

The association between selected demographic variables on investors' expected utility values and risk tolerance

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Declaration of original work

I, Leandri Maritz, declare that this mini-dissertation is my own unaided work. Any assistance that I have received has been duly acknowledged in this dissertation. It is submitted in partial fulfilment of the requirements of the Masters of Commerce at the North-West University, Potchefstroom Campus. It has not been submitted before for any degree or examination at this institution or any other university.

Leandri Maritz

Signature

A handwritten signature in black ink, consisting of a series of loops and strokes, positioned over a horizontal line.

2018-11-12

Date

The association between selected demographic variables on investors' expected utility values and risk tolerance has been focused on in various countries all over the world. Some demographic variables were found to have an effect on how investors make financial investment decisions in other countries. Their possible effect must be determined within a South African environment. FinaMetrica has a database available in which they store the financial risk tolerance score of investors from all over the world and these scores have been calculated by the answers investors provided to the 25 questions asked in their questionnaire. The database was received from FinaMetrica and the South African investors who completed all the required fields for this research were focused on. It was found that the five major variables to have an effect in other countries are the gender variable, age variable, generation variable, education level variable and income level variable. These variables were identified as supporting variables to the primary theory of this research paper - the expected utility theory. The expected utility theory states that individuals want to maximise the utility they receive from investments. If the factors that affect how individuals make financial investment decisions can be determined, it can assist investors in increasing their expected utility value. Various statistical analyses were done and correlations were investigated and significant associations were found between the identified demographic variables and the financial risk tolerance score of investors. The identified significant relationships were found due to the specific demographic variable having a p-value of less than 1%, which is overwhelming evidence that the null hypothesis (for that specific variable) should be rejected: $H_0 (Variable) : \beta_1 = 0$ (There is no significant relationship between the selected variable and financial risk tolerance). From analyses done in this research with identified demographic variables that supports the expected utility theory and financial risk tolerance, it was found that the identified variables support the expected utility theory and that an investors' expected utility can be strengthened by looking at the five supporting demographic variables. The expected utility theory is strengthened by analysing the five identified demographic variables and it will assist investors and financial advisors in making a more informed financial investment decision as an investors risk tolerance would be more accurately determined and will be more reliable for decision making. One of the limitations of this research is that the FinaMetrica database consists of South Africans who have access to technology and, therefore, it is not a good example of the diversity of this country. It is, therefore, recommended that information about the demographics of investors and the way they invest should be obtained. This should be done in such a manner that available information represents the diversity of the South African population. With this information, an additional analysis should be done to determine whether

more accurate conclusions can be drawn with regards to South Africa and the effect demographics may have on the way financial investment decisions are made.

KEYWORDS:

Financial risk tolerance; expected utility theory; demographics; gender; age and generation; education and income

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Chapter one

Introduction

1.1 Introduction

Financial risk tolerance can be described as the maximum amount of uncertainty that individuals are prepared to accept when making financial decisions (Chavali & Mohan Raj., 2016:169). It can also be defined as the degree to which investors are willing to accept a less favourable outcome in pursuit of one that is more favourable (Finametrica, 2015). Financial risk tolerance focuses, therefore, on the willingness of individuals to participate in behaviour where an attractive goal is within reach but the realisation of the goal is uncertain and partnered by the probability of a loss (Abhijeet & Dinesh, 2010:17).

Financial risk tolerance is the most important factor that is used to determine the composition of asset portfolios for investors and needs to align with the terms of risks and returns that meet the needs of these investors (Ho, Milevsky & Robinson, 1994:111). Grable, McGill and Britt (2009) indicate that to measure the financial risk tolerance of investors is difficult because there are various dimensions involved when determining the attitude of investors towards risk. Moreover, a number of factors also influence their financial risk tolerance and decision-making habits.

The ability of investors to handle risk can be related to demographic features, such as gender; marital status; age; income; occupation; time horizon; portfolio size; and investment knowledge (Chavali & Mohan Raj, 2016:169). These demographic features of investors can be used to distinguish between the levels of financial risk tolerance, and a link between these variables can be established to help and predict the risk tolerance of investors (Grable, 2000:625).

According to Davis, Hands and Maki (1997), the *expected utility theory* states that investors or decision-makers have to choose between risky or uncertain investment opportunities or prospects by comparing their expected utility values. In addition, the history of the expected utility theory is often interpreted in terms of the following smooth generalisation process: The

principle of maximising expected monetary values. Kahneman and Tversky (1979) are of opinion that the expected utility theory is dominating the analysis of decision-making under risk. In this theory the utilities are weighted by their probabilities. This theory was investigated in this research study while supporting demographic variables have been identified that support the expected utility theory. This research was done within the conceptual scope of the expected utility theory and was used as the lens to focus on the other identified variables.

The primary theory of this research was, therefore, the *expected utility theory* and various secondary variables were identified that support the above-mentioned theory. In previous research, demographic variables were found to have an effect on the financial risk tolerance investors are willing to take - this supports the expected utility theory. There was focused on five possible demographic variables that can influence the risk tolerance of investors: (1) *gender variable*; (2) *age variable*; (3) *generation variable*; (4) *education variable*; and (5) *income variable*. The age and generation variables are very closely related but they show different outcomes. In short, the age variable states that as individuals age, the way in which they make financial decisions change. The generation variable states that based on the timeframe in which individuals were born, their behaviour will differ due to the way the world is changing and what is happening in the world around them.

The risk tolerance of investors is important with regard to investment firms who are in need of a greater understanding of whether investors can tolerate a pre-defined risk level. It will assist in determining if investors are prepared to suffer financial losses and if they are able to recover from such losses. Risk tolerance also plays a role to determine whether sufficient returns are generated to maintain a certain living standard. If risk tolerance is properly analysed, risk and adequate retirement returns can be balanced and a break-even point can even be found.

The first demographic variable; the *gender variable* states that men are more prone to take higher financial risks when investing and that women are more risk averse than men. Bajtelsmit and Bernasek (1996:1) asked the following question, "Why do women invest differently than men?" They investigated this phenomenon and found that women have a lower risk tolerance, which causes them to have lower returns than men in the long run. This finding was contradicting their theory, because women were found to have a longer life expectancy than men (Ho *et al.*, 1994:110), which makes women more ideal to invest in a riskier portfolio. The gap between the investment portfolios of men and women is of enormous economic importance (Bannier & Neubert, 2016:130). If women are less willing to invest in risky financial

assets, it is expected of them to earn less money and have lower returns over time (Ryack & Sheikh, 2016:157). Since women are expected to have a longer lifespan, and they have a lower labour income and are more risk averse, women are more vulnerable to experience poverty in old age (Bannier & Neubert, 2016:130).

Research done on the second demographic variable, the *age variable*, found that as individuals age the level of financial risk they take decreases. According to the age variable, risk tolerance decreases with age (Yoa, Sharpe & Wang, 2011:880) – highlighting the fact that found that risk tolerance relates negatively to age. Grable *et al.* (2009:9) established that older working adults are more prone to underrate their risk tolerance than younger working adults. Despite all the research done regarding the age effect on financial risk tolerance, no clear conclusion can be drawn concerning the strengths of this relationship.

The *generation variable* states that the timeframe in which individuals was born will affect their financial decisions. Each generation experiences a distinctive demographic, political and socioeconomic environment and the experiences shared by a generation can affect their attitude towards financial risk (Russo & Schoemaker, 1992:16).

The fourth demographic variable; the *education level variable*, is also of importance. The level of education of investors has an effect on the risk that investors are willing to take. Yoa *et al.* (2011:885) found that education has a positive effect on the willingness of investors with regards to higher levels of risk. Investors with professional qualifications invest differently than investors with high school certificates.

Vast amounts of research are available on the last demographic variable; the *income variable*, and is an indication that risk tolerance has a direct link to the amount of remuneration investors receive (Roszkowski & Grable, 2010:270). It was found in their research that risk-averse workers prefer a fixed salary while risk-tolerant workers prefer variable payments. Kannadhasan (2015:176) states that higher income investors make higher risk investments, because they have enough resources available to cover their essential commitments and also since they invest surplus money, they have a greater capacity to incur risk.

Yoa and Hanna (2005:67) maintain that the biological, demographical and socioeconomic characteristics together with the psychological makeup of individuals affect their risk tolerance. These characteristics are ingrained from a very young age; children already know at an early age how they should react to risk (Mussen, Cogner & Kagan, 1963). How children are raised and how they react in certain situations are some characteristics that form part of their personality and will affect their behaviour as adults (Mussen *et al.*, 1963).

There are numerous variables that can affect the risk tolerance of investors but for the aim of this research only gender, age, generation, education and income were focused on. Previous research found these variables to be significant, however, research has not yet been done with South African data in recent years within the context of the expected utility theory. This research focused, therefore, on the above-mentioned variables.

1.2 Research motivation

In previous research, demographic differences were investigated in various countries and focused on the risk tolerance of investors and their investment decisions based on demographics. FinaMetrica's database was used to analyse investment decisions. South African companies, such as Allan Gray, uses FinaMetrica's questionnaire to analyse the risk tolerance of their investors before any financial decisions are made.

The database acquired from FinaMetrica contains over 370 000 financial risk evaluations. It has been filtered so that there are only South African investors left whose data were fully complete with no missing values. The aim of the research was to better understand how South African investors with access to technology make financial decisions and whether the identified demographic variables have an effect on financial risk tolerance in a South African context. This research was limited South African investors who have access to technological resources, such as computers, to complete surveys and make investments.

Research findings can assist investors to accurately determine the level of financial risk they are willing to take and to ensure that they find an equilibrium point between their willingness to take risks and their expected future returns. This research was not only a modelling

exercise; it also tested the primary theory and secondary variables and tried to refine and improve these variables.

The practical value of the research centres on assisting investors and brokers to be more informed and make more accurate financial investment decisions. The theoretical (academic) contribution of the research focuses on the refinement of the *expected utility theory* in a South African context. Currently, South Africa experiences a huge imbalance in the standard of living and only South African investors who make financial investments and have access to technology formed part of this research.

1.3 Problem statement

The gap identified in the research is that it is currently not known how the chosen demographic variables and risk tolerance are related in a South African context. An association between risk and demographic variables can assist investors and investment advisors when making financial and investment decisions. The relationship between financial risk tolerance and the demographic variables were identified, the literature review further indicated that gender, age, generation, education and income assist investors in determining how investments are made.

The importance, or insignificance, of considering demographics to determine the risk objectives of investors also played an important role. Demographics particularly play an important role in an emerging market context, such as South Africa, where the diversity concerning demographics is unique compared to other regions around the world.

From an academic point of view, it is better to understand the mentioned primary theory and secondary variables in a South African context and to investigate whether these variables need some refinement with regard to a South African context. Within the broad conceptual framework of the *expected utility theory*, the problem of the study can be summarised asking what the association is between the selected demographic variables of investors and their financial risk tolerance?

1.4 Objectives

The main objective of this research study was:

- To analyse the association between selected demographic variables on the expected utility values and risk tolerance of investors.

To achieve the main objective of this mini-dissertation, the following secondary objectives were focused on:

1. To conceptualise the five supporting variables that were found relevant to financial risk tolerance in previous literature that supports the main objective of the expected utility theory.
2. To identify the appropriate methodology for this research and to design the research to test the identified selected variables.
3. To analyse risk tolerance and the five demographic variables.
4. To analyse associations to empirically test the five supporting variables in a South African environment.
5. To draw a conclusion about the findings and make recommendations to support investors in the context of the expected utility theory.

To enable the study to conclude upon the main objective, five hypotheses were developed and tested namely: There is no significant relationship (null hypothesis) between the five demographic variables gender, age, generation, education and income and financial risk tolerance. The null hypothesis for each variable was as follow: $H_0(Variable) : \beta_1 = 0$ (There is no significant relationship between the selected variable and financial risk tolerance). The alternative hypothesis for each variable was: $H_1(Variable) : \beta_1 \neq 0$ (There is a significant relationship between the selected variable and financial risk tolerance).

1.5 Research methodology

The research' epistemological paradigm for this study was of a positivistic nature, as the ontological assumption of the research outcome was done objectively and through an impersonal voice. Positivism as a research paradigm holds that a scientific method is used

and this should be used to establish the truth and an objective reality (Wagner, Kawulich & Garner, 2012).

The research study made use of a quantitative approach, which means that mathematical and statistical numerical analyses were done. The research methodology consisted of deductive reasoning. Deductive reasoning is a logical process in which a conclusion is based on the concordance of multiple premises that are generally assumed to be true (Maree, 2016:39). Deductive reasoning is sometimes referred to as top-down logic, implying from the general to the specific. In this research study, 3473 (general) investors were tested for each demographic variable (specific) and the original data were used to assess the next variable.

A research onion (Chapter three) was used to help to provide an effective progression through the research methodology design stages. As a tool, it can be very helpful - it is adaptable and can be used for almost every type of research methodology in a variety of contexts. The research onion was developed by Saunders, Lewis, Thornhill and Wang (2007) to help researchers recognise the steps they must follow in order to formulate an effective methodology.

1.6 Research design, data collection and analysis

In this research study, South African investors were used to consider the effect gender, age, generation, education level and income level have on the amount of risk they are willing to accept and to determine whether or not these demographics are related to the financial decision of investors or not.

In 1997, FinaMetrica Pty Limited (formerly ProQuest), an Australian-based risk-profiling firm, developed a valid and reliable 25-question psychometric **risk assessment test** together with the Applied Psychology Unit of the University of New South Wales School of Psychology. Since 1998, FinaMetrica has used its online risk profiling system to obtain information of investors and now they have a database with more than 370 000 risk profiles of investors worldwide. The data included 4979 South African investors who completed the questionnaire of which 3473 of the respondents were considered valuable as all the desired information was obtained ($N = 3473$).

The questionnaire is available to the financial planning industry and can be completed as a hard-copy or it can be completed and assessed through the FinaMetrica website. The test consists of 25 questions that are assessed and used to generate a standardised risk tolerance score to indicate the risk tolerance of investors. Together with the 25 questions on risk tolerance is a set of eight demographic questions dealing with age, gender, education level, income, marital status, annual income (combined if married), dependents and net assets. Details regarding the questionnaire are provided in Appendix A of this mini-dissertation.

In this research study, the answers to the 25 questions in the FinaMetrica questionnaire were used to categorise the risk tolerance of investors by allocating a score (between 0–100) to each of the investor – 0 represents a complete risk-avoidance attitude and 100 represents a risk-seeking attitude.

Independent and control variables were identified from the FinaMetrica data. The identified independent variables considered were gender, age, generation, education level and income level. The control variables were marital status, annual combined income of married couples, number of dependents and value of net assets. These variables are explained in detail in Chapter four.

