framed in a gambling setting. Respondents chose a large required pay-out when wagering an amount of money with 50% chance of success. However, when presented with risk from a financial standpoint, individuals seem to have a significantly higher attitude for risk. This financial risk was not originally evident and was expressed in the variability of cashflows between multiple retirement income options. Respondents selected retirement income options which were riskier than those provided as comparisons. This suggest that people's financial literacy understanding is lacking regarding identifying financial risk. Additionally, this result also suggests that the framing bias has a significant impact on financial choices.

The respondents to the questionnaire possessed a high level of understanding in the area of financial literacy. The questionnaire tested key financial concepts such as the value of diversification and the time value of money. Financial literacy has been shown to have a significant impact on sound financial decision making. A high level of financial literacy oftentimes leads to improved monetary wellbeing. This study suggests that a person's level of financial literacy is correlated to the age at which a person begins to invest. A person with a higher financial literacy, on average, begins to invest at an earlier age. An investment at even a slightly earlier age can have a large impact on final retirement outcomes.

Data was collected from a number of individuals who saved more than 30% of their income. This was done by circulating the questionnaire on various different social media platforms. These individuals on average earn a higher income than the rest of the population. However, individuals with a high saving rate had more people proportionally in the high-income earning bracket (of R1 500 001 or more per anum). This suggests that because they have discretionary income, these individuals are able to save more. These respondents also had fewer dependents relying on them with an average number of dependents of 1.53. This is contrast to the entire population which had, on average, 1.95 dependents on average. People who save more than 30% of their income also appeared to be slightly more educated than their peers. On average, they held an honours degree or equivalent while the general population, on average, held an undergraduate degree.

A factor analysis, MANOVAs and ANOVAs were used to ascertain which behavioural biases have an impact on the investing patterns of individuals. The results suggest investors in this study are short-termist and are prone to overconfidence as they believe that the future will be better than the present. However, the behavioural bias of overconfidence decreases with age.

Individuals are forced to contemplate their retirement and resultantly their futures more deeply. They therefore need to be more realistic and overconfidence no longer is a factor in investing decisions.

Additionally, the results of the study suggest that men are, on average, more financially literate and have a greater risk attitude than women. This suggests that the population at large, and particularly women, would benefit from increased financial education.

This study is significant as it can be used as guidance for funds and other professional financial institutions in the way they present information to existing and potential investors. Additionally, the outcomes of this study can be used to 'nudge' individuals into making better financial decisions that lead to enhanced retirement outcomes. This is in a similar vein to the research conducted by Richard Thaler in his seminal work *Nudge.*

6. Areas of Further Study

The questionnaire used in this study only collected data on investor characteristics and behavioural biases at a point in time and not over time. While the results indicate that overconfidence decreases with age, it is unclear on how the other biases manifests over different periods of time. Therefore, it would be possible to conduct further research investigating the evolution of the manifestation of behavioural biases over time.

Barber & Odean (2001) suggest that men exhibit higher levels of overconfidence than women. This what not explicitly tested in this study and further research could be performed on the differences in overconfidence between men and women within a South Africa context.

This study defined its population as individuals with degrees as proxy for individuals who are in financial position to invest. This was necessary from a socio-economic perspective in South Africa. Further can be carried out to ascertain the behavioural biases the investing patterns of individuals who do not have degrees. Additionally, the results and findings from this study of degreed individuals could compared with one another. Additionally, a more suitable localised proxy could be developed for risk which would be appropriate within a South African context.

The behavioural biases affecting the investing patterns of individuals were investigated in this study. Many people opt to not make significant investing decisions regarding key investment decisions (such as asset allocation) themselves. Rather they often rely on professional money managers and equivalent finance professionals to make choices on their behalf. As a result, a further area for study is an investigation into the behavioural biases that affect the investing patterns of finance professionals. A particular area of interest is whether the same biases manifest themselves when people are managing their own money versus when they are managing the money of others.

The researcher expended considerable energy to ensure that the random sample obtained was of an appropriate size. However, further studies could be conducted with an even bigger sample size.

A regression analysis could be used as a method of data analysis in future studies. Additionally, a more representative sample could be used to include individuals who do not have degrees. A stricter level of significance could also be used to assess results.

Noteworthy behavioural biases stemming from seminal behavioural finance literature were measured and explored in this study. However, other behavioural biases do exist in other past studies. Further research could be carried out on these biases excluded from this study.

This study only investigated the behavioural biases affecting the investing patterns of South Africans. There is further research that can be conducted into the behavioural biases evident in individuals in other countries. Additionally, research can be conducted into the differences between the behavioural biases in multiple countries and into the causes of the magnitude of manifestation of various behavioural biases.

The framing bias was only explored using the placement of retirement income options when varying the cashflows as a result of a risk. This bias can manifest itself in varying different forms. Further research could be conducted into different variations of the framing bias where other items, besides for potential retirement income, are framed in different ways. Additionally, these future studies can explore the difference between their results and the framing results resulting from this study.

This study exposed the existence of the ‘sandwich generation’, who support both their children and their parents. Further research can be carried out to on this group of people and whether behavioural nudges could better their financial position.

This study focused on the behavioural biases that have an impact on the saving and investing decisions of individuals. Further research could be conducted on whether these behavioural biases also have an impact on other key financial decisions such as spending habits.

Further research could also be conducted in the perceived discrepancy of attitudes towards risk between South Africa and the United States of America as highlighted in Section 2.1.9.

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Appendix A

Masters Questionnaire

The Behavioural Biases Affecting the Investing Decisions of South Africans

Introduction

Dear respondent.
Thank you for taking the time to fill out this questionnaire. Your assistance is greatly appreciated! This questionnaire should take approximately twelve minutes.

The following questionnaire is a part of a research study undertaken to evaluate the behavioural biases that influence the investing patterns of South Africans.

Please note. there are no right or wrong answers in this questionnaire. Please indicate your personal view and thinking in answering the questions. irrespective of what you believe others will think. For all text to be inputted. please input a number only and do not include any symbols (for example. %).

Furthermore. it will be highly appreciated if you complete the questionnaire as thoroughly as possible. **All information gathered is anonymous will be treated as confidential** and will be only be used for academic purposes and will be reported as mathematical averages. variances and correlations.

Participation in this study is completely voluntary and you may withdraw from the study at any point with no consequences.
By completing the questionnaire. you agree to the following: consent to take part in the questionnaire understand that data gathering will be confidential
Thank you very much.
Isaac Lipschitz
Masters Student in Accounting
School of Accountancy
Faculty of Law and Commerce
University of the Witwatersrand
Email: isaaclipschitz@gmail.com

Do you earn some form of an income? (be it as a salary or otherwise)

- ○ Yes
- ○ No

Do you live in South Africa or identify as a South African?

- ○ Yes
- ○ No

Demographic Information

How old are you?

- ○ Under 20
- ○ 21 - 35
- ○ 36 -50
- ○ 51 - 65
- ○ Over 65
- ○ Rather not say

What is your highest level of education completed?

- ○ Grade 12 or lower
- ○ diploma/higher certificate
- ○ Undergraduate degree
- ○ Honours/post-graduate degree
- ○ Masters
- ○ Doctorate
- ○ Rather not say

Please state your gender.

- ○ Male
- ○ Female
- ○ Other
- ○ Rather not say

How many dependents do you have?

- ○ 0
- ○ 1
- ○ 2
- ○ More than 2
- ○ Rather not say

What is your marital status?

- ○ Married
- ○ Widowed
- ○ Divorced
- ○ Separated
- ○ Never married
- ○ Rather not say

On a scale from one to ten. with one being extremely unhealthy and ten being extremely healthy. how healthy are you?

_____

Using a percentage as an indicator. how likely do you think it is that it will snow in Johannesburg next year?

_____

Using a percentage as an indicator. how confident are you in your estimate of the above question?

_____

You are required to participate in a gamble. You are required to wager R100 and your chances of winning are 50%. What is the minimum amount that the bet must pay out in order for you to be comfortable with the risk taken?

_____

Financial Information

What is the income category that best describes your gross annual income before deductions and including all sources of income (in terms of South African Rands)?

- ○ 0 – 78150
- ○ 78151 – 195 850
- ○ 195 851 – 305850
- ○ 305851 – 423 300
- ○ 423 301 – 555 600
- ○ 555 601 – 708 310
- ○ 708 311 – 1 500 000
- ○ 1 500 001 and above
- ○ Rather not say

Approximately what percentage of your monthly income is allocated towards savings and investments?