The data was analysed by applying the following statistical techniques: descriptive statistics, corrected item-total correlation, analysis of variance (ANOVA), exploratory factor analysis, correlation analysis and regression analysis.

Finally, the analysis of the data was also tested for reliability by determining the Cronbach's Alpha. Cronbach's Alpha is a measurement tool of internal consistency and measures how closely related a set of items in a group is – it measures the of scale reliability. The Cronbach's Alpha was found to be 0.899, which is a very reliable score. It is very close to 1, indicating that the data used in this research study were reliable.

Validity encompasses the entire experimental concept (Pietersen & Maree, 2016:239) and establishes whether the results obtained meets all of the requirements of the scientific research method. Two forms of validity can be identified: internal and external validity. The

research study was done with the continuous awareness to measure “what is supposed to be measured” (Pietersen & Maree, 2016:240).

1.7 Outline and structure of chapters

Chapter one: Introduction

This chapter introduced the study by discussing the research motivation, followed by the problem statement and the main and secondary objectives. The chapter also presents a brief explanation of the methodology, including the research design, data collection and statistical analysis chosen for the study.

Chapter two: Literature review

In this chapter previous literature was investigated with the aim of determining which demographic variables were found in the past that could support the expected utility theory. Further, this investigation was used to confirm the five supporting variables that support financial risk tolerance.

Chapter three: Research methodology

Chapter three illustrates the research philosophy and justifies why the chosen research approach was selected. This chapter investigated the second secondary research objective and identified what methodologies were used in this study.

Chapter four: Results of the statistical analysis and hypothesis testing

Chapter four analyses the data using the identified methods and tested five hypotheses that were developed in the study. This chapter, therefore, investigated the third and fourth secondary objective.

Chapter five: Conclusions and recommendations

The final chapter concludes the research and makes recommendations for future research. The chapter assisted in the fifth secondary research objective, as well as with the main objective of this study.

Chapter two

Literature review

2.1 Introduction

This chapter is a literature review which focuses on three aspects namely, the conceptual framework to provide the context wherein the study has been done, the concept of risk tolerance, followed by the demographic variables that represents the five variables that influence the risk tolerance of investors.

The aim of this chapter is to reach the first of the secondary objectives, to conceptualise the five supporting variables found in support of the financial risk tolerance by previous research. The literature review would assist in determining which variables was found in previous research to have an effect on financial risk tolerance and should be investigated in this study for a South African population.

2.2 Conceptual framework

Financial risk and the impact thereof on investors differ. Risk capacity reflects the ability of investors to handle and deal with a possible financial loss resulting from investments made and financial risks taken. *Risk aversion* is a term used when referring to financial risk tolerance. Risk averse investors are investors with a lower appetite for financial uncertainty (Ryack & Sheikh, 2016:158). It is important to accurately assess the tolerance of investors to prevent over participation in markets that can result in unnecessary losses or that may lead to financial mistakes that causes high opportunity costs (Yoa *et al.*, 2011:881).

The expected utility theory states that the choices investors make with regards to risk appetite can be viewed as the choice between gambles or prospects (Kahneman & Tversky, 1979). The way investors make financial decisions concerning risks describes, therefore, this theory. It is, therefore, essential that financial advisors are able to correctly determine whether investors are making realistic financial investment decisions based on their risk appetite and

demographics to ensure that the outcome they receive from their investments are aligned with their desired outcome.

Investing cannot be viewed as a game: It can have a major impact on the future well-being of investors. Practically everyone makes investments. Even if investors do not invest in specific assets, such as stock, investments are still made with regards to pension plans, savings or life insurance (Kabra, Mishra & Dash, 2010:308). The objective of any financial investment is to generate healthy returns. In reality, a gap can be observed between the expected return and the actual return of investors (DeHart, Friedel, Lown & Odum, 2016:2). A review of current risk-taking and risk-tolerance research indicates that various factors, such as gender, age, occupation, marital status (Chavali & Mohan Raj, 2016:170) can influence the level of risk-taking in everyday investing decisions and matters (Grable, 2000:626).

In research done by Schwegler (2010), recommendations were made to South African investors to make use of specific derivatives for emerging markets. There was stated that investors may have a negative attitude towards derivative products, and the need to educate investors on how derivatives work and their understanding of derivatives also has an effect on how they invest. The more knowledge an investor has, the more realistic the financial decisions that they make, will be. If an investor has financial knowledge and a positive attitude it can be determined whether they will invest differently from someone with a negative attitude and no or little financial knowledge.

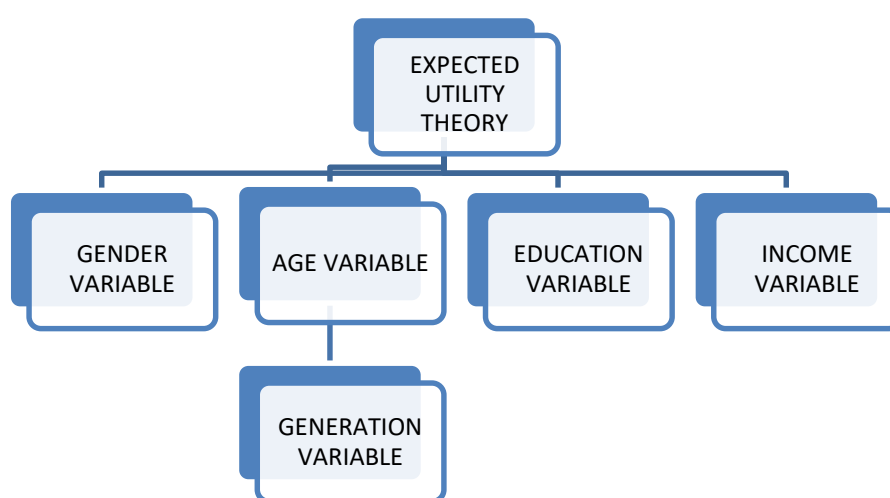
Kabra *et al.* (2010:309) examined the factors that influence behaviour, investment risk tolerance and the decision-making process. The target was to classify investors who invest regularly and their response based on factors such as age, gender, profession and their annual income. Investors were found to invest according to their risk preferences. Previous research identified and developed various variables that influence financial risk tolerance and can be associated with how the financial risk tolerance of investors is determined.

Based on the variables identified in previous research, this study focused on financial risk tolerance and its relationship to demographic variables. The effect of each demographic variable was analysed to determine the association it has on financial risk tolerance. The expected utility theory was the primary theory that was used and supporting variables were also focused on to see how these variables supported the primary theory.

The expected utility theory states that investors or decision-makers choose between uncertain and risky situations by comparing their expected utility values (Kahneman & Tversky, 1979). The way investors determine their expected utility value can be influenced by demographic variables that were identified as the secondary objectives.

The figure below illustrates what the expected utility of investors consists of:

Figure 1: Expected utility flowchart



Source: Previous literature inspection

Figure 1 indicates that the expected utility theory is the primary theory. In addition, the gender variable, age and generation variable, education variable and the income variable are there to strengthen the expected utility theory. It also assisted in determining what demographic variables have an effect on how investors determine the expected utility they receive from certain financial risks they are willing to take. Ultimately, the expected utility of investments is the value that investors feel they will receive from taking a certain amount of financial risk, and the financial return they will receive from that investment is based on risks and will determine whether their return will be worth the risks.

2.3 Risk tolerance

Financial risk tolerance influenced almost every part of investors' economic and social life (Grable, 2000:625). The future is uncertain and investors have to decide how much risk they

are willing to take, since a higher return is associated with a higher risk (Kabra *et al.*, 2010:310). Therefore, investors need to find their equilibrium point. The equilibrium point is where an investor finds that the expected risk and the return is in balance, according their needs. The importance between risk and uncertainty (White, 2014) needs to be highlighted. Risk should not be viewed the same as uncertainty: The degree of predictability is greater, because the various outcomes of risk can be identified and managed. Risk can be determined to some extent, but uncertainty cannot be determined nor prepared for.

Musilika (2016) found that investors are commonly advised to extend investment duration in their wealth portfolios consisting of riskier investments. However, extended investment durations are coupled with the movement of funds into safer portfolios as investors come within reach of their desired investment return target. Such strategies may be scary to some investors and can lead to lower financial risks taken due to the fear of losses.

The objective of financial investments is to protect capital assets (Chavali & Mohan Raj, 2016:169), to achieve good returns and to decrease the gap between perceived and actual return to minimise losses. Major losses occur since investors tend to overestimate actual risk tolerance levels due to their desire to appear socially acceptable. If investors do not evaluate their risk tolerance levels correctly, they tend to make irrational decisions in behavioural finance. Irrational decisions could lead to financial losses that investors would be unable to recover from. Therefore, it should be minimised as far as possible.

Financial risk tolerance is important, because it directly affects portfolio decisions (Bannier & Neubert, 2016:131) and it is essential to achieve long-term financial goals. If financial risk tolerance is correctly determined via informed and rational decisions, portfolios will be appropriate. Inappropriate levels of risk tolerance can lead to major financial losses (Grable *et al.*, 2009). Investors will then have a very low risk tolerance level and this motivates behaviour where investments are made in conservative portfolios and may cause difficulties in achieving their desired returns and retirement goals (Yoa & Hanna, 2005:67).

In research done by Grable (2000), descriptive discriminate analysis was used to determine whether the characteristics of investors can influence their financial success. There was found that financial success can be explained, or partly explained, by a combination of personality characteristics and the socioeconomic background. Demographics are, therefore, of key

importance, because the personality and socio-economic background of investors are indeed influenced by their education level.

In addition, financial impulsiveness was investigated in recent studies to determine what impact impulsiveness has on investment decisions. A descriptive analysis was used and there was found that investors frequently make short-term financial decisions that provide immediate benefits (Abhijeet & Dinesh, 2010:16), instead of making more consistent decisions with long-term goals. Impulsive financial choices can be described as delay discounting (DeHart *et al.*, 2016). *Delay discounting* can be defined as the depreciation of the value of a reward related to the time that it takes to be released (DeHart *et al.*, 2016). The delay discount curve can be described by hyperbolic functions, which predicts that the value will decrease proportionally more during shorter delays and proportionally less during longer delays. Investors often create a budget at the beginning of the month or set a financial goal, but then they reverse their preferences and spend impulsively. This is an important factor to consider - investors are impulsive and this affects the way they invest.

Investors are risk averse if they prefer a certain outcome in which the return differs from a higher possible return at a riskier option (Kahneman & Tversky, 1979). In the expected utility theory, risk aversion has a concave relationship to the utility function. The presence of risk aversion is perhaps the best-known generalisation regarding risky choices. It is easy to think that investors base their investment decisions solely on their willingness to tolerate risk. However, various factors influence investors with regard to their willingness to tolerate certain levels of financial risk.

Kahneman and Tversky (1979) are of the opinion that the expected utility theory needs to be extended in several directions, because some of the generalisation effects have immediate effects. These effects must be further developed, because some effects only influence investors after some time has gone by. Investors base their financial decisions on investment opportunities, ownership options or available finance structures together with the degree of perceived uncertainty in an enabling environment (White, 2014). An enabling environment explained that if the environment for investors seems positive, funding and investments occur much easier.

2.4 Demographic variables

“People are often unjustifiably certain of their beliefs” (Russo & Schoemaker, 1992:7). This is of economic concern, as investors tend to make decisions based on what they think and believe and *not* on what they see. People in the modern world do not adapt to change or let things influence what they believe, thus seeing does not influence modern investors as much as their own thoughts and beliefs. The truth of this statement was highlighted by making use of factor analysis to prove that demographics have an impact (Chavali & Mohan Raj, 2016:175) on the risk tolerance of investors and their investment decisions. Variable factors influence the demographics of investors and guide their behaviour with regard to financial decisions. Kannadhasan (2015) researched demographics and financial risk tolerance and found that human behaviour varies and it can lead to both positive and negative outcomes. A cluster analysis and correlations were used. The demographics of investors play a major role in the way they make their initial investment decisions, as they can either be target-orientated to achieve major returns or act in a cautious manner.

By making use of a cross-tabulation analysis, the demographic characteristics of investors were found to have significant effects on financial risk tolerance (Yoa & Hanna, 2005:67). Grable (2000:628) investigated personality factors that can determine financial risk in everyday money matters and found that socioeconomic factors, such as income, may play an important role in financial expectations. Hallahan, Faff and McKenzie (2003) found a significant relationship between financial risk tolerance and demographic characteristics. The two most prominent factors that were found to have an impact on financial risk tolerance are age and income.

A large amount of previous research focus on the use of demographic variables and characteristics to predict the risk tolerance of investors (Hallahan *et al.*, 2003). Demographic characteristics have been identified that effect the way in which investors make investment decisions, and these variables need to be tested against financial risk tolerance to determine to what extent they affect investors decisions.

Kannadhasan (2015) maintain that human behaviour differs and various factors exist that can help to determine why investors behave the way they do. Behaviour is ultimately the reason why investors make certain financial decisions and investments. Various internal and external

factors can influence the behaviour of investors and can alter their investment decisions. If the different factors that affect the way investors make financial decisions can be determined, it will assist in more accurate and reliable investment decisions.

The extra cost investors are willing to absorb to be ethical (Halton, 1996) should also be considered and affect how investors make investment decisions. Ethical investments are dependent on the amount of opportunities available. Conflicting opinions exist about performance - during ethical investments financial and social factors must be taken into consideration. Millson and Ward (2004) purport that transparency is also of great importance to stakeholders and especially to private equity investors who are in need of frequent and current information to manage their business affairs.

Halton (1996) found that the United States (US) model seems appropriate for South Africa - a certain portion of assets is invested in "high social impact" investments. A small portion is then allocated to higher risk investments and poor returns should be kept to a minimum. According to Seepie (2013), the investment goals of investors should be based on the *modern portfolio theory* (MPT) as this theory forms the foundation of finance. The importance of risk management needs to be taken into consideration and investment portfolios should comprise of different investments of different risk levels.

There was found that geometric mean returns generated from the magic formula investment strategy (Ker-Fox, 2017) are maximised when the portfolio size is maintained between 10 and 15 shares. Ker-Fox (2017) tested this magic formula in a South African environment to determine its effectiveness. If the magic formula investment strategy is applied in a South African market based on its historical performance, a '5 year 20 share' and a '1 year 10 share' portfolio should be made available for risk-averse investors and risk-seeking investors, respectively. Risk-neutral investors should create a '2 years 10 share' or a '6 months 15 share' portfolio. The above-mentioned portfolios for risk-neutral investors should maximise their expected return. In research done by Ramjee (2017), he found that the South African Listed Property Index has a low market risk beta and that it will, therefore, be less volatile to invest in than the overall stock market. This finding can be of assistance to investors who are prone to be more risk-averse. It will assist investors in determining investment portfolios that can generate high investment returns in line with their level of risk appetite. Moreover, there is no difference between property investments listed as active or passive.