- ○ Less than 5%
- ○ 5% - 10%
- ○ 11% - 15%
- ○ 16% - 20%
- ○ 21% - 25%
- ○ 26% - 30%
- ○ More than 30%
- ○ Rather not say

Approximately what percentage of your monthly income is allocated towards supporting friends and extended family that do not live in your household?

- ○ Less than 5%
- ○ 5% - 10%
- ○ 11% - 15%
- ○ 16% - 20%
- ○ 21% - 25%
- ○ 26% - 30%
- ○ More than 30%
- ○ Rather not say

Financial Portfolio

Consider the following table of retirement planning options:

Table 1. Monthly retirement provided by three different investment options during good and bad market conditions:

	Option A	Option B	Option C
Good market conditions (50% chance)	R12 600	R15 400	R17 640
Bad market conditions (50% chance)	R12 600	R11 200	R9 800

Source Benartzi and Thaler (2002)

How likely would you be to choose Option C as your only retirement fund?

- Extremely likely
- Moderately likely
- Slightly likely
- Neither likely nor unlikely
- Slightly unlikely
- Moderately unlikely
- Extremely unlikely

How likely are you to invest in a company that you or a friend/ family member have worked for?

- Extremely likely
- Moderately likely
- Slightly likely
- Neither likely nor unlikely
- Slightly unlikely
- Moderately unlikely
- Extremely unlikely

What percentage. if any. of your overall financial portfolio would you consider to be invested in risky shares?

- 0% - 20%
- 21% - 40%
- 41% - 60%
- 61% - 80%
- 80% - 100%
- Rather not say

Consider the following table of retirement planning options:
Table 2. Monthly retirement provided by three different investment programs during good and bad market conditions:

	Program 1	Program 2	Program 3
Good market conditions (50% chance)	R15 400	R17 640	R19 320
Bad market conditions (50% chance)	R11 200	R9 800	R8 400

Source Benartzi and Thaler (2002)

How likely would you be to choose Program 2 as your only retirement fund?

- Extremely likely
- Moderately likely
- Slightly likely
- Neither likely nor unlikely
- Slightly unlikely
- Moderately unlikely
- Extremely unlikely

Financial Choices

“I consider saving and investing to be a very important part of my relationship with money” Which of the following would describe your relationship with the above statement?

- ○ Extremely strong
- ○ Moderately strong
- ○ Slightly strong
- ○ Neutral
- ○ Slightly weak
- ○ Moderately weak
- ○ Extremely weak

At what age did you start saving/investing? (Please enter 200 if you have not started saving/investing)

“I have given my planned retirement age a lot of thought and consideration” Which of the following would describe your relationship with the above statement?

- ○ Extremely strong
- ○ Moderately strong
- ○ Slightly strong
- ○ Neutral
- ○ Slightly weak
- ○ Moderately weak
- ○ Extremely weak

At what age do you plan to retire?

_____

Suppose you need to borrow R100. Which is the lower amount to pay back: R105 or R100 plus three percent?

- ○ R105
- ○ R100 plus 3%
- ○ Don't know
- ○ Refused

Suppose over the next 10 years the prices of the things you buy double. If your income also doubles. will you be able to buy less than you can buy today. the same as you can buy today. or more than you can buy today?

- ○ Less
- ○ The same (assuming interest rates remain constant)
- ○ More
- ○ Don't know
- ○ Refused

Suppose you put money in the bank for two years and the bank agrees to add 15 percent per year to your account based on the account balance. Will the bank add more money to your account the second year than it did the first year. or will it add the same amount of money both years?

- ○ More
- ○ The same
- ○ Don't know
- ○ Refused

Suppose you had R100 in a savings account and the bank adds 10 percent per year to the account based on the account balance. After five years. if you did not remove any money from the account. would you have…

- ○ More than R150
- ○ Exactly R150
- ○ Less than R150
- ○ Don't know
- ○ Refused

Suppose you have some money. Is it safer to put your money into one business or investment. or to put your money into multiple businesses or investments?

- ○ One business or investment
- ○ Multiple businesses or investments
- ○ Don't know
- ○ Refused

Non-Financial Choices

Imagine that you are offered a choice between the following two gambles: a) 65% chance to win R80 b) 30% chance to win R25 Which option would you choose?

- ○ a)
- ○ b)

Imagine that you are offered a choice between the following three options: a) 60% chance to win R15 b) 30% chance to win R30 c) Pay R6 to add one more random gamble to the choice set.

- ○ a)
- ○ b)
- ○ c)

Linda is 31 years old. single. outspoken. and very bright. She majored in philosophy. As a student she was deeply concerned with issues of discrimination and social justice and also participated in anti-apartheid demonstrations. Please rank the following options of Linda's employment from 1-6 with 1 being the most likely and 6 being the least likely: (Please slide the options to change the ranking order)

_____ Linda is cook
_____ Linda is a bank teller
_____ Linda is a bank teller and is active in the feminist movement
_____ Linda is a cashier
_____ Linda is gardener
_____ Linda is a waitress

Which do you believe is more likely:

- ○ a) 6 coin tosses resulting in 3 heads and 3 tails.
- ○ b) 1000 coin tosses resulting in 500 heads and 500 tails.
- ○ c) (a) and (b) are equally likely

Two urns. one with seven red balls and three blue balls (urn one). the other with three red balls and seven blue balls (urn two). are placed in front of you. Twelve balls are drawn at random with each ball replaced back into the urn it came from after each draw. This process yields eight reds and four blues. Approximately what is the probability (in a percentage) the balls came from the first urn (No calculations are required. merely make an estimate)?

_____

What percentage of United Nation countries do you believe are African (60)?

_____

Appendix B

This appendix contains tables related to the MANOVA and ANOVA tests.

Table 7: MANOVA 1 multivariate tests

Effect		Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	.437	21.708[b]	10.000	280.000	.000
	Wilks' Lambda	.563	21.708[b]	10.000	280.000	.000
	Hotelling's Trace	.775	21.708[b]	10.000	280.000	.000
	Roy's Largest Root	.775	21.708[b]	10.000	280.000	.000
OVERCONF	Pillai's Trace	.034	.994[b]	10.000	280.000	.448
	Wilks' Lambda	.966	.994[b]	10.000	280.000	.448
	Hotelling's Trace	.036	.994[b]	10.000	280.000	.448
	Roy's Largest Root	.036	.994[b]	10.000	280.000	.448
RISKAVE	Pillai's Trace	.015	.438[b]	10.000	280.000	.927
	Wilks' Lambda	.985	.438[b]	10.000	280.000	.927
	Hotelling's Trace	.016	.438[b]	10.000	280.000	.927
	Roy's Largest Root	.016	.438[b]	10.000	280.000	.927
SAVALL	Pillai's Trace	.107	3.368[b]	10.000	280.000	.000
	Wilks' Lambda	.893	3.368[b]	10.000	280.000	.000
	Hotelling's Trace	.120	3.368[b]	10.000	280.000	.000
	Roy's Largest Root	.120	3.368[b]	10.000	280.000	.000
STATQUO3	Pillai's Trace	.038	1.105[b]	10.000	280.000	.358
	Wilks' Lambda	.962	1.105[b]	10.000	280.000	.358
	Hotelling's Trace	.039	1.105[b]	10.000	280.000	.358
	Roy's Largest Root	.039	1.105[b]	10.000	280.000	.358
SAMRNEG	Pillai's Trace	.060	1.787[b]	10.000	280.000	.063
	Wilks' Lambda	.940	1.787[b]	10.000	280.000	.063
	Hotelling's Trace	.064	1.787[b]	10.000	280.000	.063
	Roy's Largest Root	.064	1.787[b]	10.000	280.000	.063
Fram1_r	Pillai's Trace	.000	.[b]	.000	.000	.
	Wilks' Lambda	1.000	.[b]	.000	284.500	.
	Hotelling's Trace	.000	.[b]	.000	2.000	.
	Roy's Largest Root	.000	.000[b]	10.000	279.000	1.000
Fam_r	Pillai's Trace	.039	1.127[b]	10.000	280.000	.342
	Wilks' Lambda	.961	1.127[b]	10.000	280.000	.342
	Hotelling's Trace	.040	1.127[b]	10.000	280.000	.342
	Roy's Largest Root	.040	1.127[b]	10.000	280.000	.342
Fram2_r	Pillai's Trace	.000	.[b]	.000	.000	.
	Wilks' Lambda	1.000	.[b]	.000	284.500	.
	Hotelling's Trace	.000	.[b]	.000	2.000	.

	Roy's Largest Root	.000	.000[b]	10.000	279.000	1.000
savrel_r	Pillai's Trace	.042	1.224[b]	10.000	280.000	.275
	Wilks' Lambda	.958	1.224[b]	10.000	280.000	.275
	Hotelling's Trace	.044	1.224[b]	10.000	280.000	.275
	Roy's Largest Root	.044	1.224[b]	10.000	280.000	.275
retrel_r	Pillai's Trace	.147	4.836[b]	10.000	280.000	.000
	Wilks' Lambda	.853	4.836[b]	10.000	280.000	.000
	Hotelling's Trace	.173	4.836[b]	10.000	280.000	.000
	Roy's Largest Root	.173	4.836[b]	10.000	280.000	.000
conserv_r	Pillai's Trace	.043	1.251[b]	10.000	280.000	.259
	Wilks' Lambda	.957	1.251[b]	10.000	280.000	.259
	Hotelling's Trace	.045	1.251[b]	10.000	280.000	.259
	Roy's Largest Root	.045	1.251[b]	10.000	280.000	.259
anchor_r	Pillai's Trace	.086	2.636[b]	10.000	280.000	.004
	Wilks' Lambda	.914	2.636[b]	10.000	280.000	.004
	Hotelling's Trace	.094	2.636[b]	10.000	280.000	.004
	Roy's Largest Root	.094	2.636[b]	10.000	280.000	.004
baserneg_r	Pillai's Trace	.025	.723[b]	10.000	280.000	.703
	Wilks' Lambda	.975	.723[b]	10.000	280.000	.703
	Hotelling's Trace	.026	.723[b]	10.000	280.000	.703
	Roy's Largest Root	.026	.723[b]	10.000	280.000	.703
FINLIT1	Pillai's Trace	.000	.[b]	.000	.000	.
	Wilks' Lambda	1.000	.[b]	.000	284.500	.
	Hotelling's Trace	.000	.[b]	.000	2.000	.
	Roy's Largest Root	.000	.000[b]	10.000	279.000	1.000
FINLIT2	Pillai's Trace	.000	.[b]	.000	.000	.
	Wilks' Lambda	1.000	.[b]	.000	284.500	.
	Hotelling's Trace	.000	.[b]	.000	2.000	.
	Roy's Largest Root	.000	.000[b]	10.000	279.000	1.000
FINLIT3	Pillai's Trace	.000	.[b]	.000	.000	.
	Wilks' Lambda	1.000	.[b]	.000	284.500	.
	Hotelling's Trace	.000	.[b]	.000	2.000	.
	Roy's Largest Root	.000	.000[b]	10.000	279.000	1.000
FINLIT4	Pillai's Trace	.000	.[b]	.000	.000	.
	Wilks' Lambda	1.000	.[b]	.000	284.500	.
	Hotelling's Trace	.000	.[b]	.000	2.000	.
	Roy's Largest Root	.000	.000[b]	10.000	279.000	1.000
FINLIT5	Pillai's Trace	.000	.[b]	.000	.000	.
	Wilks' Lambda	1.000	.[b]	.000	284.500	.
	Hotelling's Trace	.000	.[b]	.000	2.000	.
	Roy's Largest Root	.000	.000[b]	10.000	279.000	1.000

FINLITTOT	Pillai's Trace	.000	.[b]	.000	.000	.
	Wilks' Lambda	1.000	.[b]	.000	284.500	.
	Hotelling's Trace	.000	.[b]	.000	2.000	.
	Roy's Largest Root	.000	.000[b]	10.000	279.000	1.000
FRAMTOT	Pillai's Trace	.000	.[b]	.000	.000	.
	Wilks' Lambda	1.000	.[b]	.000	284.500	.
	Hotelling's Trace	.000	.[b]	.000	2.000	.
	Roy's Largest Root	.000	.000[b]	10.000	279.000	1.000
GAM	Pillai's Trace	.120	3.818[b]	10.000	280.000	.000
	Wilks' Lambda	.880	3.818[b]	10.000	280.000	.000
	Hotelling's Trace	.136	3.818[b]	10.000	280.000	.000
	Roy's Largest Root	.136	3.818[b]	10.000	280.000	.000

b. Exact statistic
Data from the first MANOVA performed.

Table 8: MANOVA 1 tests of between-subject effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	AGE	34.459[a]	19	1.814	1.714	.033
	EDU	27.346[b]	19	1.439	1.407	.122
	GEN	12.325[c]	19	.649	3.308	.000
	DEP	37.485[d]	19	1.973	1.478	.092
	MAR	161.068[e]	19	8.477	2.394	.001
	HEALTH	93.788[f]	19	4.936	2.526	.001
	INC	380.837[g]	19	20.044	4.519	.000
	SUPALL	55.895[h]	19	2.942	3.031	.000
	SAVAGE	46.188[i]	19	2.431	1.641	.046
	RETAGE	71.051[j]	19	3.740	1.618	.051
Intercept	AGE	4.099	1	4.099	3.873	.050
	EDU	19.046	1	19.046	18.620	.000
	GEN	12.859	1	12.859	65.576	.000
	DEP	3.513	1	3.513	2.631	.106
	MAR	66.549	1	66.549	18.790	.000
	HEALTH	7.868	1	7.868	4.026	.046
	INC	9.838	1	9.838	2.218	.138
	SUPALL	16.711	1	16.711	17.215	.000
	SAVAGE	14.543	1	14.543	9.818	.002
	RETAGE	71.297	1	71.297	30.840	.000

OVERCONF	AGE	.050	1	.050	.048	.827
	EDU	.040	1	.040	.039	.843
	GEN	.034	1	.034	.175	.676
	DEP	4.221	1	4.221	3.161	.076
	MAR	13.275	1	13.275	3.748	.054
	HEALTH	.036	1	.036	.018	.893
	INC	6.080	1	6.080	1.371	.243
	SUPALL	3.571	1	3.571	3.678	.056
	SAVAGE	.010	1	.010	.007	.933
	RETAGE	1.274	1	1.274	.551	.458
RISKAVE	AGE	1.272	1	1.272	1.201	.274
	EDU	1.105	1	1.105	1.080	.299
	GEN	.004	1	.004	.018	.892
	DEP	.752	1	.752	.563	.454
	MAR	3.889	1	3.889	1.098	.296
	HEALTH	.561	1	.561	.287	.592
	INC	11.523	1	11.523	2.598	.108
	SUPALL	.028	1	.028	.029	.865
	SAVAGE	.070	1	.070	.047	.828
	RETAGE	2.441	1	2.441	1.056	.305
SAVALL	AGE	.494	1	.494	.467	.495
	EDU	4.206	1	4.206	4.112	.043
	GEN	.045	1	.045	.232	.630
	DEP	12.371	1	12.371	9.265	.003
	MAR	29.444	1	29.444	8.313	.004
	HEALTH	3.071	1	3.071	1.571	.211
	INC	6.046	1	6.046	1.363	.244
	SUPALL	1.100	1	1.100	1.133	.288
	SAVAGE	4.449	1	4.449	3.003	.084
	RETAGE	8.781	1	8.781	3.798	.052
STATQUO3	AGE	.004	1	.004	.004	.949
	EDU	1.852	1	1.852	1.810	.180
	GEN	.005	1	.005	.025	.874
	DEP	1.096	1	1.096	.821	.366
	MAR	.328	1	.328	.093	.761
	HEALTH	.045	1	.045	.023	.880
	INC	2.455	1	2.455	.554	.457
	SUPALL	.215	1	.215	.222	.638
	SAVAGE	2.828	1	2.828	1.909	.168
	RETAGE	15.258	1	15.258	6.600	.011