Kabra *et al.* (2010) found that psychologists tend to believe that decisions made by investors are mostly determined by unique factors in a specific decision setting. This finding was later contradicted as there was found that the way in which investors make investment choices is based on their lifestyle and demographic attributes. It is built into investors from a very young age, and if the demographics that affect this decision can be determined it will ensure wiser decision making.

The expected utility theory confirms that investors make decision based on risky and uncertain prospects due to a perceived expected utility that investors think they will gain from investments (Davis *et al.*, 1997). These decisions differ, because their demographics help shape and determine the way in which they make decisions and perceive financial risk. Previous research has identified numerous demographical variables and in this study it was decided to focus on five selected demographic variables, namely, gender, age, generation, education and income.

2.4.1 Gender

There exists one factor related to financial risk tolerance that does follow a traditional and consistent pattern amongst investors, namely, the tendency for women to have a lower risk willingness than men (Grable, 2013:7). A *gender variable* exists, because men are more likely to take health risks and are more prone to gamble with their investments. Men tend to have higher financial risk tolerance scores than women. If the investment portfolios of men and women are compared (Bajtelsmit & Bernasek, 1996:8), the risk appetite in asset allocation of the baby boomer generation is higher in investments done by men. Three explanations were found for why women appear to be more risk averse than men: (1) knowledge and experience; (2) basic socioeconomic differences; and (3) socialisation differences.

A gender gap in financial risk-taking is of enormous economic importance (Bannier & Neubert, 2016:130), as lower risk leads to the accumulation of less wealth over time. This gender gap can be caused by women experiencing a lack in financial knowledge, less skills in numeracy, a lack of familiarity with financial products or a lower risk tolerance in general. The gender difference favouring men is well established (Roszkowski & Grable, 2010:271), as men tend to take higher risks when investing. This increases the risk of women suffering financial hardships at an older age as they tend to obtain lower returns from their long-term investments

than men. In a world that wants to reduce the discrimination between genders this can be of concern. Women should be motivated to take on more financial risk so that they can receive more returns in the future.

Hallahan *et al.* (2003) found that gender - as a demographic characteristic – highlights an important differentiating factor. In general, females show a lower risk preference than males. This finding is an important factor to consider and stressed by various previous research studies: Women wield less power to finance and household finance than males do - males are usually in charge and in control of financial matters. There is, however, a difference in receiving income and controlling that income (Bajtelsmit & Bernasek, 1996) and that husbands usually control the income and they have been making more financial decisions than women over the years and have more experience and self-confidence when investing.

Studies also found that women invest more conservatively due to certain personality traits unique to their gender (Kannadhasan, 2015). Men are often referred to as thrill-seekers or sensation-seekers and these qualities are often reflected in their investment decisions.

The gender variable exists due to two reasons (Ryack & Sheikh, 2016). The first reason is that the biological and evolutionary differences between the two genders have resulted in men being more prone to take financial risks than women. The second reason is the way in which their take on financial risks differs due to cultural influences that stem from differences in traditional societal roles expected of males and females.

The gender variable was, therefore, of significant importance in this study, as there has been found that this variable has an effect on how investors make their financial decisions. If it can be confirmed (by this study) that gender plays a significant role when making financial investment decisions, it would make it easier for financial advisors and investors to make a more informed and rational investment decision.

More emphasis is put on financial retirement planning (Durrheim, 2016), because women have a different perception of investing than men. Durrheim (2016) found that the following factors have a significant relationship with the way women approach investments: attitudes, personal values and time horizon knowledge. Women who are identified as risk-takers plan for their

retirement early in life and they are more comfortable with making financial decisions that are in line with their personalities and attitudes.

2.4.2 Age and generation

Another important variable that has been researched excessively during the last couple of years is the effect the *age variable* has on the willingness of investors to take financial risks. Yoa *et al.* (2011:880) are of opinion that age impacts the financial risk tolerance of investors and found that financial risk tolerance tends to generally decrease with a person's age. Grable *et al.* (2009:7) found that older working adults are more likely to underestimate their risk tolerance than younger working adults, therefore, it can be an indicator to show that as investors age, their financial risk tolerance decreases. Most of the research indicates that risk tolerance decreases with age (Yoa *et al.*, 2011:880) and that an inverse relationship exists between risk tolerance and financial decisions of individuals (Kannadhasan, 2015:177).

Grable *et al.* (2009:7) concluded that younger working adults have not yet attained precision in their knowledge of risk and risky situations, and that most of the time they make overconfident financial decisions with regard to their risk tolerance estimation. This is probably due to younger working adults lacking the judgement to accurately apply financial investment estimations to situations due to insufficient feedback received over their short lifespan.

Generational effects also play a pivotal role (Yoa *et al.*, 2011:880). The *generation variable* states that the financial risk tolerance of investors will depend on when they are born. Each generation experiences a unique demographic, political, and socioeconomic environment during their formative years (Russo & Schoemaker, 1992:16). Contrasting experiences shared by generations may contribute to dissimilar attitudes towards financial risks. Investors who experienced the Great Depression tended to remain risk averse for the remainder of their lives (Grable, 2013:8).

The generational effect (Yoa *et al.*, 2011:885) impacts on the experiences of individuals with regard to the economic, political and cultural environments related to a particular generation and these experiences affects the way in which they feel and behave towards risk. It may be possible for young investors to over-estimate their risk tolerance. If mis-estimations occur,

younger working adults can take financial risks that exceed their psychometrically measured willingness to incur uncertainty and volatility in their household portfolio (Grable *et al.*, 2009:1).

Risk-averse investors consider multiple factors and seek diversified information before executing investment transactions (Ryack & Sheikh, 2016:173). Investors' risk preference, and the amount of information they need to make decisions, can be dependent on the way they were raised and the situations that were specific to their age or generation. This research study identified that investors are the most influenced by age and gender factors with regard to their risk appetite.

2.4.3 Education

The rationality of investors is a major concern to financial advisors. Research has been done to determine whether investors are making decisions that are rational, if decisions are made objectively and if they make use of all relevant information available to them (Abhijeet & Dinesh, 2010:7). Rationality links with the level of education of investors and whether they developed personal skills on how to evaluate certain options. Investors should be able to weigh positives and negative options and, possible outcomes must be considered before decisions are made.

Yoa *et al.* (2011:885) found that education also has a positive effect on the willingness of respondents to take more financial risks. Investors with a higher education level tend to be more willing to take on financial risks as they know how to evaluate investment options. They also have strategies in place when losses occur on how to recover from them. Less educated investors tend to be more risk averse and they do not want to suffer financial losses as the recovery period tends to take longer (DeHart *et al.*, 2016:3).

The *education variable* is presumed (Grable *et al.*, 2009:5) to be positively associated with risk tolerance. Investors with a bachelor's degree tend to be more risk tolerant than investors with a high school certificate or a lower qualification, as they tend to be risk averse. This was found due to qualified investors having more knowledge and being able to make more informed and rational financial decisions.

DeHart *et al.* (2016:9) found that a financial education course of one semester proves to be an effective method of decreasing the delay discount. Financial education can, therefore, be used to determine if it reduces delay discounting and if education has an effect on the risks investors are comfortable taking when investing. DeHart *et al.* (2016:3) stated that: “financial education participants in this research reported an increase in financial risk tolerance compared to the control participants.”

Moreover, financial literacy has been of extreme importance in recent years. Research has found that even when investors are more educated in financial matters (DeHart *et al.*, 2016:3), they still make irrational decisions that lead to major financial losses. Irrational decisions of investors (Abhijeet & Dinesh, 2010:17) tend to decrease when investors are educated. In addition, the more educated investors are, the higher their income levels, which have a positive impact on them experiencing financial losses. Thus, education was found to be an important variable to be investigated in this study, as previous research found it to have an effect on how financial decisions were made.

2.4.4 Income

Investors try to allocate a portion of their income for investments to assist them in increasing their wealth (Kannadhasan, 2015:178). Investor's with a higher annual income tend to be more risk tolerant, as they have enough capital available to fulfil their monthly financial responsibilities. They have capital available in case of emergencies and they are, therefore, more open to financial risks. Moreover, their ability to recover from financial losses is quicker than investors who are earnings a lower income and who are unable to recover from financial losses quickly (Roszkowski & Grable, 2010:271).

One of the biggest impacts of the *income variable* on financial risk tolerance is how quickly investors can recover if major financial losses are suffered. The study predicted that the income of investors can have an effect on the amount of risks investors are willing to shoulder (Abhijeet & Dinesh, 2010:10). The overall objective of financial investments is to obtain good returns (Chavali & Mohan Raj, 2016:169), but at a risk level they could recover from quickly should losses occur.

Hallahan *et al.* (2003:484) highlights two prominent factors that have been found to impact financial risk tolerance: age and income. They made use of a cross-sectional regression analysis to determine the effect of certain demographic characteristics on the attitude towards risk. They found that risk tolerance exhibits a concave relationship with income across all age groups, irrespective of gender.

Metherell (2011) is of the opinion that age, gender, race and income have a significant effect on the financial risk tolerance levels of investors. He also found that education and religion have no significant effect on the financial risk tolerance of investors. Furthermore, he also found that investors falling into the second highest income category are significantly more risk tolerant than those in the lowest income category. The higher the income level of an investor, the more comfortable the investor will be taking on higher risk. This is due to their ability to recover quicker. It was therefore an important variable found in previous literature to be investigated in this study.

2.4.5 Other demographic variables identified

Additionally, overconfidence, sensitivity to rumours, conservatism and representative bias (Abhijeet & Dinesh, 2010:17) were found to impact on the investment behaviour of individuals. Overconfidence and estimation bias are also quite often used by investors when they make predictions for future actions and events (Griffin, Dunning & Ross, 1990:1129), even in cases where base rate probabilities may indicate outcomes that deviate from their predictions (Nowell & Alston, 2007:132). Abihijeet and Dinesh (2010:17) examined the psychological biases influencing the behaviour of investors. It concluded that an increase in information diffusion frequencies and greater transparency are helpful to investors.

Overconfidence is closely related to the concept of estimation bias (Griffin *et al.*, 1990:1129). “Overconfident behavioural predictions and trait inferences may occur because investors make inadequate allowance for the uncertainties of situational construal”, (Griffin *et al.*, 1990:1128).

Overconfidence has also been attributed to an illusion of control exhibited by certain decision-makers (Grable *et al.*, 2009:3). The tendency to believe that risk can be controlled often leads

to reduced levels of risk aversion. According to Russo and Schoemaker (1992:8), “good decision making requires more than knowledge of facts, concepts, and relationships. It also requires metaknowledge - an understanding of the limits of our knowledge”. Knowledge is a term that can be influenced by many factors and there any many variables that can influence investors and the decisions they make, such as marital status, a combined income, and net assets (Finametrica, 2015). All of these variables can be used as a proxy when financial risk tolerance scores are calculated.

2.4.6 Summary of literature review

Within the conceptual scope of the expected utility theory the literature review found that some of the identified variables have an effect on financial risk tolerance, and these significant variables was used to guide this research. These variables formed the secondary research objective, which was to identify the five variables that supported the primary objective of the expected utility theory. The (1) *gender variable* (Bajtelsmit & Bernasek, 1996:8) has an effect on the financial risk tolerance of investors but, a clear understanding of the significance of this effect was not achieved. According to the (2) *age variable* (Yoa *et al.*, 2011:883), financial risk tolerance generally decreases with the aging of individuals and the generation investors are born into also affects their financial risk tolerance. The (3) *generation variable* states that individuals born in a specific generation have a unique experience of their demographic, political, and socioeconomic environment during their impressionable years (Russo & Schoemaker, 1992:16). The (4) *education variable* (DeHart *et al.*, 2016:9) was found to be significant with regard to financial education. Investors with a higher educational level recover quicker when losses are suffered. The last demographic variable, (5) the *income variable*, was also found to be significant (Ho *et al.*, 1994:119), since financially more secure investors have the ability to recover quicker if high risks were taken.

The literature review assisted in shaping the research study and additional variables were identified that should be taken into consideration when the risk tolerance of investors is determined. This research was demarcated to investigate only **five** selected demographic variables linked with the following variables: the *gender variable*; the *age variable*, *generation variable*; the *education variable*; and *income variable*. Since these variables were found to have effect in previous studies and in other countries, their effect in a South African context must also be evaluated. A research gap was identified and to the best of the researcher’s knowledge, no prior research was found concerning risk tolerance in South Africa within the

context of the expected utility theory. Other identified variables (Table 5) were not comprehensively investigated but were rather used as control variables to develop a sensible regression analysis model.

Chapter three

Research methodology

3.1 Introduction

The previous chapters are essential to convey the literature used for this research. The current chapter explains the research procedure followed in this research study. This chapter illustrates the research philosophy used in this research and justifies why the chosen approach was selected. The research design is defined, and the steps that were taken to ensure reliability and validity are explained. The research' epistemological paradigm that underpinned this research study was of a positive nature and why a quantitative approach was followed is also explained. This chapter looked into the second secondary objective and identified what methodologies were used in this study. A paradigm leads to asking certain questions and is called a research methodology. A research design can be compared to an architectural blueprint (Wagner *et al.*, 2012:21) that is followed in the construction of a house or building. A research design tells the researcher how their research should be conducted, for example, the methods that should be used to collect data and analyse data. The research methodology can be viewed as the bridge that connects the paradigm with the methods.