SAMRNEG	AGE	2.576	1	2.576	2.434	.120
	EDU	4.109	1	4.109	4.017	.046
	GEN	.151	1	.151	.770	.381
	DEP	.709	1	.709	.531	.467
	MAR	.347	1	.347	.098	.755
	HEALTH	2.811	1	2.811	1.438	.231
	INC	7.223	1	7.223	1.628	.203
	SUPALL	.012	1	.012	.013	.911
	SAVAGE	.095	1	.095	.064	.800
	RETAGE	2.136	1	2.136	.924	.337
Fam_r	AGE	.646	1	.646	.610	.435
	EDU	.982	1	.982	.960	.328
	GEN	.200	1	.200	1.020	.313
	DEP	.316	1	.316	.237	.627
	MAR	1.770	1	1.770	.500	.480
	HEALTH	6.356	1	6.356	3.252	.072
	INC	9.453	1	9.453	2.131	.145
	SUPALL	.202	1	.202	.208	.649
	SAVAGE	2.981	1	2.981	2.013	.157
	RETAGE	.042	1	.042	.018	.893
Fram2_r	AGE	.000	0	.	.	.
	EDU	.000	0	.	.	.
	GEN	.000	0	.	.	.
	DEP	.000	0	.	.	.
	MAR	.000	0	.	.	.
	HEALTH	.000	0	.	.	.
	INC	.000	0	.	.	.
	SUPALL	.000	0	.	.	.
	SAVAGE	.000	0	.	.	.
	RETAGE	.000	0	.	.	.
savrel_r	AGE	.073	1	.073	.069	.793
	EDU	2.167	1	2.167	2.118	.147
	GEN	.088	1	.088	.449	.504
	DEP	.558	1	.558	.418	.519
	MAR	1.133	1	1.133	.320	.572
	HEALTH	3.362	1	3.362	1.720	.191
	INC	.086	1	.086	.019	.890
	SUPALL	2.786	1	2.786	2.870	.091
	SAVAGE	7.084	1	7.084	4.782	.030
	RETAGE	.693	1	.693	.300	.585

retrel_r	AGE	11.244	1	11.244	10.624	.001
	EDU	1.368	1	1.368	1.338	.248
	GEN	.323	1	.323	1.646	.200
	DEP	4.754	1	4.754	3.560	.060
	MAR	37.823	1	37.823	10.679	.001
	HEALTH	2.401	1	2.401	1.229	.269
	INC	91.734	1	91.734	20.680	.000
	SUPALL	1.516	1	1.516	1.561	.212
	SAVAGE	5.846	1	5.846	3.947	.048
	RETAGE	11.541	1	11.541	4.992	.026
conserv_r	AGE	2.200	1	2.200	2.078	.150
	EDU	.183	1	.183	.179	.673
	GEN	.070	1	.070	.356	.551
	DEP	1.860	1	1.860	1.393	.239
	MAR	8.290	1	8.290	2.341	.127
	HEALTH	11.124	1	11.124	5.692	.018
	INC	7.334	1	7.334	1.653	.200
	SUPALL	.777	1	.777	.801	.372
	SAVAGE	1.878	1	1.878	1.268	.261
	RETAGE	.861	1	.861	.372	.542
anchor_r	AGE	.370	1	.370	.350	.555
	EDU	.250	1	.250	.244	.621
	GEN	4.284	1	4.284	21.846	.000
	DEP	.480	1	.480	.359	.549
	MAR	6.838	1	6.838	1.931	.166
	HEALTH	.129	1	.129	.066	.798
	INC	13.808	1	13.808	3.113	.079
	SUPALL	.000	1	.000	.000	.990
	SAVAGE	.598	1	.598	.404	.526
	RETAGE	.001	1	.001	.000	.985
baserneg_r	AGE	.155	1	.155	.146	.702
	EDU	.055	1	.055	.054	.817
	GEN	.554	1	.554	2.827	.094
	DEP	.168	1	.168	.126	.723
	MAR	.496	1	.496	.140	.709
	HEALTH	.075	1	.075	.039	.845
	INC	1.583	1	1.583	.357	.551
	SUPALL	.713	1	.713	.735	.392
	SAVAGE	1.956	1	1.956	1.321	.251
	RETAGE	.110	1	.110	.047	.828

FINLIT1	AGE	.000	0	.	.	.
	EDU	.000	0	.	.	.
	GEN	.000	0	.	.	.
	DEP	.000	0	.	.	.
	MAR	.000	0	.	.	.
	HEALTH	.000	0	.	.	.
	INC	.000	0	.	.	.
	SUPALL	.000	0	.	.	.
	SAVAGE	.000	0	.	.	.
	RETAGE	.000	0	.	.	.
FINLIT2	AGE	.000	0	.	.	.
	EDU	.000	0	.	.	.
	GEN	.000	0	.	.	.
	DEP	.000	0	.	.	.
	MAR	.000	0	.	.	.
	HEALTH	.000	0	.	.	.
	INC	.000	0	.	.	.
	SUPALL	.000	0	.	.	.
	SAVAGE	.000	0	.	.	.
	RETAGE	.000	0	.	.	.
FINLIT3	AGE	.000	0	.	.	.
	EDU	.000	0	.	.	.
	GEN	.000	0	.	.	.
	DEP	.000	0	.	.	.
	MAR	.000	0	.	.	.
	HEALTH	.000	0	.	.	.
	INC	.000	0	.	.	.
	SUPALL	.000	0	.	.	.
	SAVAGE	.000	0	.	.	.
	RETAGE	.000	0	.	.	.
FINLIT4	AGE	.000	0	.	.	.
	EDU	.000	0	.	.	.
	GEN	.000	0	.	.	.
	DEP	.000	0	.	.	.
	MAR	.000	0	.	.	.
	HEALTH	.000	0	.	.	.
	INC	.000	0	.	.	.
	SUPALL	.000	0	.	.	.
	SAVAGE	.000	0	.	.	.
	RETAGE	.000	0	.	.	.

FINLIT5	AGE	.000	0	.	.	.
	EDU	.000	0	.	.	.
	GEN	.000	0	.	.	.
	DEP	.000	0	.	.	.
	MAR	.000	0	.	.	.
	HEALTH	.000	0	.	.	.
	INC	.000	0	.	.	.
	SUPALL	.000	0	.	.	.
	SAVAGE	.000	0	.	.	.
	RETAGE	.000	0	.	.	.
FINLITTOT	AGE	.000	0	.	.	.
	EDU	.000	0	.	.	.
	GEN	.000	0	.	.	.
	DEP	.000	0	.	.	.
	MAR	.000	0	.	.	.
	HEALTH	.000	0	.	.	.
	INC	.000	0	.	.	.
	SUPALL	.000	0	.	.	.
	SAVAGE	.000	0	.	.	.
	RETAGE	.000	0	.	.	.
FRAMTOT	AGE	.000	0	.	.	.
	EDU	.000	0	.	.	.
	GEN	.000	0	.	.	.
	DEP	.000	0	.	.	.
	MAR	.000	0	.	.	.
	HEALTH	.000	0	.	.	.
	INC	.000	0	.	.	.
	SUPALL	.000	0	.	.	.
	SAVAGE	.000	0	.	.	.
	RETAGE	.000	0	.	.	.
GAM	AGE	7.306	1	7.306	6.903	.009
	EDU	.092	1	.092	.090	.764
	GEN	3.031	1	3.031	15.456	.000
	DEP	.074	1	.074	.055	.814
	MAR	2.712	1	2.712	.766	.382
	HEALTH	12.867	1	12.867	6.583	.011
	INC	17.296	1	17.296	3.899	.049
	SUPALL	.055	1	.055	.056	.812
	SAVAGE	3.130	1	3.130	2.113	.147
	RETAGE	.302	1	.302	.131	.718

Error	AGE	305.871	289	1.058		
	EDU	295.612	289	1.023		
	GEN	56.672	289	.196		
	DEP	385.880	289	1.335		
	MAR	1023.573	289	3.542		
	HEALTH	564.834	289	1.954		
	INC	1281.985	289	4.436		
	SUPALL	280.538	289	.971		
	SAVAGE	428.090	289	1.481		
	RETAGE	668.134	289	2.312		
Total	AGE	2543.000	309			
	EDU	2750.000	309			
	GEN	621.000	309			
	DEP	1604.000	309			
	MAR	4130.000	309			
	HEALTH	6662.000	309			
	INC	8993.000	309			
	SUPALL	1123.000	309			
	SAVAGE	1829.000	309			
	RETAGE	6956.000	309			
Corrected Total	AGE	340.330	308			
	EDU	322.958	308			
	GEN	68.997	308			
	DEP	423.366	308			
	MAR	1184.641	308			
	HEALTH	658.621	308			
	INC	1662.822	308			
	SUPALL	336.434	308			
	SAVAGE	474.278	308			
	RETAGE	739.184	308			

a. R Squared = .101 (Adjusted R Squared = .042)

b. R Squared = .085 (Adjusted R Squared = .024)

c. R Squared = .179 (Adjusted R Squared = .125)

d. R Squared = .089 (Adjusted R Squared = .029)

e. R Squared = .136 (Adjusted R Squared = .079)

f. R Squared = .142 (Adjusted R Squared = .086)

g. R Squared = .229 (Adjusted R Squared = .178)

h. R Squared = .166 (Adjusted R Squared = .111)

i. R Squared = .097 (Adjusted R Squared = .038)

j. R Squared = .096 (Adjusted R Squared = .037)

Data from the first ANOVA performed.