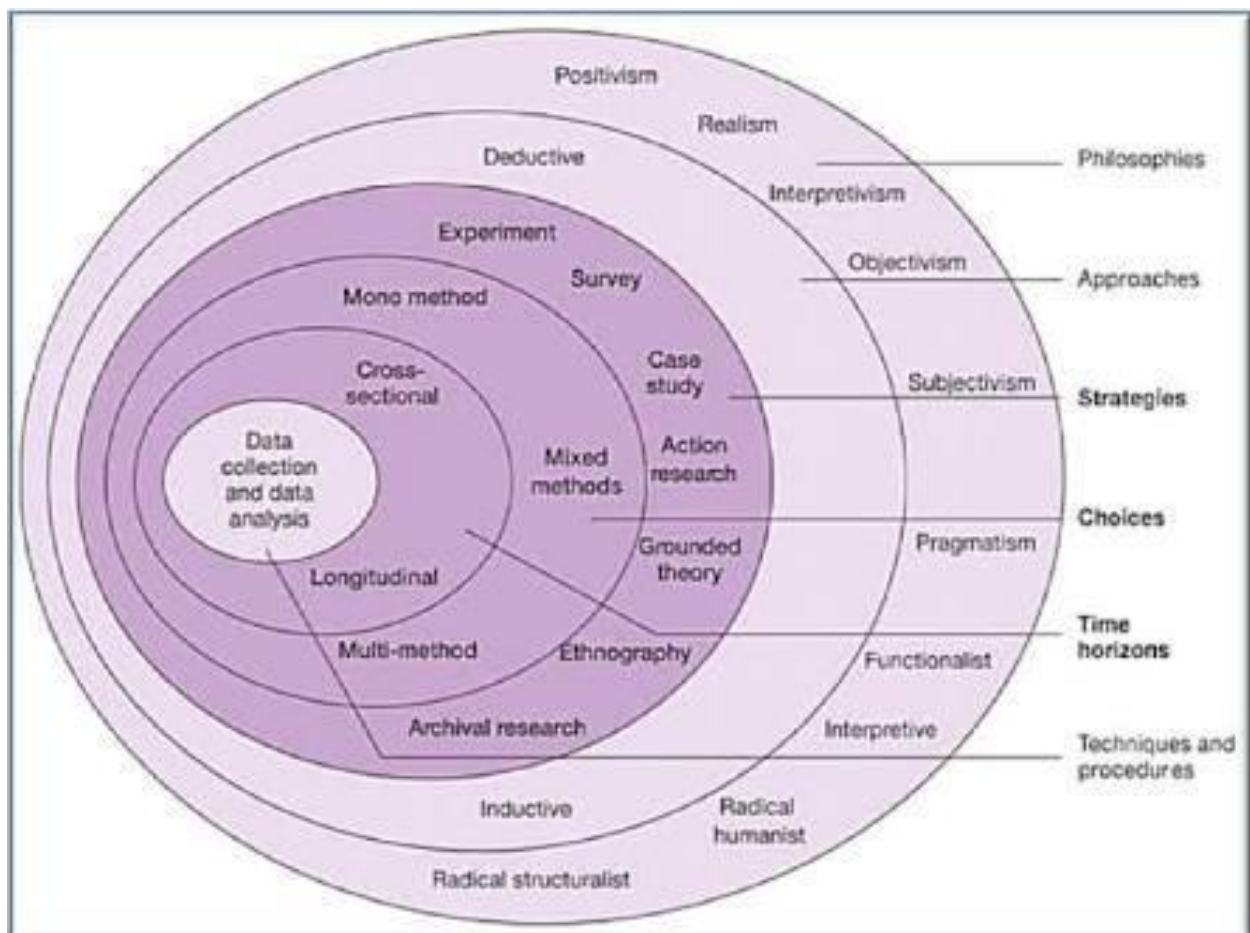
This research study was done objectively through an impersonal voice and the ontological assumptions of this research are, therefore, of a positive nature. Positivism as a research paradigm holds that a scientific method was used to establish the truth and an objective reality (Wagner *et al.*, 2012). This research paradigm uses quantitative research methods and techniques to obtain data and can include questionnaires, observations, tests and/or experiments. This research study made use of the results of a questionnaire sent to investors captured in FinaMetrica's database. This database was made available to the researcher. The questionnaire that FinaMetrica used consist of 25 questions (see Appendix A). This questionnaire was completed by investors and their financial risk tolerance score was determined according to the information provided.

3.2 Research process

A research onion was used to provide an effective progression through the research methodology design stages. A research onion is very helpful, as it is very adaptable and can

be used for almost any kind of research methodology and in a variety of contexts. The research onion was developed by Saunders *et al.* (2007:132) to assist researchers in recognising the stages they must follow when formulating an effective methodology. The research onion is illustrated in Figure 2:

Figure 2: Research onion



Source: Saunders *et al.* (2007:132)

3.3 Research onion

The first step is to determine a definition for the research philosophy. A suitable starting point for the research approach is then created and adopted in the second step. In step three, the research strategy is adopted and in step four the choices for data collection are determined. Step five indicates the time horizon and step six represents the stage during which the data collection methodology is identified. The research onion is very beneficial as it creates a series

of steps in which the different methods of collecting data are easily understood. In addition, it illustrates the steps to describe the methodology followed in a research study.

The different stages of a research onion (Saunders *et al.* 2007:132) are as follow: 1) a research philosophy is formulated; 2) a research approach is implemented; 3) applicable research strategies are chosen; 4) possible choices for collecting data are considered; 5) a research time horizon is determined; and 6) specific data methods are adopted by the researcher and the analysis is completed. Different stages of a research onion can be used by researchers to describe a particular research methodology and design.

3.3.1 Research philosophy

The first step in the process of the research onion is to formulate a research philosophy. Saunders *et al.* (2007) emphasise that in the research philosophy, researchers consolidate significant assumptions about the way in which they view the world. When deciding on a research methodology, an appropriate method should be established to answer the research question.

A research paradigm outlines the philosophical dimensions of social sciences due to the fundamental beliefs that affect the ways in which social research is conducted, including the choice of a particular research methodology (Wagner *et al.*, 2012). Philosophical assumptions (Maree, 2016:33) with regard to the following three things inform the paradigm: 1) the nature of reality (ontology); 2) ways of knowing (epistemology); and 3) ethics and value systems (axiology). This assists researchers to ask certain questions and use appropriate approaches during a systematic enquiry.

The paradigms are summarised in Table 3.

Table 3: Research paradigm summary

	Positivist / Post- positivist paradigm	Constructivist / Interpretative paradigm	Transformative / Emancipatory paradigm	Postcolonial / Indigenous paradigm

Reason for doing the research	To discover laws that can be generalised and govern the universe	To understand and describe human nature	To empower investors to radically change society	To challenge deficit thinking and promote transformation
Philosophical assumptions	Informed mainly by realism and idealism	Informed by hermeneutics and phenomenology	Informed by critical theory and postcolonial discourses	Informed by indigenous knowledge systems
Ontological assumptions	One reality, knowable within probability	Multiple socially-constructed realities	Multiple realities shaped by social, political, cultural, economic and race values	Socially-constructed multiple realities shaped by a set of multiple connections human beings have with their environment
Place of values in the research process	Science is free in value	Values form an integral part of social life	All science must begin with a value position	All research must be guided by relational accountability that promotes respectful representation
Nature of knowledge	Objective	Subjective	Dialectical understanding aimed at critical praxis	Knowledge is relational and all indigenous knowledge systems are built on relations

What counts as truth	Based on precise observations and measurements that are verifiable	Truth is context-dependent	It is informed by a theory that unveils illusions	It is informed by a set of multiple relations that one has with the universe
Methodology	Quantitative, correlational, experimental and surveys	Qualitative, naturalistic and phenomenological	A combination of quantitative and qualitative research	Participatory, liberating and transformative research approaches and methodologies that draw from indigenous knowledge systems
Techniques of gathering data	Mainly questionnaires, observations, tests and experiments	Mainly interviews, pictures, diaries and documents	A combinations of the techniques mentioned in the previous two paradigms	Techniques based on philosophical sagacity and ethno-philosophy language frameworks

Source: Wagner *et al.* (2012:54)

This research study was done from a positive point of view accompanied by a quantitative methodology. If Table 3 is focused on and compared to the research study, the following is evident:

- This study was done to discover a solution that can be generalised to investors in South Africa and to determine whether one of the selected demographic variables has

an effect on the manner in which South African investors make financial investment decisions.

- The philosophical assumption is mainly informed by realism and idealism. In this research study, philosophical assumptions were agreed to and the research was aligned with these assumptions and shaped accordingly.
- The ontological assumptions centred on a single, tangible reality that is relatively constant across setting and time. For this research it meant that the demographic variables identified were focused on and that if an effect was found, a conclusion can be made that will have a significant effect on financial decisions made across South Africa.
- In this research process, science was viewed as free in value and if a demographic variable was found to have a significant effect on financial decision-making this must be confirmed and verified.
- The knowledge of this research was objective.
- The truth in this research was determined based on analyses and measurements that were verifiable and reliable.
- The methodology was quantitative of nature and the surveys done by FinaMetrica were analysed and summarised by them. These surveys were used by the researcher to do additional research.
- FinaMetrica made use of questionnaires to gather the available data.

3.3.2 Research approach

A research approach can either follow deductive or inductive reasoning (Maree, 2016:39). A deductive approach develops a hypothesis (Saunders *et al.*, 2007:121) based on a pre-existing theory where after a research approach is formed and tested. This is the best suitable approach when a research project has to determine whether observed phenomena fit with expectations based on previous research findings.

Further, an inductive approach is characterised by moving from the specific to the general. When this approach is selected, researchers use the observations as their starting point and then patterns are searched for in the data. There is no framework in this approach that informs the initial data collection and a research focus can be formed after the data have been collected.

In this research study, a deductive approach was followed as already identified variables were further investigated. This approach is characterised by a development from the general to the specific. A general theory knowledge base was established, and specific knowledge gained from the research process was then tested and compared. The identified variables were studied and the data from FinaMetrica were analysed and compared with the original variables to determine whether there are some association between the selected variables and financial risk tolerance existed.

3.3.3 Research strategies

Step three in a research onion entails the research strategy or also identified as the research design. A research design can be compared to an architectural blueprint that is followed in the construction of a building (Wagner *et al.*, 2012). Coherence ensures that the topic, the research question, methodology and methods used in a research study all fit within the same research framework or paradigm. Various research design methods are summarised in Table 4:

Table 4: Research design methods

Research design	Summary
Action research	Is used to improve or change a situation that researchers are researching.
Ethnography	Focuses on the research of culture with the aim of describing and interpreting cultural behaviour.
Experimental research	Demonstrates cause-effect relationships when researchers randomly select a sample of participants and randomly assigns them to experimental groups and control groups.
Grounded theory	A theory can be generated or an existing theory can be expanded, or otherwise modified from the data researchers collected while conducting research.
Phenomenology	The analysis of the experiences of investors who are uniquely situated in a particular phenomenon.

Surveys	Surveys are used to gather data from large groups of investors in a relatively short period of time in the form of questionnaires or interviews.
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Source: Wagner *et al.* (2012:22)

In conclusion this study followed a survey research design method. The variables used in this research study already existed and they were tested in a South African context.

3.3.4 Choices for data collection strategies

Step four of a research onion involves the research approach. It can be a quantitative, qualitative or a combination of both methods (Maree, 2016:40). In this research study, a research paradigm of positive nature was used and the appropriate methodology included quantitative methods.

A quantitative research method is best captured in numbers (Saunders *et al.*, 2007) and by countable things. A quantitative analysis was done in this research as scientific and mathematical data were used to understand a problem. The research methodology used in this research was deductive reasoning, because the researcher focused on the financial risk tolerance scores of the investors to determine whether a single demographic variable could have an effect on these scores. Secondary data was used by obtaining a database from FinaMetrica.

3.3.5 Research time horizon

The time horizon is the time framework within which the research has been completed. There are two types of time horizons found in a research onion: 1) a cross-sectional time horizon and 2) a longitudinal time horizon. In a cross-sectional time horizon, a time is set for when the data must be collected and in a longitudinal time horizon, data are collected repeatedly over a certain period of time.

In this research study, data were collected repeatedly over a period of time by FinaMetrica and captured on datasheet. Data were collected to make the datasheet reliable as the amount of information increased.

3.3.6 Collection of data methods and analysis

The core objective of this research was to investigate the effect certain demographic variables had on the willingness of investors to tolerate financial risk.

FinaMetrica granted access to their database where all the information is stored from questionnaires completed by investors all over the world. The database lists the country of the investors and all the answers to the questionnaire (Appendix A). FinaMetrica's database was filtered for all of the South African investors whose information is complete. This resulted in $N = 3473$ - a large population of reliable respondents. However, this population of South African investors are not a fair representation of the South African population, as this particular population only included investors who have access to the Internet and who make financial investments.

The questions that the investors had to answer when completing the questionnaire (see Appendix A) focused on how these investors invest. The questionnaire also contains a list of eight demographic questions dealing with age, gender, education level and income level. FinaMetrica developed a system that takes the answers to these 25 questions and then uses the answers to develop a personalised financial risk tolerance score for each investor. A quantitative research methodology was, therefore, best suited for the objective of this research study.

Only the available data from FinaMetrica's database were used. This information was used as the raw data. After the data were received from FinaMetrica, the information was captured on a Microsoft Excel spreadsheet.

Henceforth the data was tested in various ways to determine whether a relationship existed between financial risk tolerance and certain demographic variables.

The variables mentioned in Chapter one were also tested against the financial risk tolerance scores of the investors to determine whether a relationship existed between them. Statistical tools were used in this process.

3.3.6.1 Descriptive statistics

Descriptive statistics were used as the first tool of statistical analysis. The difference in demographic variables such as gender (the number of males and females) was determined, for example, and then represented on an appropriate chart. This method was appropriate to summarise the data in order for specific values to be recited easily. The mean (average) of the data, the minimum and maximum, the standard deviation and standard error were included (Wegner, 2007:135). Standard deviation is a numerical representation of the data to indicate if members of a group differ from the mean of a group. Standard error measures the statistical accuracy of an estimate. The standard error is equal to the standard deviation of the theoretical distribution of a large population.

It was not necessary for inferences, because the assumption was made that the whole population was used and not just a sample. Therefore, the **P-values were not used in this section of the analysis**. The analysed data were interpreted by focusing on the standard deviation and error between each demographic variable and financial risk tolerance scores. The minimum and maximum of the data available for each variable were also considered to determine whether the data were accurate and a reliable representation, minimum and maximum was only focused on when it was significant and reliable in the analysis.

3.3.6.2 Corrected item-total correlation

A corrected item-total correlation (Field, 2005) was done to determine the correlation between the questions asked in the questionnaire and the demographic variable identified in this study. If a certain question was found relevant in determining how investors' make financial investment decisions. A correlation can assist in identifying support for the variables used in this study.

3.3.6.3 Analysis of variance (ANOVA)

An analysis of variance (ANOVA) was done to analyse the difference between the means of investors demographics and their financial risk tolerance scores (Gujarati & Porter, 2010:179). Statistically significant differences were used to investigate variables in order to determine relationships. In this study eta-squared measures the proportion of the total variance in a dependent variable that is associated with the membership of different groups defined by an independent variable.

3.3.6.4 Exploratory factor analysis

An exploratory factor analysis was done; a statistical method (Pietersen & Maree, 2016:242) used to uncover the underlying structure of a relatively large set of variables. The data were grouped into sensible groups and based on the groups, relationships between them and the financial risk tolerance scores were determined.

The purpose of a factor analysis is to reduce many individual items to fewer dimensions. In most cases, a factor analysis is rotated after extraction and it has several rotation methods. A factor analysis attempts to bring inter-correlated variables together under a more general variable. The starting point of a factor analysis is to put together variables with high inter-correlations as they can measure one underlying variable.