Table 9: MANOVA 2 multivariate tests

Effect		Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	.765	47.911[b]	19.000	280.000	.000
	Wilks' Lambda	.235	47.911[b]	19.000	280.000	.000
	Hotelling's Trace	3.251	47.911[b]	19.000	280.000	.000
	Roy's Largest Root	3.251	47.911[b]	19.000	280.000	.000
AGE	Pillai's Trace	.108	1.787[b]	19.000	280.000	.024
	Wilks' Lambda	.892	1.787[b]	19.000	280.000	.024
	Hotelling's Trace	.121	1.787[b]	19.000	280.000	.024
	Roy's Largest Root	.121	1.787[b]	19.000	280.000	.024
EDU	Pillai's Trace	.066	1.037[b]	19.000	280.000	.419
	Wilks' Lambda	.934	1.037[b]	19.000	280.000	.419
	Hotelling's Trace	.070	1.037[b]	19.000	280.000	.419
	Roy's Largest Root	.070	1.037[b]	19.000	280.000	.419
GEN	Pillai's Trace	.155	2.700[b]	19.000	280.000	.000
	Wilks' Lambda	.845	2.700[b]	19.000	280.000	.000
	Hotelling's Trace	.183	2.700[b]	19.000	280.000	.000
	Roy's Largest Root	.183	2.700[b]	19.000	280.000	.000
DEP	Pillai's Trace	.126	2.126[b]	19.000	280.000	.005
	Wilks' Lambda	.874	2.126[b]	19.000	280.000	.005
	Hotelling's Trace	.144	2.126[b]	19.000	280.000	.005
	Roy's Largest Root	.144	2.126[b]	19.000	280.000	.005
MAR	Pillai's Trace	.095	1.544[b]	19.000	280.000	.070
	Wilks' Lambda	.905	1.544[b]	19.000	280.000	.070
	Hotelling's Trace	.105	1.544[b]	19.000	280.000	.070
	Roy's Largest Root	.105	1.544[b]	19.000	280.000	.070
HEALTH	Pillai's Trace	.130	2.201[b]	19.000	280.000	.003
	Wilks' Lambda	.870	2.201[b]	19.000	280.000	.003
	Hotelling's Trace	.149	2.201[b]	19.000	280.000	.003
	Roy's Largest Root	.149	2.201[b]	19.000	280.000	.003
INC	Pillai's Trace	.193	3.516[b]	19.000	280.000	.000
	Wilks' Lambda	.807	3.516[b]	19.000	280.000	.000
	Hotelling's Trace	.239	3.516[b]	19.000	280.000	.000
	Roy's Largest Root	.239	3.516[b]	19.000	280.000	.000
SUPALL	Pillai's Trace	.167	2.958[b]	19.000	280.000	.000
	Wilks' Lambda	.833	2.958[b]	19.000	280.000	.000
	Hotelling's Trace	.201	2.958[b]	19.000	280.000	.000
	Roy's Largest Root	.201	2.958[b]	19.000	280.000	.000
SAVAGE	Pillai's Trace	.111	1.836[b]	19.000	280.000	.019

	Wilks' Lambda	.889	1.836[b]	19.000	280.000	.019
	Hotelling's Trace	.125	1.836[b]	19.000	280.000	.019
	Roy's Largest Root	.125	1.836[b]	19.000	280.000	.019
RETAGE	Pillai's Trace	.125	2.115[b]	19.000	280.000	.005
	Wilks' Lambda	.875	2.115[b]	19.000	280.000	.005
	Hotelling's Trace	.143	2.115[b]	19.000	280.000	.005
	Roy's Largest Root	.143	2.115[b]	19.000	280.000	.005

b. Exact statistic

This table provides information regarding the second MANOVA test performed where the impact of demographic variables on behavioural biases was investigated.

Table 10: MANOVA 2 tests of between-subject effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	OVERCONF	58.952[a]	10	5.895	1.223	.275
	RISKAVE	24.327[b]	10	2.433	.682	.741
	SAVALL	239.124[c]	10	23.912	6.574	.000
	GAM	76.830[d]	10	7.683	5.844	.000
	FRAMTOT	93.192[e]	10	9.319	2.339	.011
	FINLIT1	.557[f]	10	.056	1.070	.386
	FINLIT2	3.297[g]	10	.330	1.873	.049
	FINLIT3	.678[h]	10	.068	1.716	.077
	FINLIT4	1.709[i]	10	.171	2.143	.021
	FINLIT5	.889[j]	10	.089	3.836	.000
	FINLITTOT	16.977[k]	10	1.698	3.094	.001
	STATQUO3	10.407[l]	10	1.041	1.405	.177
	SAMRNEG	10.292[m]	10	1.029	2.197	.018
	Fram1_r	78.671[n]	10	7.867	1.781	.063
	Fam_r	49.898[o]	10	4.990	2.187	.019
	Fram2_r	87.346[p]	10	8.735	2.443	.008
	savrel_r	74.764[q]	10	7.476	5.353	.000
	retrel_r	257.704[r]	10	25.770	9.196	.000
	conserv_r	28.443[s]	10	2.844	1.162	.316
	anchor_r	24.262[t]	10	2.426	2.284	.014
	baserneg_r	42.392[u]	10	4.239	1.542	.124
Intercept	OVERCONF	151.279	1	151.279	31.396	.000
	RISKAVE	78.415	1	78.415	21.993	.000
	SAVALL	89.167	1	89.167	24.512	.000
	GAM	31.153	1	31.153	23.696	.000

	FRAMTOT	8.047	1	8.047	2.019	.156
	FINLIT1	6.055	1	6.055	116.358	.000
	FINLIT2	2.767	1	2.767	15.717	.000
	FINLIT3	6.010	1	6.010	152.096	.000
	FINLIT4	4.514	1	4.514	56.632	.000
	FINLIT5	4.481	1	4.481	193.417	.000
	FINLITTOT	117.011	1	117.011	213.273	.000
	STATQUO3	15.238	1	15.238	20.569	.000
	SAMRNEG	19.307	1	19.307	41.215	.000
	Fram1_r	31.059	1	31.059	7.032	.008
	Fam_r	87.654	1	87.654	38.419	.000
	Fram2_r	70.725	1	70.725	19.781	.000
	savrel_r	168.873	1	168.873	120.900	.000
	retrel_r	131.188	1	131.188	46.813	.000
	conserv_r	49.664	1	49.664	20.297	.000
	anchor_r	190.006	1	190.006	178.866	.000
	baserneg_r	68.460	1	68.460	24.905	.000
AGE	OVERCONF	6.713	1	6.713	1.393	.239
	RISKAVE	.359	1	.359	.101	.751
	SAVALL	17.603	1	17.603	4.839	.029
	GAM	3.770	1	3.770	2.868	.091
	FRAMTOT	17.756	1	17.756	4.456	.036
	FINLIT1	6.411E-5	1	6.411E-5	.001	.972
	FINLIT2	.284	1	.284	1.613	.205
	FINLIT3	.003	1	.003	.086	.769
	FINLIT4	.044	1	.044	.554	.457
	FINLIT5	.064	1	.064	2.743	.099
	FINLITTOT	1.127	1	1.127	2.054	.153
	STATQUO3	.237	1	.237	.320	.572
	SAMRNEG	2.304	1	2.304	4.918	.027
	Fram1_r	6.248	1	6.248	1.415	.235
	Fam_r	.766	1	.766	.336	.563
	Fram2_r	2.938	1	2.938	.822	.365
	savrel_r	8.348	1	8.348	5.977	.015
	retrel_r	23.384	1	23.384	8.344	.004
	conserv_r	1.072	1	1.072	.438	.509
	anchor_r	.001	1	.001	.001	.977
	baserneg_r	.265	1	.265	.096	.756
EDU	OVERCONF	.212	1	.212	.044	.834
	RISKAVE	2.424	1	2.424	.680	.410

	SAVALL	5.087	1	5.087	1.398	.238
	GAM	.489	1	.489	.372	.542
	FRAMTOT	.203	1	.203	.051	.822
	FINLIT1	.025	1	.025	.472	.493
	FINLIT2	.041	1	.041	.232	.631
	FINLIT3	.004	1	.004	.107	.744
	FINLIT4	.038	1	.038	.477	.490
	FINLIT5	.018	1	.018	.787	.376
	FINLITTOT	.003	1	.003	.005	.946
	STATQUO3	.661	1	.661	.893	.346
	SAMRNEG	3.523	1	3.523	7.520	.006
	Fram1_r	.953	1	.953	.216	.643
	Fam_r	.324	1	.324	.142	.706
	Fram2_r	2.035	1	2.035	.569	.451
	savrel_r	1.726	1	1.726	1.236	.267
	retrel_r	5.885	1	5.885	2.100	.148
	conserv_r	.243	1	.243	.099	.753
	anchor_r	.089	1	.089	.084	.773
	baserneg_r	.001	1	.001	.001	.982
GEN	OVERCONF	4.412	1	4.412	.916	.339
	RISKAVE	.169	1	.169	.048	.828
	SAVALL	9.784	1	9.784	2.689	.102
	GAM	16.920	1	16.920	12.870	.000
	FRAMTOT	.927	1	.927	.233	.630
	FINLIT1	.198	1	.198	3.813	.052
	FINLIT2	.001	1	.001	.005	.941
	FINLIT3	.043	1	.043	1.087	.298
	FINLIT4	.408	1	.408	5.120	.024
	FINLIT5	2.319E-5	1	2.319E-5	.001	.975
	FINLITTOT	1.601	1	1.601	2.919	.089
	STATQUO3	.012	1	.012	.016	.900
	SAMRNEG	2.726E-5	1	2.726E-5	.000	.994
	Fram1_r	4.386	1	4.386	.993	.320
	Fam_r	1.711	1	1.711	.750	.387
	Fram2_r	1.281	1	1.281	.358	.550
	savrel_r	1.145	1	1.145	.820	.366
	retrel_r	1.870	1	1.870	.667	.415
	conserv_r	.243	1	.243	.099	.753
	anchor_r	18.493	1	18.493	17.409	.000
	baserneg_r	16.352	1	16.352	5.949	.015

DEP	OVERCONF	1.996	1	1.996	.414	.520
	RISKAVE	.010	1	.010	.003	.958
	SAVALL	27.034	1	27.034	7.432	.007
	GAM	2.570	1	2.570	1.955	.163
	FRAMTOT	8.624	1	8.624	2.164	.142
	FINLIT1	.210	1	.210	4.044	.045
	FINLIT2	.010	1	.010	.056	.813
	FINLIT3	.264	1	.264	6.684	.010
	FINLIT4	.096	1	.096	1.204	.273
	FINLIT5	.060	1	.060	2.597	.108
	FINLITTOT	1.292	1	1.292	2.355	.126
	STATQUO3	.506	1	.506	.683	.409
	SAMRNEG	.313	1	.313	.667	.415
	Fram1_r	2.085	1	2.085	.472	.493
	Fam_r	9.238	1	9.238	4.049	.045
	Fram2_r	19.189	1	19.189	5.367	.021
	savrel_r	4.889	1	4.889	3.500	.062
	retrel_r	14.904	1	14.904	5.318	.022
	conserv_r	.005	1	.005	.002	.965
	anchor_r	1.487	1	1.487	1.400	.238
	baserneg_r	8.795	1	8.795	3.200	.075
MAR	OVERCONF	14.330	1	14.330	2.974	.086
	RISKAVE	.008	1	.008	.002	.963
	SAVALL	14.360	1	14.360	3.947	.048
	GAM	1.218	1	1.218	.926	.337
	FRAMTOT	4.179	1	4.179	1.049	.307
	FINLIT1	.158	1	.158	3.028	.083
	FINLIT2	.031	1	.031	.173	.677
	FINLIT3	.274	1	.274	6.923	.009
	FINLIT4	.018	1	.018	.226	.635
	FINLIT5	.020	1	.020	.875	.350
	FINLITTOT	.543	1	.543	.990	.321
	STATQUO3	.219	1	.219	.296	.587
	SAMRNEG	1.025	1	1.025	2.188	.140
	Fram1_r	3.468	1	3.468	.785	.376
	Fam_r	3.393	1	3.393	1.487	.224
	Fram2_r	15.261	1	15.261	4.268	.040
	savrel_r	.002	1	.002	.001	.972
	retrel_r	2.798	1	2.798	.999	.318
	conserv_r	.326	1	.326	.133	.715

	anchor_r	1.129	1	1.129	1.062	.304
	baserneg_r	1.523	1	1.523	.554	.457
HEALTH	OVERCONF	.318	1	.318	.066	.797
	RISKAVE	1.128	1	1.128	.316	.574
	SAVALL	.130	1	.130	.036	.850
	GAM	16.262	1	16.262	12.369	.001
	FRAMTOT	42.732	1	42.732	10.724	.001
	FINLIT1	.096	1	.096	1.838	.176
	FINLIT2	.778	1	.778	4.422	.036
	FINLIT3	.005	1	.005	.137	.712
	FINLIT4	.002	1	.002	.027	.871
	FINLIT5	.026	1	.026	1.129	.289
	FINLITTOT	.730	1	.730	1.330	.250
	STATQUO3	.334	1	.334	.451	.502
	SAMRNEG	1.291	1	1.291	2.755	.098
	Fram1_r	22.748	1	22.748	5.150	.024
	Fam_r	7.289	1	7.289	3.195	.075
	Fram2_r	3.124	1	3.124	.874	.351
	savrel_r	8.698	1	8.698	6.227	.013
	retrel_r	10.711	1	10.711	3.822	.052
	conserv_r	13.829	1	13.829	5.652	.018
	anchor_r	.103	1	.103	.097	.756
	baserneg_r	.274	1	.274	.100	.752
INC	OVERCONF	.171	1	.171	.035	.851
	RISKAVE	3.484	1	3.484	.977	.324
	SAVALL	62.065	1	62.065	17.062	.000
	GAM	12.424	1	12.424	9.450	.002
	FRAMTOT	1.460	1	1.460	.366	.545
	FINLIT1	.012	1	.012	.225	.636
	FINLIT2	.145	1	.145	.824	.365
	FINLIT3	.029	1	.029	.736	.392
	FINLIT4	.273	1	.273	3.420	.065
	FINLIT5	.009	1	.009	.386	.535
	FINLITTOT	.000	1	.000	.000	.983
	STATQUO3	.153	1	.153	.207	.650
	SAMRNEG	3.679	1	3.679	7.854	.005
	Fram1_r	.328	1	.328	.074	.785
	Fam_r	12.277	1	12.277	5.381	.021
	Fram2_r	3.173	1	3.173	.887	.347
	savrel_r	11.045	1	11.045	7.907	.005