The extraction of principal components takes place by calculating the Eigenvalues. The number of positive Eigenvalues determines the number of dimensions needed to represent a set of scores without any loss of information. The number of positive Eigenvalues (greater than 1) determines (Pietersen & Maree, 2016:243) the number of factors to be extracted.

The difference between a factor analysis and a principal component analysis is very important in interpreting the factor loading. If the factor loading is squared, the variance accounted for by each variable is found. The outcome of a factor analysis depends on the number of variables and the magnitude of their factor loadings. Cronbach's Alpha is a measurement tool of internal consistency and measures how closely related a set of items in a group is – it is the scale measure of reliability.

3.3.6.5 Correlation analysis

A correlation analysis was done in this study. This analysis involves the measurement of the relationship between variables (Wegner, 2007:418). A correlation analysis analyses the direction and magnitude of relationships between variables. When a large sample is used, the results of Pearson is preferred and not the results of Spearman. However, if the results are very closely aligned with each other, results can be confirmatory. In this research the entire population was used when analyses were done.

3.3.6.6 Multi-regression analysis

A multi-regression analysis identifies the independent and dependent variables in a model and takes mathematical inter-correlation into account to determine whether an association exists between them. A multi-regression analysis can also be used to predict the values of a dependent variable; given the values of one or more independent variable.

A regression analysis (Gujarati & Porter, 2010:25) assesses whether predictor variables accounts for variability in dependent variables. For every variable identified, a regression analysis is done where one insignificant independent variable is omitted until only significant variables are left in the model (Laerd Statistics, 2018). This assists in determining if a correlation can be formed so that estimations can be made if a demographic variable is found to have an effect on an investors financial risk tolerance.

3.4 Summary

This chapter explains the research objectives by discussing the methodological decisions the researcher made and the overall procedures that were used to collect, analyse, interpret and report the data. The underlying philosophical assumptions are addressed at the beginning of the chapter.

A research onion was used to guide the researcher through the methodology design stages. In step one a research philosophy was formulated, and a positivist paradigm was implemented. Step two was to implement a research approach, and the implemented

approach was a deductive approach. Step three was to select a research strategy and this study followed a survey research design method. In step four choices for collecting data was considered and in this research, quantitative research as a methodology was used, as it is widely used to support the positivism research paradigm. Step five identified a time horizon that collected data over a period of time. Lastly, step six identified methods of collecting and analysing data.

The researcher strongly believes that given the research purpose and the general research question, the use of a quantitative research method enhanced the reliability and validity of this research study.

Chapter four

Results of the statistical analyses and hypothesis testing

4.1 Introduction

The variables that were identified in Chapter one were tested, as they were thought to have an effect on the financial risk tolerance of investors. Therefore, various statistical analyses were done (listed in Chapter three). These analyses guided the researcher to determine which of the identified variables had an effect on financial risk tolerance. They assisted in reaching the third and fourth secondary objectives, namely to analyse risk tolerance and the five demographic variables and to determine the associations between the risk tolerance and the demographic variables in a South African environment. Furthermore, hypotheses were developed and tested as an aid to reach the fourth secondary, as well as the main objective.

4.1.1 Hypotheses

Supporting variables were identified and investigated to determine whether these variables supported the expected utility theory. Gender, age, generation, education level and income level were the five most promising variables based on literature that could support the expected utility investors obtain from making certain financial decisions.

Hypotheses were developed to assist with the analysis in determining whether an association existed between the identified variables and financial risk tolerance. To test these mentioned variables, the following hypotheses were presented:

Gender:

- $H_0 (1): \beta_1 = 0$ (There is no significant relationship between gender and financial risk tolerance).
- $H_1 (1): \beta_1 \neq 0$ (There is a significant relationship between gender and financial risk tolerance).

Age:

- $H_0 (2): \beta_1 = 0$ (There is no significant relationship between age and financial risk tolerance).
- $H_1 (2): \beta_1 \neq 0$ (There is a significant relationship between age and financial risk tolerance).

Generation:

- $H_0 (3): \beta_1 = 0$ (There is no significant relationship between generation and financial risk tolerance).
- $H_1 (3): \beta_1 \neq 0$ (There is a significant relationship between generation and financial risk tolerance).

Education:

- $H_0 (4): \beta_1 = 0$ (There is no significant relationship between education and financial risk tolerance).
- $H_1 (4): \beta_1 \neq 0$ (There is a significant relationship between education and financial risk tolerance).

Income:

- $H_0 (5): \beta_1 = 0$ (There is no significant relationship between income and financial risk tolerance).
- $H_1 (5): \beta_1 \neq 0$ (There is a significant relationship between income and financial risk tolerance).

4.1.2 Statistical analysis tools

The financial risk tolerance score of each investor and the questions they were asked to determine their financial risk tolerance score were used during statistical analyses. The population was used that consisted of investors whose details were already captured on the FinaMetrica database with all of the required fields already completed ($N = 3473$). This means that data were entered into each of the identified variable fields and the population consisted of all the possible outcomes (Gujarati & Porter, 2010:407).

A **statistical analysis** consisting of descriptive statistics (Table 6) was used to determine whether minimum, maximum or average values could assist in understanding the data captured on the FinaMetrica database, before **other statistical analyses**, mentioned in Chapter three, were done (Wegner, 2007:138).

A corrected item-total correlation (Field, 2005) was used to test the correlations between the different questions asked in the FinaMetrica questionnaire. It was used to determine what questions correlated the highest and whether the questions that correlated with each other supported the identified variables (Flom, 2018).

ANOVA tests were done to determine if a correlation existed between the financial risk tolerance scores of the investors (Gujarati & Porter, 2010:179).

An exploratory factor analysis was done to group the questions. The group with the highest correlation with regard to the financial risk tolerance scores was investigated. An analysis was done within the group to determine what the underlying questions were, and this was investigated to determine if these underlying questions supported any of the identified variables (Rahn, 2018).

A correlation analysis was done to determine the degree to which changes in one variable predicted changes in other variables. This analysis was necessary to determine which of the identified variables had the highest correlation to the financial risk tolerance scores and how strong that correlation was (Wegner, 2007:418). A correlation analysis differs from a corrected item-total correlation as a correlation analysis determines the correlation between variables, and the latter determines the association the different questions has to each other.

A regression analysis was also used to calculate the beta starred for each variable with regard to the financial risk tolerance scores. The purpose of this analysis was to determine how strong the beta starred of each variable was in relation to the financial risk tolerance scores and how strong the relationship between them was (Wegner, 2007:408).

To determine what group of variables had the highest relationship to the financial risk tolerance scores, a multiple regression analysis was done. A group was identified and then, another

analysis was done with that particular group to determine which of the variables had the highest relationship to the financial risk tolerance scores (Laerd Statistics, 2018). With the multiple regression analysis, generations were used rather than age. The age of investors had an effect on the financial risk tolerance scores and the generation groups were investigated for a more detailed explanation.

The following generation groups were identified and incorporated (Serafino, 2018):

- Baby Boomers: 1946-1964
- Generation X: 1965-1980
- Millennials: 1981-1995

A Pearson and a Spearman correlation was done to determine a linear correlation between specific variables and the financial risk tolerance scores. These correlations were necessary to determine whether a strong relationship existed between the variables and the financial risk tolerance scores. The Pearson correlation evaluated the linear relationship between two continual variables while the Spearman correlation evaluated the monotonic relationship between two continual or ordinary variables.

4.1.3 Variables identified

The analysis consisted of dependent and independent variables. Financial risk tolerance was used as the dependent variable. The coding used for each of the independent variables is presented in Table 5. The first four were the main variables and the rest was used as control variables to develop sensible regression models. Generations as a variable is not listed in the table below, since it was used according to the years (as explained in Chapter 4.1.2).

Table 5: Independent variables and control variables

Variables	Measurement
Gender (D1)	1=Male 2=Female
Year of birth (Age) (D2)	Year of birth entered
Education level (D3)	1=Did not complete high school

	2=Completed high school
	3=Trade or diploma qualification
	4=University degree or higher qualification
Income level (D4)	1=Under R100 000 p.a.
	2=R100 000-R249 999 p.a.
	3=R250 000-R499 999 p.a.
	4=R500 000-R999 999 p.a.
	5=R1 000 000-R2 999 999 p.a.
	6=R3 000 000 and above
Marital status (D5)	1=Yes
	2=No
Annual combined income if married (D6)	1=Under R100 000 p.a.
	2=R100 000-R249 999 p.a.
	3=R250 000-R499 999 p.a.
	4=R500 000-R999 999 p.a.
	5=R1 000 000-R2 999 999 p.a.
	6=R3 000 000 and above
Number of dependents (D7)	Total number of dependents besides yourself entered
Value of net assets (D8)	1= Under R50 000.
	2=R50 000-R124 999.
	3=R125 000-R249 999.
	4=R250 000-R499 999.
	5=R500 000-R999 999.
	6=R1 000 000-R2 499 999.
	7=R2 500 000-R4 999 999.
	8=R5 000 000-R9 999 999.
	9=R10 000 000- R24 999 999.
	10=R25 000 000 and above

Source: FinaMetrica (2015)

The above-mentioned variables were tested individually against financial risk tolerance to determine whether they had an effect on the level of risk investors are willing to take. If it was found that certain variables have an effect on financial risk tolerance they were used to do various analysis with later in the chapter. When two variables that were similar was found to have an effect on financial risk tolerance, the most significant one was selected and used in this research. For example, when personal income was found to be significant, it was expected

that annual combined income would have an effect as these two measures are very closely related. In this case the researcher used the one that already has an established theory behind it, which was the income variable.

In Table 5, a list of independent and control variables are provided. The independent variables are the five major variable groups: gender, age, generation, education level and income level variable. These variables can stand-alone and did not depend on other variables that were measured. The control variables were constant throughout the investigation and ensured that when changes were found in financial risk tolerance, it was due to a change in the independent variable and not control variables. Control variables were used, because they were viewed as contributing factors to help identify relationships between the independent variable and dependent variables.

A discussion of the descriptive statistics follows later in this chapter (4.2), however to assist the reader in becoming familiar with the data a summary of the descriptive statistic is shown in Table 6. The information concerning the analysis of the identified variables, the factor groups and variables identified are discussed later in this chapter. Note that Table 6 should be read in conjunction with Table 5 that indicates the different selection options of the respondents.

Table 6: Descriptive statistics of identified variables

Variable	N	Mean	Standard deviation	Median	Minimum	Maximum
Gender	3473	1.428	0.495	1	1	2
Age (year of birth)	3473	1969.69	10.641	1966	1901	1996
Baby Boomers	1359	1955	0.489	1956	1946	1964
Generation X	1111	1973	0.428	1973	1965	1980
Millennials	720	1988	0.450	1985	1981	1995
Education	3473	3.387	0.798	4	1	4
Income	3473	3.360	1.303	3	1	6
Marital status	3473	1.293	0.455	1	1	2
Combined income	2657	3.945	1.222	4	1	6

Variable	N	Mean	Standard deviation	Median	Minimum	Maximum
Number of dependents	3473	1.565	1.473	1	0	10
Value of net assets	3473	6.129	2.318	6	1	10

Source: SPSS analysis

From Table 6 the following can be seen:

- Gender has a minimum of 1 and a maximum of 2. This is due to male being given a numerical value of 1 and female a value of 2. The median was 1 due to most of the investors being male, the median (the middle of the values) lies within males. The descriptive statistic for gender is thus not reliable to look at since each gender is given a numerical value. Gender was further explained in 4.2.1.
- The age (year of birth) had a minimum of 1901 and a maximum of 1996. This indicates that the data captured in the FinaMetrica database consisted of the information of individuals born in these years. The data were captured over a time period and the individual born in 1901 could have already passed away. The median of age and the different generations included in Table 6 only indicated what year the middle value of age or of that generation was born. Age was further explained in 4.2.2.
- If the investors from the different generations are added together, they did not add up to the total research population of 3473. The different generations had a total of 3190 ($1359 + 1111 + 720 = 3190$). This is due to individuals born before 1946 ($2017 \text{ time of analysis} - 1946 = 71$) would already be retired and not used for this study as only working investors were considered. The combined income value population, was different due to all the investors not being married and not all having a combined income.
- Education and income was represented by minimum and maximum values, together with the median for education (further explained in 4.2.3), income (further explained in 4.2.4). These values represented the categories in Table 5 by using numerical values.
- Marital status, combined income, number of dependents and value of net assets were not investigated as they were independent variables and only used to support the control variables. The minimum and maximum values, together with the median for marital status, combined income and value of net assets represent the categories represented in Table 5.

- The minimum and maximum values, together with the median for number of dependent represent the number of dependent investors had at the time they completed the questionnaire.

4.1.4 FinaMetrica questionnaire

In Table 7, an excerpt of the questions used in the FinaMetrica questionnaire is provided. The questions are a summary of the full questions in the FinaMetrica questionnaire that can be viewed in Appendix A. It is important to note that the below excerpt is a summarised version of the questionnaire in Appendix A to make it easy for the reader to get a clear understanding of what each questions entails, as the full version is available in Appendix A.

FinaMetrica's questionnaire consists of 25 questions that they use to determine the financial risk tolerance scores of investors. *However, only questions 1-24 was used to determine the financial risk tolerance scores of investors, since question 25 focuses on the personal view of investors with regard to their financial risk tolerance score.*

Investors choose an appropriate answer from the list of possible answers. The answers can be "Yes" or "No", or they are provided with a list with more detailed options to choose from. Investors choose the option that explains them the best and their answers are used to determine a financial risk tolerance score.

Table 7: FinaMetrica questionnaire summary

1. You have to rate your willingness to take financial risk.
2. You have to state how easily you adapt when things go wrong financially.
3. When you think of the word "risk" in a financial context, which of the words comes to mind first: Danger; Uncertainty; Opportunity of Thrill.
4. Have you ever invested a large sum in a risky investment mainly for the "thrill" of seeing whether it went up or down in value?
5. If you had to choose between more job security with a small pay increase and less job security with a big pay increase, which would you pick?