	retrel_r	83.035	1	83.035	29.630	.000
	conserv_r	.777	1	.777	.318	.573
	anchor_r	.379	1	.379	.357	.551
	baserneg_r	8.704	1	8.704	3.167	.076
SUPALL	OVERCONF	13.313	1	13.313	2.763	.098
	RISKAVE	2.663	1	2.663	.747	.388
	SAVALL	5.474	1	5.474	1.505	.221
	GAM	.050	1	.050	.038	.845
	FRAMTOT	.221	1	.221	.056	.814
	FINLIT1	8.408E-6	1	8.408E-6	.000	.990
	FINLIT2	1.136	1	1.136	6.451	.012
	FINLIT3	.071	1	.071	1.798	.181
	FINLIT4	.193	1	.193	2.417	.121
	FINLIT5	.745	1	.745	32.166	.000
	FINLITTOT	6.925	1	6.925	12.621	.000
	STATQUO3	.085	1	.085	.115	.735
	SAMRNEG	.037	1	.037	.080	.777
	Fram1_r	35.700	1	35.700	8.083	.005
	Fam_r	6.135	1	6.135	2.689	.102
	Fram2_r	30.299	1	30.299	8.474	.004
	savrel_r	.014	1	.014	.010	.920
	retrel_r	1.042	1	1.042	.372	.542
	conserv_r	4.818	1	4.818	1.969	.162
	anchor_r	.468	1	.468	.440	.507
	baserneg_r	.180	1	.180	.066	.798
SAVAGE	OVERCONF	.013	1	.013	.003	.959
	RISKAVE	1.904	1	1.904	.534	.465
	SAVALL	47.457	1	47.457	13.046	.000
	GAM	5.854	1	5.854	4.452	.036
	FRAMTOT	.854	1	.854	.214	.644
	FINLIT1	.012	1	.012	.231	.631
	FINLIT2	.730	1	.730	4.145	.043
	FINLIT3	.021	1	.021	.525	.469
	FINLIT4	.253	1	.253	3.177	.076
	FINLIT5	.040	1	.040	1.713	.192
	FINLITTOT	3.277	1	3.277	5.972	.015
	STATQUO3	2.562	1	2.562	3.459	.064
	SAMRNEG	.060	1	.060	.129	.720
	Fram1_r	.559	1	.559	.127	.722
	Fam_r	2.874	1	2.874	1.260	.263

	Fram2_r	.031	1	.031	.009	.926
	savrel_r	23.448	1	23.448	16.787	.000
	retrel_r	5.281	1	5.281	1.884	.171
	conserv_r	.117	1	.117	.048	.827
	anchor_r	.548	1	.548	.515	.473
	baserneg_r	5.096	1	5.096	1.854	.174
RETAGE	OVERCONF	4.017	1	4.017	.834	.362
	RISKAVE	2.713	1	2.713	.761	.384
	SAVALL	30.454	1	30.454	8.372	.004
	GAM	1.133	1	1.133	.862	.354
	FRAMTOT	2.012	1	2.012	.505	.478
	FINLIT1	.001	1	.001	.010	.919
	FINLIT2	.000	1	.000	.003	.959
	FINLIT3	.032	1	.032	.817	.367
	FINLIT4	.002	1	.002	.027	.869
	FINLIT5	.003	1	.003	.150	.699
	FINLITTOT	.015	1	.015	.027	.869
	STATQUO3	4.036	1	4.036	5.448	.020
	SAMRNEG	1.328	1	1.328	2.834	.093
	Fram1_r	.784	1	.784	.178	.674
	Fam_r	.682	1	.682	.299	.585
	Fram2_r	.284	1	.284	.079	.778
	savrel_r	13.403	1	13.403	9.595	.002
	retrel_r	64.980	1	64.980	23.187	.000
	conserv_r	2.708	1	2.708	1.107	.294
	anchor_r	.044	1	.044	.041	.839
	baserneg_r	.215	1	.215	.078	.780
Error	OVERCONF	1435.870	298	4.818		
	RISKAVE	1062.495	298	3.565		
	SAVALL	1084.028	298	3.638		
	GAM	391.779	298	1.315		
	FRAMTOT	1187.475	298	3.985		
	FINLIT1	15.508	298	.052		
	FINLIT2	52.457	298	.176		
	FINLIT3	11.775	298	.040		
	FINLIT4	23.754	298	.080		
	FINLIT5	6.904	298	.023		
	FINLITTOT	163.495	298	.549		
	STATQUO3	220.758	298	.741		
	SAMRNEG	139.598	298	.468		

	Fram1_r	1316.171	298	4.417		
	Fam_r	679.888	298	2.282		
	Fram2_r	1065.495	298	3.575		
	savrel_r	416.245	298	1.397		
	retrel_r	835.118	298	2.802		
	conserv_r	729.150	298	2.447		
	anchor_r	316.560	298	1.062		
	baserneg_r	819.142	298	2.749		
Total	OVERCONF	9625.000	309			
	RISKAVE	4113.000	309			
	SAVALL	6642.000	309			
	GAM	1661.000	309			
	FRAMTOT	1315.000	309			
	FINLIT1	292.000	309			
	FINLIT2	236.000	309			
	FINLIT3	296.000	309			
	FINLIT4	281.000	309			
	FINLIT5	301.000	309			
	FINLITTOT	6578.000	309			
	STATQUO3	731.000	309			
	SAMRNEG	1513.000	309			
	Fram1_r	6395.000	309			
	Fam_r	7581.000	309			
	Fram2_r	7016.000	309			
	savrel_r	12759.000	309			
	retrel_r	9223.000	309			
	conserv_r	5165.000	309			
	anchor_r	9815.000	309			
	baserneg_r	8467.000	309			
Corrected Total	OVERCONF	1494.822	308			
	RISKAVE	1086.822	308			
	SAVALL	1323.152	308			
	GAM	468.608	308			
	FRAMTOT	1280.667	308			
	FINLIT1	16.065	308			
	FINLIT2	55.754	308			
	FINLIT3	12.453	308			
	FINLIT4	25.463	308			
	FINLIT5	7.793	308			
	FINLITTOT	180.472	308			

	STATQUO3	231.165	308			
	SAMRNEG	149.890	308			
	Fram1_r	1394.841	308			
	Fam_r	729.786	308			
	Fram2_r	1152.841	308			
	savrel_r	491.010	308			
	retrel_r	1092.822	308			
	conserv_r	757.592	308			
	anchor_r	340.822	308			
	baserneg_r	861.534	308			

a. R Squared = .039 (Adjusted R Squared = .007)

b. R Squared = .022 (Adjusted R Squared = -.010)

c. R Squared = .181 (Adjusted R Squared = .153)

d. R Squared = .164 (Adjusted R Squared = .136)

e. R Squared = .073 (Adjusted R Squared = .042)

f. R Squared = .035 (Adjusted R Squared = .002)

g. R Squared = .059 (Adjusted R Squared = .028)

h. R Squared = .054 (Adjusted R Squared = .023)

i. R Squared = .067 (Adjusted R Squared = .036)

j. R Squared = .114 (Adjusted R Squared = .084)

k. R Squared = .094 (Adjusted R Squared = .064)

l. R Squared = .045 (Adjusted R Squared = .013)

m. R Squared = .069 (Adjusted R Squared = .037)

n. R Squared = .056 (Adjusted R Squared = .025)

o. R Squared = .068 (Adjusted R Squared = .037)

p. R Squared = .076 (Adjusted R Squared = .045)

q. R Squared = .152 (Adjusted R Squared = .124)

r. R Squared = .236 (Adjusted R Squared = .210)

s. R Squared = .038 (Adjusted R Squared = .005)

t. R Squared = .071 (Adjusted R Squared = .040)

u. R Squared = .049 (Adjusted R Squared = .017)

Data from the first ANOVA performed.

Appendix C

Coding of the survey

Question number 1 asked respondents if they earn some form of income. If the answer to the question was 'no', that response was excluded from the study because that respondent did not form part of the population to be sampled. Similarly, if the response to question 2, which asked if respondents lived in South Africa or identified as South African, was 'no', that response was also excluded from the study because that respondent did not form part of the population to be sampled.

The data collected from respondents was converted into Likert-scale values in order for the data to be used in a factor analysis and to smooth outliers. Please refer to the table below for the coding of the variables.