6. When faced with a major financial decision, are you more concerned about possible losses or possible gains?
7. How do you feel about financial decisions after making them?
8. If you were in a job where you could choose to be paid a salary, commission or a mix of both. What would you pick?
9. What degree of risk would you have taken with your financial decisions in the past?
10. What degree of risk are you currently prepared to take with your financial decision?
11. Have you ever borrowed money to make an investment (other than for a home)?
12. How much confidence do you have in your abilities to make good financial decisions?
13. If you had a bad past experience with a company, would you buy stock now if the company is under new management?
14. By how much could the total value of all your investments go down before you would begin to feel uncomfortable?
15. A house needs to be sold or renovated and there is some talk of constructing a major highway next to the house, and this would lower its value considerably. What would you do?
16. Which mix of investments do you find most appealing? Would you prefer all low-risk/ low-return, all high-risk/ high-return, or somewhere in between?
17. How low would the chance of a loss have to be for you to make the investment?
18. Which is more important to you - that the value of your investment does not fall or that it retains its purchasing power?
19. In recent years, how have your personal investments changed?
20. How much of the funds you have available to invest would you be willing to place in investments where both return and risk are expected to be above average?
21. Think of the average rate of return you would expect to earn on an investment portfolio over the next ten years. How does this compare with what you think you would earn if you invested the money in one-year CDs (certificates of deposit)?
22. Would you take a risk in arranging your affairs to qualify for a government benefit or obtain a tax advantage?

23. You could take a variable interest rate that will rise and fall as the market rate changes. Or you could take a fixed interest rate which is 1% more than the current variable rate but will not change as the market rate changes. Or you could take a mix of both. How would you prefer your loan to be made up?

24. Insurance can cover a wide variety of life's major risks - theft, accident, illness, death etc. How much coverage do you have?

25. This questionnaire is scored on a scale of 0 to 100. When the scores are graphed they will follow the familiar bell-curve of the normal distribution. The average score is 50. Two-thirds of all scores are within 10 points of the average. Only 1 in 1000 is less than 20 or more than 80. What do you think your score will be?

Henceforward, the questions in FinaMetrica's questionnaire are referred to as RT1 (risk tolerance; question 1) or RT2 (risk tolerance; question 2). The financial risk tolerance score awarded to each of the investors by FinaMetrica is referred to as the FRTScore.

4.2 Descriptive statistics

The different variables were tested based on the questions asked in FinaMetrica's questionnaire. The valid data from the 3473 investors were used in this research study and evaluated, according to the different variables. A graphical representation of the data of the 3473 investors are illustrated in Figure 8. Standard deviation, standard error, minimum and maximum were utilised when *significant and reliable* (Wegner, 2007:138) in the analysis below.

To interpret the statistics, the researcher made use of a statistician. The researcher wanted the data to be a fair and accurate representation of the population in order for reliable and valuable conclusions to be drawn. The data were analysed, according to the five selected variables discussed in the following section.

4.2.1 Gender

Figure 8: Gender distribution of data

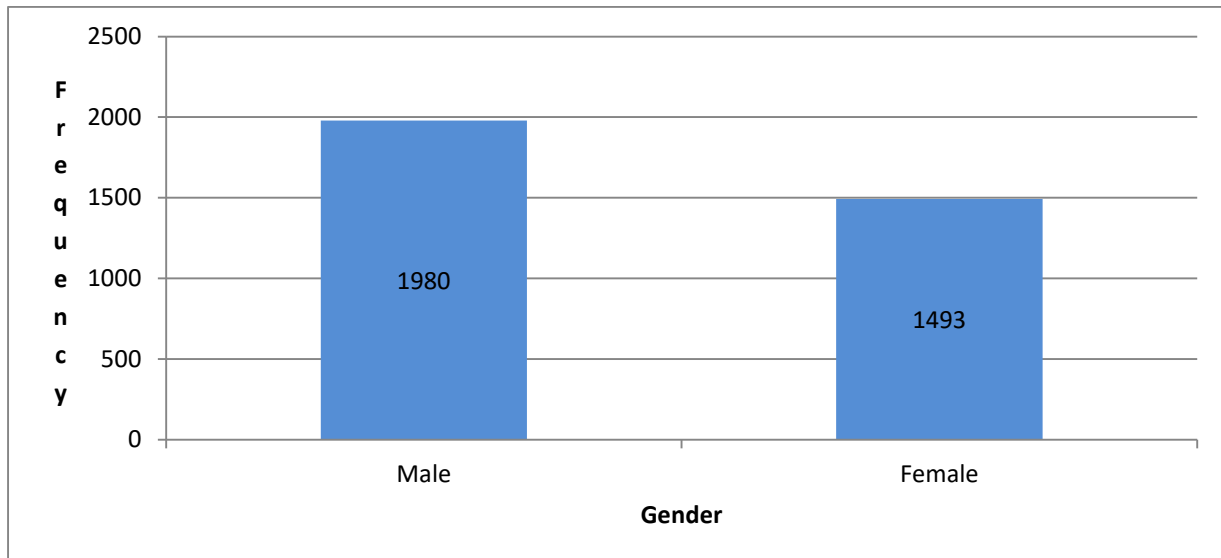


Figure 8 represents female and male investors whose financial risk information was captured on the FinaMetrica database. The male investors (1980) are far more than the number of female investors (1493) listed. However, the imbalance did not affect the outcome of the study, as the population was sufficient to be able to draw valuable conclusions.

The descriptive statistics for gender did not provide an accurate measure to work with, as males were given a numerical value of 1 and females a numerical value of 2. Gender had, therefore, a mean of 1.428 – there were more male investors in the population than female investors. Standard deviation and standard error, minimum and maximum were irrelevant, as the numerical values provided by the statistical analysis did not relate to a specific variable and were, therefore, not reliable and trustworthy if conclusions were made.

4.2.2 Age (year of birth)

Figure 9: Age (year of birth) distribution of data

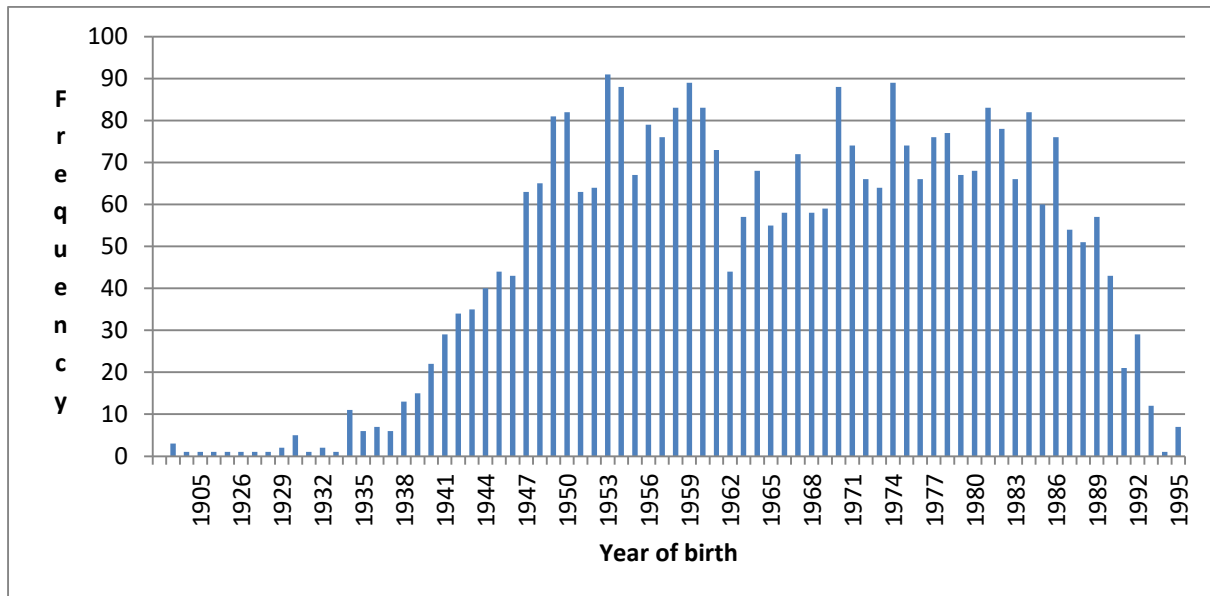


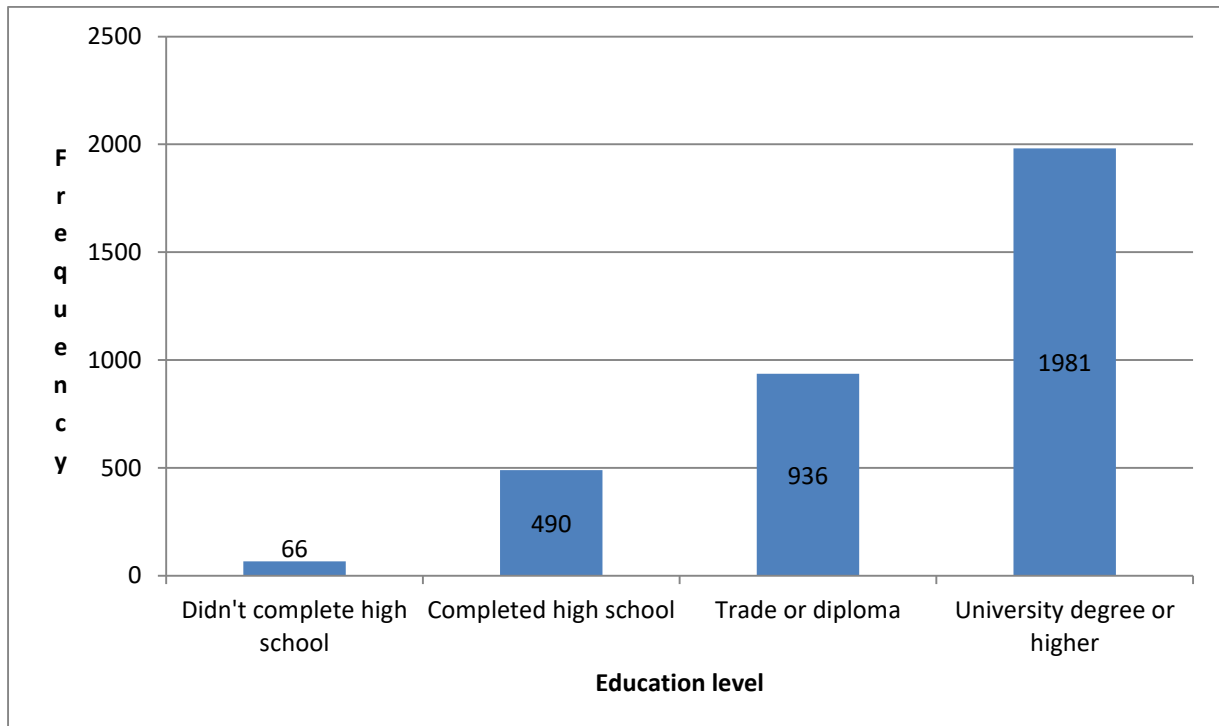
Figure 9 confirms a population of investors who are currently working and earning a salary. Investors born after 1995 are currently still studying and not earning a salary yet. These investors did not contribute towards this research study. Moreover, investors born before 1952 (2017 time of analysis – 65 years) were assumed retired and so not make investment decisions anymore.

The following is evident from the descriptive statistics: The average age of investors in this population (Table 6) is 49 years and they are born in 1969. The standard deviation for this age was 10.641 and the standard error was 0.485.

The researcher made use of investors above the age of 22 (2017 time of analysis – 1995), as they are already working and earning a salary. *No investors older than 65 were used*, as they are already retired and they do not make active investment decisions.

4.2.3 Education

Figure 10: Education distribution of data



When the education data were investigated, one of the limitations of the data were confirmed. The data used in this study do not represent the entire South African population. Only investors who make investment decisions and have access to Internet are categorised as qualified investors.

The minimum and maximum, mean and standard deviation were also not reliable, as evident in Figure 10. The minimum will represent the minimum degree of investors who did not complete high school or a maximum degree of investors who qualified with a university degree or a higher qualification.

4.2.4 Income

Figure 11: Income distribution of data

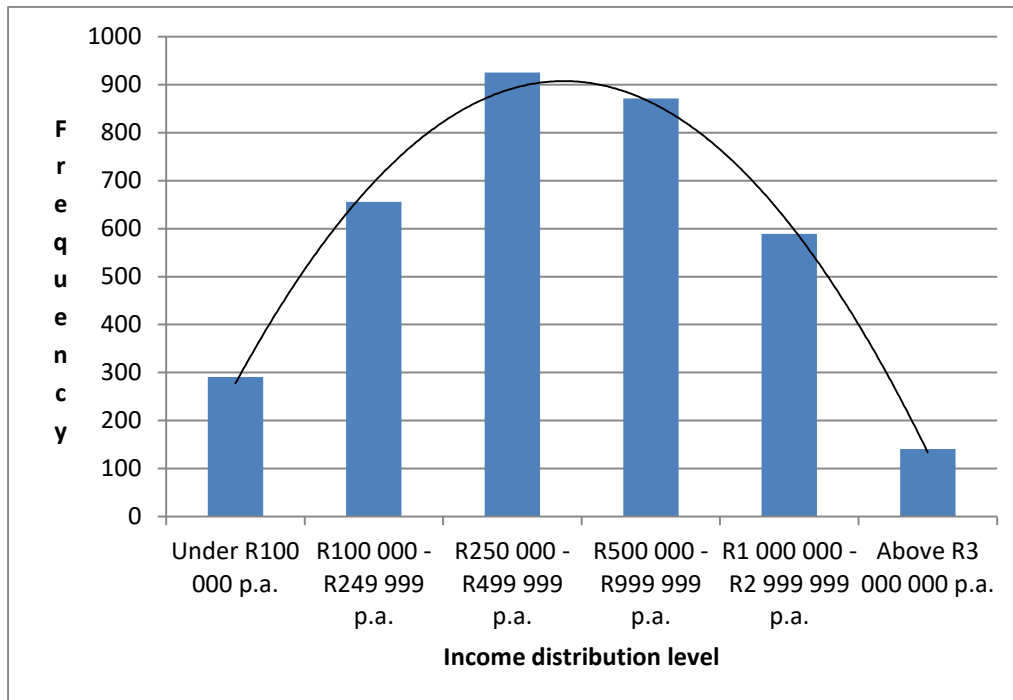


Figure 11 confirms the distribution of the income of the population and reflects a normal distribution curve. A normal distribution curve occurs when the majority of the data points lie in and around the middle and decreases at the same rate in both directions of the curve.

The mean for the income distribution was 3.360 and had a standard deviation of 1.303. The standard error was 0.251; and the prior mentioned was numerical values based on 0-100. The mean was centred on a group earning an income between R250 000–R499 999 on an annual basis. The mean fell between interval 3 and 4 and the standard deviation and error were made from that amount. The minimum and maximum were also not sufficient – only the minimum and maximum groups were represented. It is, therefore, evident that the majority of the investors earns an income in the middle income distribution level and decreases at more or less the same rate in both directions of the curve.

The normal distribution curve indicated that 68% of the information fell between the mean and one standard deviation and confirmed that the mean was in the class interval where the normal distribution curve had its turning point – the income group earning R250 000–R499 999 per

annum. If one standard deviation was moved to the left or to the right, the income level earnings would have moved one group together with the standard deviation moving up or down.

4.3 Corrected item-total correlation

A corrected item-total correlation (Field, 2005) was done. The first 24 research questions asked in the FinaMetrica's questionnaire were tested for correlations between the different questions. The higher the correlation, the higher that specific question was related to the rest of the questions. The lower the correlation, the lower a particular question's relation to the rest of the questions (Flom, 2018).

Table 12: Corrected item-total correlation (from the highest to the lowest correlation)

Ranking	FinaMetrica's questions	Corrected item-total correlation
1	RT16	0.733
2	RT10	0.707
3	RT1	0.704
4	RT20	0.664
5	RT9	0.598
6	RT19	0.596
7	RT14	0.585
8	RT17	0.580
9	RT3	0.542
10	RT21	0.540
11	RT8	0.539
12	RT5	0.535
13	RT6	0.523
14	RT13	0.518
15	RT2	0.495
16	RT22	0.476
17	RT12	0.468
18	RT18	0.435
19	RT4	0.416
20	RT7	0.396

21	RT11	0.301
22	RT15	0.300
23	RT23	-0.264
24	RT24	0.125

Based on the correlations listed in Table 12, it is evident that the first six questions have the highest correlation with the other questions. These six questions were, therefore, viewed as the most important questions that assisted in determining the financial risk tolerance scores of investors. The higher the correlation, the higher the impact of that question. The first six questions had a correlation of approximately 0.6 or higher. These six questions are discussed below, according to their correlation:

- RT 16 - what type of investment does investors find the most appealing (this question had the biggest impact and the highest correlation).
- RT 10 - the degree of risk investors are currently prepared to take.
- RT 1 - how investors rate their willingness to take financial risks.
- RT 20 - the willingness of investors to invest in certain types of funds.
- RT 9 - past financial risks taken by investors.
- RT 19 – how the personal investments of investors have changed over the years.

The following two questions had the lowest correlation and did not provide values that aligned with the values and information obtained from the other questions:

- RT 23 - how the loans of investors should be made up.
- RT 24 - how much insurance cover does investors have.

The two above-mentioned questions did not make any significant contribution to the rest of the research study. It was, therefore, decided to not use these two questions in the analyses, because these questions did not assist in the accuracy and validity of the study.

4.4 Analysis of variance (ANOVA)

The FRTScore of each of the investors were calculated to determine the correlation between the investors demographics and their total financial risk tolerance score. Eta-squared (η^2)

measures the effect size in ANOVA. η^2 is calculated as follows: The sum of squares of the complete group divided by the sum of squares of the total.

Eta-squared can be interpreted as follows: 0.01 is a small correlation; 0.06 is a moderate correlation; and 0.14 is a large correlation (Gujarati & Porter, 2010:179). An eta-squared analysis was done on the FinaMetrica data:

$$\eta^2 = \frac{29\,652.839}{412\,357.357} = 0.0719$$

From the 0.0719 score obtained, a moderate correlation was determined for the total financial risk tolerance scores of the investors - a moderate correlation existed between the investors demographics and the financial risk tolerance scores they had received. A factor analysis was done next to investigate which of the identified variables supported this correlation.

4.5 Exploratory factor analysis

An exploratory factor analysis is a statistical method used to describe variability amongst observed, correlated variables in terms of a potentially lower number of unobserved variables called factors (Rahn, 2018). An exploratory factor analysis (Pietersen & Maree, 2016:244) was done, to group the questions asked in the FinaMetrica's questionnaire into smaller groups that relate to each other because, the 22 FinaMetrica questions (RT1-RT22) were not previously broken-up into groups. These similar groups were then tested against the financial risk tolerance scores of investor to determine which groups had the highest effect on how the financial risk tolerance scores were determined. The smaller groups were then investigated to determine if the questions supported any of the identified variables.

The data were grouped where the values attached to the questions fitted the best and related questions were then paired. The researcher only included questions into a group where the variance was more than or very close to 0.5 to ensure that only closely related questions were grouped together. If a question had a value below 0.5, it was omitted from the factor analysis, as only the major three groups were focused on. Each question was given a numerical value to indicate how closely the relation was to a certain factor and to other questions. When certain

questions were grouped together and related questions were identified, it guided the research towards the identified variables that had a significant influence on how investors make financial risk tolerance decisions.

The questions asked in FinaMetrica's questionnaire were analysed according to their initial Eigenvalues and groups of questions with the highest significance were identified. If the Eigenvalue is more than one, it confirms the factor is of significance (Pietersen & Maree, 2016:243). Table 13 shows the three major factors that were extracted from the questions in the questionnaire. The Eigenvalues in the table below showed how many of the 22 questions (refer to Table 12) had a combined effect on the financial risk tolerance scores of the investors. The cumulative percentage shows the percentage of the questions that fell within these three factors below:

Table 13: Factor analysis of questionnaire questions

Factors	Eigenvalue	Cumulative percentage
1	7.963	33.18
2	1.186	38.12
3	1.142	42.88

The following was inferred:

- Factor one consisted of 33.18% of the questions in the questionnaire that were used to group and calculate the financial risk tolerance scores of investors. 7.963% of the questions are completely related to Factor one.
- Factor two and three consisted of approximately 4.94% ($38.12 - 33.18$) and 4.76 % ($42.88 - 38.12$), respectively.
- Eigenvalue of more than 1 is confirmation that this exploratory exercise proves that three factors are present.
- The cumulative percentage of these three factors added up to 42.88% of all the information.

The results of the rotated factor analysis are shown in Table 14. In a rotated factor analysis, variables and factors are rotated around an axe to compare them with each other. The results of the top three identified factors were inserted, as all of the questions were relevant and these factors are discussed in the following section.

Table 14: Questions in the questionnaire grouped under different factors

A rotated factor analysis			
	Factor one loading	Factor two loading	Factor three loading
RT16	0.739	.	.
RT20	0.728	.	.
RT10	0.694	.	.
RT17	0.645	.	.
RT14	0.633	.	.
RT21	0.616	.	.
RT19	0.604	.	.
RT1	0.550	0.399	0.359
RT22	0.531	.	.
RT13	0.510	.	.
RT18	0.445	.	0.329
RT15	0.408	.	.
RT3	0.407	0.376	.
RT4	.	0.698	.
RT11	.	0.686	.
RT9	0.352	0.544	0.325
RT8	0.329	0.525	.
RT5	0.429	0.442	.
RT7	.	.	0.793
RT12	.	.	0.613
RT2	0.347	.	0.449
RT6	0.359	.	0.437
Values less than 0.3 are not shown here			

From Table 14 it is evident that Factor one consisted of 18 questions of which 10 questions were significant. Factor two consisted out of seven questions of which four questions were significant while Factor three consisted out of seven questions of which only two were significant. Some of these question fitted into two or more factor groups, but questions were used in the group where these questions had the highest significance (> 0.5). If a question did not have a significant relationship to any one of the factors, the questions were not used. If a question had a value with relation to all three factors, that question was used in the factor where that question had the highest relevance. Questions 23 and 24 were not used as concluded in Table 12. Question 25 was not used, as it indicated an estimate of the level of financial risk that investors had to determine and was not deemed accurate or relevant to the research study.

From the questions that were grouped together with the aid of a factor analysis, each group was given a name based on the questions that were grouped together. See Annexure A or Table 7 for these questions. The appropriate names for the groups were as follows:

- Factor one was called *level of risk*: This group consisted out of questions RT16, RT20, RT10, RT17, RT14, RT21, RT19, RT1, RT22 and RT13. Questions with a value of less than 0.5 were not used, as their relevance was not of statistical importance and only the above-mentioned questions were focused on. It is evident that the underlying question focuses on the risk appetite of investors and how their appetite has changed over recent years.
- Factor two was called *past experience*: This group consisted of questions RT4, RT11, RT9 and RT8. Questions with a value of less than 0.5 were not used, as their relevance was not of statistical importance and only the above-mentioned questions were focused on. It is evident that the underlying question focuses on the financial decisions that were made by investors in the past and how they handled certain situations.
- Factor three was called *personal attitudes and feelings*: This group consisted of questions RT7 and RT12. Questions with a value of less than 0.5 were not used, as their relevance was not of statistical importance and only the above-mentioned two questions were focused on. It is evident that the underlying question focuses on the concern of investors when financial decisions are made and how they feel when something goes wrong.

It is, therefore, clear that Factor one (level of risk) contained the most amount of questions and the underlying question focuses on the risk appetite of investors and how their appetite has changed over recent years. A large number of questions were grouped together and they were not evenly spread and additional calculations are, therefore, necessary to determine the importance of these questions with regard to the financial risk tolerance scores of the investors.

A communality estimate was done where the variance between each research question and the financial risk tolerance scores were tested. Communality estimates are the proportion of variance of the variables accounted for by the common factors. It is calculated by adding the sum of squares of each row of the factor pattern matrix. The higher the communality estimate the better. Communality estimates above 0.5 is deemed strong. The results were inserted below:

Table 15: Communality estimate of the questions in the questionnaire

Questions in the questionnaire:	Final communality estimates:
RT1	0.590
RT2	0.365
RT3	0.380
RT4	0.518
RT5	0.407
RT6	0.389
RT7	0.645
RT8	0.444
RT9	0.526
RT10	0.603
RT11	0.472
RT12	0.476
RT13	0.343
RT14	0.461
RT15	0.275
RT16	0.646
RT17	0.463
RT18	0.306
RT19	0.447
RT20	0.591
RT21	0.425
RT22	0.319

From the communality estimate listed in Table 15, it is clear which of the factors have the closest variance to the financial risk tolerance scores. The questions that were identified to have the closest relationship are: RT1, RT4, RT7, RT9, RT10, RT16 and RT20.

Questions that obtained a communality estimate of less than 0.5 were eliminated and not used, because these questions did not fit well with the factor groups - only questions with a communality of higher than 0.5 were focused on.

The highest influencing questions were RT7 and RT16 with, variances of 0.645 and 0.646 respectively. RT7 focused on the feelings of investors after making certain financial decisions while the focal point of RT16 was the preference of investors with regard to their financial risk tolerance levels. It is, therefore, evident that the relationship between investors and their financial risk tolerance scores were closely related to the perception they had about themselves and their willingness to tolerate financial risk.

The next questions were RT1 (rate your risk), RT9 (feelings about financial decisions), RT10 (degree of risk investors are prepared to take) and RT20 (change in the total level of investments before investors get uncomfortable). These identified questions had a high relationship and assisted in determining the financial risk tolerance scores of investors more accurately.

4.6 Correlation analysis between demographic variables and risk tolerance

A correlation coefficient is used to determine the degree to which changes to one value of one variable can predict a change to the value of another. Values are expressed between +1 and -1. If the value moves closer to +1 or -1 the correlation grows stronger. If the value moves closer to +1 the relation grows stronger for a positive correlation and as the value moves closer to -1 it grows stronger for a negative correlation. If a correlation moves closer to zero, it becomes a weaker correlation - a correlation of zero means that there is no correlation between the two values (Wegner, 2007:418). The financial risk tolerance score given to each of the investors was correlated to each of the identified variables to determine whether the correlation between them was significant and important or if only low correlations existed.

A Pearson correlation was done for each factor and its variables together with a p-value test. If the p-value was less than 1%, the H_0 was rejected due to overwhelming evidence. If the p-value is less than 5%, it is strong evidence to reject H_0 . The data shown in Table 16-18 confirms the analysis done between the different demographic variables and Factor one (level

of risk), Factor two (past experience) and Factor three (personal attitudes and feelings). Only four of the five identified hypothesis were investigated, as age was focused on rather than generation. Generations was focused on in a further analysis. All of the demographic variables are included in Tables 16-18 to provide a complete analysis. However, only D1 (Gender), D2 (Age), D3 (Education level) and D4 (Income level) were used to test the hypothesis stated in Chapter one. Furthermore, Generations (H_0 (3)) was also not tested in this section, since D2 (Age) was included. Age and generation variables were not tested together as the same information was used to do the analyses (year of birth). When age was found to be a more reliable measure; age was tested, and where generation was found to be a more reliable measure; generation was tested.

Table 16: A Pearson correlation between Factor one (level of risk) and variables

Factor one: Level of risk	Pearson correlation	p-value
Gender (D1)	-0.140	0.000
Age (D2)	0.272	0.000
Education level (D3)	0.234	0.000
Income level (D4)	0.216	0.000
Marital status (D5)	0.023	0.191
Annual combined income (D6)	0.225	0.003
Number of dependents (D7)	0.052	-0.020
Value of net assets (D8)	-0.020	0.256

In Table 16, the following is evident:

- The strongest correlation was found with D2, D3, D6, D4 and D1 (in this particular order).
- Age (D2) showed a positive correlation indicating that there is a positive relationship between age and financial risk tolerance. A positive relationship indicates that as investors age, they are willing to tolerate a higher level of risk.

- Education level (D3) showed a positive correlation indicating that there is a positive relationship between education level and financial risk tolerance. A positive relationship indicates that as investors are more educated, they are willing to tolerate a higher level of risk.
- Combined annual income (D6) and Income level (D4) showed a positive correlation indicating that there is a positive relationship between combined annual income, income level and financial risk tolerance. A positive relationship indicates that as investors earn a higher income, they are willing to tolerate a higher level of risk.
- Gender (D1) showed a negative correlation indicating that there is a negative relationship between gender and financial risk tolerance. Male investors were given a numerical value of 1 and female a numerical value of 2. A negative relationship indicates that if an investor is female, there will be a negative relationship indicating that females will take a lower risk tolerance than males.
- It was important to investigate the p-value. A p-value of less than 1% was found for D1, D2, D3, D4 and D6, and a p-value of less than 5% for D7.
- Annual combined income (D6) and Number of dependents (D7) were not tested as a hypothesis, but were rather used to support the identified hypothesis and variables.

The hypothesis (refer to 4.1.1) was tested against the Factor one (level of risk) results:

- Gender (D1): The p-value of 0.000 was below 1%, and overwhelming evidence was found to reject the null hypothesis: H_0 (1). This implies that there is a statistical significant relationship between gender and risk tolerance based on level of risk. The negative correlation indicates that the risk tolerance of women is lower than men.
- Age (D2): The p-value of 0.000 was below 1%, and overwhelming evidence was found to reject the null hypothesis: H_0 (2). This implies that there is a statistical significant relationship between age and risk tolerance based on level of risk. The higher the age of an investor, the higher the financial risk tolerance level that they are willing to accept.
- Education level (D3): The p-value of 0.000 was below 1%, and overwhelming evidence was found to reject the null hypothesis: H_0 (4). This implies that there is a statistical significant relationship between education level and risk tolerance based on level of risk. The higher the level of education an investor has, the higher the financial risk tolerance level that they are willing to accept.
- Income level (D4): The p-value of 0.000 was below 1%, and overwhelming evidence was found to reject the null hypothesis: H_0 (5). This implies that there is a statistical

significant relationship between income level and risk tolerance based on level of risk. The higher the level of income an investor earns, the higher the financial risk tolerance level that they are willing to accept.