Please refer to the attached sample survey in Appendix A for the question numbers as well as the text of the question to be asked. The following table provides information on the questions asked in the survey, the category of data the questions collected, the responses possible and how those responses were coded, the Likert-scale of the responses if Likert coding was applicable and the direction of data (which indicates which responses indicate the highest and lowest instances of the behavioural biases to be tested):

Question Number	Data Collected	Possible Responses	Coding of Response	Likert Coding	Direction of Data	Precedent
3	Age	Under 20	1	Not applicable	Youngest respondent	Not Applicable
		21 – 35	2			
		36 – 50	3			
		51 – 65	4			
		Over 65	5			
		Rather not say	Exclude		Oldest Respondent	
4	Education	Grade 12 or lower	1	Not applicable	Lowest education level	Not applicable
		Diploma/higher certificate	2			
		Undergraduate degree	3			
		Honours/post-graduate degree	4			
		Masters	5			
		Doctorate	6			
		Rather not say	Exclude		Highest education level	
5	Gender	Male	1		Not applicable	Not applicable

		Female	2	Not applicable		
		Other	3			
		Rather not say	Exclude			
6	Dependents	0	1	Not applicable	Least number of dependents	Not applicable
		1	2			
		2	3			
		More than 2	4			
		Rather not say	Exclude		Most dependents	
7	Married	Married	1	Not applicable	Not applicable	Not applicable
		Widowed	2			
		Divorced	3			
		Separated	4			
		Never married	5			
		Rather not say	Exclude			
8	Health	Decimal number entered by the respondent	Not applicable	0 – 4 | 1	Lowest health	Not applicable
				5 | 2		
				6 | 3		
				7 | 4		
				8 | 5		
				9 | 6		
				10 | 7	Highest health	
9	Excluded from survey	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable (see the proxy for overconfidence section)
10	Overconfidence	Decimal number entered by the respondent	Not applicable	0 -15 | 1	Least overconfidence	(Weinstein, 1980)
				16 – 29 | 2		
				30 -43 | 3		
				44 – 57 | 4		
				58 – 71 | 5		
				72 – 85 | 6		
				86 - 100 | 7	Highest overconfidence	
11	Income	0 – 78150	1	Not applicable	Lowest amount of income	Not applicable
		78151 - 195 850	2			
		195851 – 305850	3			
		305851 – 423300	4			
		423301 – 555600	5			
		555601 – 708310	6			
		708311 – 1500000	7			
		1500001 and above	8			

		Rather not say	Exclude		Highest amount of income	
12	Saving allocation	Less than 5%	1	Not applicable	Lowest saving allocation	Not applicable
		5% - 10%	2			
		11% - 15%	3			
		16% - 20%	4			
		21% - 25%	5			
		26% - 30%	6			
		More than 30%	7			
		Rather not say	Exclude		Highest saving allocation	
13	Support allocation	Less than 5%	1	Not applicable	Lowest support allocation	Not applicable
		5% - 10%	2			
		11% - 15%	3			
		16% - 20%	4			
		21% - 25%	5			
		26% - 30%	6			
		More than 30%	7			
		Rather not say	Exclude		Highest support allocation	
14	Framing 1	Extremely likely	1	Not applicable	Highest propensity for framing bias	(Benartzi & Thaler, 2002)
		Moderately Likely	2			
		Slightly likely	3			
		Neither likely or unlikely	4			
		Slightly unlikely	5			
		Moderately unlikely	6			
		Extremely unlikely	7		Lowest propensity for framing bias	
15	Familiarity	Extremely likely	1	Not applicable	Highest propensity for familiarity bias	(Foad, 2010)
		Moderately Likely	2			
		Slightly likely	3			
		Neither likely or unlikely	4			
		Slightly unlikely	5			
		Moderately unlikely	6			
		Extremely unlikely	7		Lowest propensity for familiarity bias	
16	Gambling	0% - 20%	1	Not applicable	Lowest propensity for gambling bias	(Kumar, 2009)
		21% - 40%	2			
		41% - 60%	3			
		61% - 80%	4			

		81% - 100%	5			
		Rather not say	Exclude		Highest propensity for gambling bias	
17	Framing 2	Extremely likely	1	Not applicable	Highest propensity for framing bias	(Benartzi & Thaler, 2002)
		Moderately Likely	2			
		Slightly likely	3			
		Neither likely or unlikely	4			
		Slightly unlikely	5			
		Moderately unlikely	6			
		Extremely unlikely	7		Lowest propensity for framing bias	
Composite Variable	Framing Total	Calculated by subtracting Framing 2 from Framing 1	-6	-6	Most propensity for framing bias	(Benartzi & Thaler, 2002)
			-5	-5		
			-4	-4		
			-3	-3		
			-2	-2		
			-1	-1		
			0	0	Least propensity for framing bias	
			1	1		
			2	2		
			3	3		
			4	4		
			5	5		
			6	6	Most	
18	Saving Relationship	Extremely strong	1	Not applicable	Strongest relationship with saving	Not applicable
		Moderately Strong	2			
		Slightly strong	3			
		Neutral	4			
		Slightly weak	5			
		Moderately weak	6			
		Extremely weak	7		Weakest relationship with savings	
19	Saving age	Decimal number entered by the respondent	Not applicable	1 – 20 | 1	Youngest saving age	Not applicable
				21 – 25 | 2		
				26 - 30 | 3		
				31 – 35 | 4		
				36 - 40 | 5		
				41 or older | 6		
				Have not | 7	Oldest saving age	

				started yet (input of 200)			
20	Retirement relationship	Extremely strong	1	Not applicable		Strongest relationship with retirement	Not applicable
		Moderately Strong	2				
		Slightly strong	3				
		Neutral	4				
		Slightly weak	5				
		Moderately weak	6				
		Extremely weak	7			Weakest relationship with retirement	
21	Retirement age	Decimal number entered by the respondent	Not applicable	0 -40	1	Youngest planed retirement age	Not applicable
				41 – 48	2		
				49 – 55	3		
				56 – 62	4		
				63 – 69	5		
				69 – 70	6		
				71 or older	7	Oldest planned retirement age	
22	Fin lit 1	R105	0	Not applicable			(Nanziri & Olckers, 2019)
		R100 plus 3%	1			Correct answer	
		Don't know	0				
		Refused	Excluded				
23	Fin lit 2	Less	0	Not applicable			(Nanziri & Olckers, 2019)
		The same (assuming interest rates remain constant)	1			Correct answer	
		More	0				
		Don't know	0				
		Refused	Excluded				
24	Fin lit 3	More	1	Not applicable		Correct answer	(Nanziri & Olckers, 2019)
		The same	0				
		Don't know	0				
		Refused	Excluded				
25	Fin lit 4	More than R150	1	Not applicable		Correct answer	(Nanziri & Olckers, 2019)
		Exactly R150	0				
		Less than R150	0				
		Don't know	0				
		Refused	Excluded				
26	Fin lit 5	One business or investment	0	Not applicable			(Nanziri & Olckers, 2019)

		Multiple business or investments	1		Correct answer	
		Don't know	0			
		Refused	Excluded			
Composite variable	Fin lit total	Calculated by summing the results of all fin lit questions	1	1	Leat financially literate	(Nanziri & Olckers, 2019)
			2	2		
			3	3		
			4	4		
			5	5	Most financially literate	
27	Status quo 1	a)	Please see status quo bias proxy section	Not applicable	Please see status quo bias proxy section	(Tversky & Shafir, 1992)
		b)				
28	Status quo 2	a)	Please see status quo bias proxy section	Not applicable	Please see status quo bias proxy section	(Tversky & Shafir, 1992)
		b)				
		c)				
Composite variable	Status Quo 3	If the answer is Status Quo 2 is the same as Status Quo 1, a 2 is assigned, otherwise a zero is assigned if the answer is a) or b). A zero is assigned if the answer is c)	0	0	Least propensity for status quo bias	(Tversky & Shafir, 1992)
			1	1		
			2	2	Most propensity for status quo bias	
29	Base rate neglect	1	1	Not applicable	More propensity for base rate neglect bias	(Tversky & Kahneman, 1974)
		2	2			
		3	3			
		4	4			
		5	5			
		6	6		Less propensity for base rate neglect bias	
30	Sample size neglect	a) 6 coin tosses resulting in 3 heads and 3 tails	1	Not Applicable	Least propensity for sample size bias	(Tversky & Kahneman, 1974)
		b) 1000 coin tosses resulting in 500 heads and 500 tails	3		Most propensity for sample size bias	
		a) and b) are equally likely	2		Less propensity for	

						sample size neglect bias	
31	Conservatism	Decimal number entered by the respondent	Not applicable	-1000 – 0	1	Most propensity for conservatism bias	(Edwards, 1968)
				1 – 15	2		
				16 – 32	3		
				33 – 49	4		
				50 – 66	5		
				67 – 83	6		
				84 - 100	7	Least propensity for conservatism bias	
32	Anchoring	Decimal number entered by the respondent	Not applicable	0	1	Most propensity for anchoring bias	(Tversky & Kahneman, 1974)
				1 – 16	2		
				17 – 32	3		
				33 – 49	4		
				50 – 66	5		
				67 – 83	6		
				84 - 100	7	Least propensity for anchoring bias	