Table 17: A Pearson correlation between Factor two (past experience) and variables

Factor two: Past experience	Pearson correlation	p-value
Gender (D1)	−0.246	0.000
Age (D2)	−0.026	0.135
Education level (D3)	0.085	0.000
Income level (D4)	0.260	0.000
Marital status (D5)	−0.043	0.014
Annual combined income (D6)	0.205	0.000
Number of dependents (D7)	0.174	0.000
Value of net assets (D8)	0.213	0.000

The following is evident from the data shown in Table 17:

- The strongest correlation was found with D4, D1, D8, D6 and D7 (in this particular order).
- Income level (D4) showed a positive correlation indicating that there is a positive relationship between income level and financial risk tolerance. A positive relationship indicates that as investors receive a higher income, they are willing to tolerate a higher level of risk.
- Gender (D1) showed a negative correlation indicating that there is a negative relationship between gender and financial risk tolerance. Given the numerical values allocated to males and females, a negative relationship indicates that females take on a lower risk tolerance level than males.
- A p-value of less than 1% was found for D1, D3, D4, D6, D7 and D8. A p-value of less than 5% was found for D5.

- Marital status (D5), Annual combined income (D6), Number of dependents (D7) and Value of net assets (D8) were not tested as a hypothesis, but were rather used to support the identified hypothesis and variables.

These values were then used to test the hypothesis (refer to 4.1.1) against the Factor two (past experience) results:

- Gender (D1): The p-value was 0.000 and, therefore, below 1%. Overwhelming evidence was, therefore, found to reject the null hypothesis: H_0 (1). This implies that there is a statistical significant relationship between gender and risk tolerance based on past experience. The negative correlation indicates that the risk tolerance of women is lower than men.
- Age (D2): The p-value was 0.135 - not below 1% or lower than 5%. Overwhelming evidence supported, therefore, the decision not to reject the null hypothesis: H_0 (2). This implies that there is no statistical significant relationship between age and risk tolerance based on past experience.
- Education level (D3): The p-value was 0.000 and, therefore, below 1%. Overwhelming evidence was, therefore, found to reject the null hypothesis: H_0 (4). This implies that there is a statistical significant relationship between education level and risk tolerance based on past experience. The higher the level of education an investor has, the higher the financial risk tolerance level that they are willing to accept.
- Income level (D4): The p-value was 0.000 and, therefore, below 1%. Overwhelming evidence was, therefore, found to reject the null hypothesis: H_0 (5). This implies that there is a statistical significant relationship between income level and risk tolerance based on past experience. The higher the level of income of investors, the higher the financial risk tolerance level that they are willing to accept.

Table 18: A Pearson correlation between Factor three (personal attitudes and feelings) and variables

Factor three: Personal attitudes and feelings	Pearson correlation	p-value
Gender (D1)	-0.130	0.000
Age (D2)	0.013	0.447

Education level (D3)	0.089	0.000
Income level (D4)	0.120	0.000
Marital status (D5)	−0.005	0.774
Annual combined income (D6)	0.117	0.000
Number of dependents (D7)	0.014	0.422
Value of net assets (D8)	0.104	0.000

From Table 18, the following is evident:

- The strongest correlation was found with D1, D4, D6 and D8 (in this particular order).
- Gender (D1) showed a negative correlation indicating that there is a negative relationship between gender and financial risk tolerance. Given the numerical values allocated to males and females, a negative relationship indicates that females take on a lower risk tolerance level than males.
- Income level (D4) showed a positive correlation indicating that there is a positive relationship between income level and financial risk tolerance. A positive relationship indicates that as investors receive a higher income, they are willing to tolerate a higher level of risk.
- A p-value of less than 1% was found for D1, D3, D4, D6 and D8.
- Annual combined income (D6) and Value of net assets (D8) were not tested as a hypothesis, but were rather used to support the identified hypothesis and variables.

The above information was then used to test the hypothesis (refer to 4.1.1) against the results obtained from Factor three (person attitudes and feelings):

- Gender (D1): The p-value was 0.000 and, therefore, below 1%. Overwhelming evidence was found to reject the null hypothesis: H_0 (1). This implies that there is a statistical significant relationship between gender and risk tolerance based on personal attitudes and feelings. The negative correlation indicates that the risk tolerance of women is lower than men.

- Age (D2): The p-value was 0.447 - not below 1% or below 5%. Evidence, therefore, supported the decision to not reject the null hypothesis: H_0 (2). This implies that there is no statistical significant relationship between age and risk tolerance based on personal attitudes and feelings.
- Education level (D3): The p-value was 0.000 and, therefore, below 1%. Overwhelming evidence was, therefore, found to reject the null hypothesis: H_0 (4). This implies that there is a statistical significant relationship between education level and risk tolerance based on personal attitudes and feelings. The higher the level of education an investor has, the higher the financial risk tolerance level that they are willing to accept.
- Income level (D4): The p-value was 0.000 and, therefore, below 1%. Overwhelming evidence was, therefore, found to reject the null hypothesis: H_0 (5). This implies that there is a statistical significant relationship between income level and risk tolerance based on personal attitudes and feelings. The higher the income level of an investor, the higher the financial risk tolerance level that they are willing to accept.

4.7 Regression analysis

In a regression analysis, the relationships between variables are determined (dependent variable = total risk tolerance and independent variables = demographic variables). The analysis focuses on the relationship between a dependent variable and one or more independent variables. This analysis indicated how a value of the dependent variable changed when any one of the independent variables changed. The relationship of the financial risk tolerance scores with the identified variables combined were established: $FRTScore = f(D1, D2, D3, D4)$.

A R squared value is determined when a regression analysis is performed, as it confirms how close the data fit the regression line. This value is determined by the SPSS (Statistical Package for the Social Sciences) statistical tool for regression analyses. R is the degree that y changes if there is a change in x . R squared is the change in y that is attributable to a change in x . R squared lies between 0 and 1. When it lies closer to zero, it indicates a low percentage of variation in y explained by the x variable (Wegner, 2007:424).

For this research study, the adjusted R squared was important, since it was adjusted for the number of predictors in the model used. The adjusted R squared increased when the new term improved the model, *more* than would be expected by chance (further explained in 4.8.4).

A regression analysis was implemented to determine whether a close relationship existed between the five identified variables and the financial risk tolerance scores, and from that, an adjusted R squared was generated.

The beta starred (β^*) is also known as beta coefficient (Gujarati & Porter, 2010:162). The beta starred for the first four variables together with the financial risk tolerance scores was the dependent variable to determine the strength of the relationship. Beta starred was used, because it is a standardised variable that has a mean, which is always zero (Gujarati & Porter, 2010:162). Beta starred is measured in standard deviation units. The higher the absolute value of beta starred (β^*), the stronger the effect.

Beta starred is based on the assumption that the dependent variable is beta-distributed and related to a set of regressors through a linear predictor with unknown coefficients and a link function. The beta coefficient is the degree of change in the outcome variable for every 1-unit of change in the predictor variable. The t-test tests the significance and if a t-value deviates from zero (Wegner, 2007:201), the null hypothesis is more inclined to be rejected. The following calculation was not used to test the identified hypothesis but rather to obtain a more detailed understanding of what the data illustrated and assisted in understanding the data better:

$$y = b_0 + b_1x_1 + b_2x_2 + b_3x_3 + \dots + b_px_p ; y = \text{estimated value of the dependent variable}$$

$$b_0 = \text{the } y \text{ intercept coefficient}$$

$$b_1, b_2, b_3, \dots, b_p = \text{the sample coefficients for the independent variable}$$

$$x_1 = \text{Gender}; x_2 = \text{Age}; x_3 = \text{Education}; x_4 = \text{Income}$$

Table 19: A regression analysis

<u>Variable</u>	<u>Beta starred (β^*)</u>	<u>t-value</u>	<u>Explained</u>
Gender	0.213	-13.177	The beta measure was 0.213 and indicated that investors (male or female) differed in the way they make their financial investment decisions. This showed that gender had a relatively close relationship with the financial risk tolerance scores of investors.
Age (year of birth)	0.203	13.007	The beta was 0.203. If the investors were born in a different year, it had an effect on how these investors made financial investment decisions. The year of birth obtained a beta of 0.203, which means that age is a reliable measure for financial risk tolerance.
Education level	0.138	8.548	The beta effect was only 0.138. This means that the education level of investors has a minimal effect on the financial risk tolerance scores of these investors. The education level of the investors obtained the lowest beta and the effect it had on the financial risk tolerance scores is the least significant as the other variables obtained higher betas.
Income level	0.243	14.573	The beta was 0.243. Income obtained, therefore, the highest beta with regard to the effect on financial risk tolerance when compared to the other three variables. Income level thus had the highest effect on the financial risk tolerance score of investors.

With regard to the beta starred (β^*) the following was found:

- The variable with the strongest beta was the income level of investors. The income level received a beta of 0.243 which indicates a strong relationship with the financial

risk tolerance scores of investors. It was found that the financial risk tolerance scores are, therefore, very closely related to the level of income of investors.

- The variable with the second strongest beta was gender.
- The variable with the third strongest beta was age (year of birth), and lastly the education level of investors.

The first four variables (D1-D4) were used as constant variables and the financial risk tolerance scores as the dependent variable. The adjusted R squared of the regression analysis was 0.225. The R squared represents the statistical measure of how close the data fit the regression line. 22.5% is, therefore, of medium effect and means that the variables of the identified variables and the financial risk tolerance scores seemed to share a moderate correlation (Wegner, 2007:435).

4.8 Relationship between the risk tolerance of Factor one and dependent variables

4.8.1 Supporting analysis: A correlation analysis between the FRTScore of Factor one and demographic variables

Analysis were further done on Factor one (the most significant factor). This analysis was done by finding correlations between the financial risk tolerance scores of Factor one with the Pearson and Spearman correlation coefficients. The outcomes were as follows:

A Pearson correlation coefficient is the measurement of the linear correlation between two variables (Wegner, 2007). For a Pearson correlation, the three top identified factor groups and the FRTScore were used.

A Spearman correlation coefficient determines the statistical correlation and strength between two variables (Wegner, 2007). A Spearman analysis was done to determine the relationship between each variable and the total of the financial risk tolerance.

Table 20: Pearson and Spearman correlation coefficients

	Pearson correlation coefficients FRTScore	Spearman correlation coefficients FRTScore
Gender (D1)	−0.14	−0.14
Baby Boomers	−0.12	−0.12
Generation X	0.09	0.09
Millennials	0.17	0.17
Education level (D3)	0.23	0.22
Income level (D4)	0.21	0.21
Marital status (D5)	0.03	0.02
Annual combined income (D6)	0.22	0.23
Number of dependents (D7)	0.05	0.04
Value of net assets (D8)	−0.03	0.05

The following was evident from the Pearson and Spearman correlation coefficients: D1 (Gender), D3 (Education level), D4 (Income levels) and D6 (Combined income levels) had the closest relation to the FRTScore. The rest of the questions had a really low relationship with the FRTScore.

4.8.2 Research question 25: The opinion of the investors regarding their FRTScore

RT25 was approached differently than the rest of the questions. Each of the investors awarded themselves a financial risk tolerance score based on their own perceptions. An analysis was done between each of the identified factors and the financial risk tolerance score given to each investor by FinaMetrica and the financial risk tolerance score each investor would have given themselves. Table 21 shows the relation between each factor and the FRTScore based on the score determined by RT1-RT24 and FinaMetrica, and the FRTScore that the investors gave themselves in RT25. The following is evident:

Table 21: A Pearson correlation between the three identified factors, FRTScore and RT25

	Pearson correlation coefficients	
	FRTScore	RT25
Factor one: Level of risk	0.76	0.50
Factor two: Past experience	0.48	0.25
Factor three: Personal attitudes and feelings	0.43	0.30

According to Table 21, there is a difference between the FRTScore that was determined for investors by FinaMetrica and the FRTScore given to investors by themselves. This finding could be an indication that the investors are not equipped to accurately estimate their own FRTScore. Since questions (RT1-24) of the questionnaire did not align with the risk tolerance score the investors gave themselves. Therefore, the FRTScore of Factor one, two and three is a more accurate measure of the financial risk tolerance scores of investors and when this score is based on the perception of the investors regarding their financial risk tolerance, it is inaccurate.

Table 22: A Spearman correlation between the three identified factors, FRTScore and RT25

Spearman correlation coefficients		
	FRTScore	RT25
Factor one: Level of risk	0.75	0.55
Factor two: Past experience	0.42	0.24
Factor three: Personal attitudes and feelings	0.37	0.30

The above statistics confirm the Pearson correlation coefficient conclusion. Factor one had the highest impact on the financial risk tolerance scores of the investors followed by Factor two and Factor three. These statistics confirmed that Factor one is the most significant factor to focus on when the financial risk tolerance of investors is determined. Factor two and three could then be used as support to Factor one.

4.8.3 Correlation analysis between independent variables

A correlation analysis was done between the eight identified independent variables to identify if any of the identified variables had an effect on another identified variable. If two variables were found to have had a high correlation it would have provided the necessary evidence to not test both the variables in a regression analysis as the same results would have been obtained. If correlated questions are used together, it can lead to co-linearity that makes further analysis of the data inaccurate (Wegner, 2007:418). Variables must maintain independent relations with other variables.

A correlation analysis was completed between the eight identified independent and control variables and resulted in the following:

Table 23: A Pearson correlation matrix of the relation between variables

	D1	D2	D3	D4	D5	D6	D7	D8
Gender (D1)	1	0.113	-0.075	-0.330	0.207	-0.142	-0.179	-0.228
Age (D2)	0.113	1	0.198	-0.008	0.229	0.132	0.022	-0.515
Education level (D3)	-0.075	0.198	1	0.290	0.011	0.313	0.067	0.057
Income level (D4)	-0.330	-0.008	0.290	1	-0.163	0.766	0.289	0.476
Marital status (D5)	0.207	0.229	0.011	-0.163	1	-0.268	-0.302	-0.302
Combined income (D6)	-0.142	0.132	0.313	0.766	-0.268	1	0.241	0.420
Number of dependents (D7)	-0.179	0.022	0.067	0.289	-0.302	0.241	1	0.186
Value of net assets (D8)	-0.228	-0.515	0.057	0.476	-0.302	0.420	0.186	1

From the statistics provided in Table 23, D2 (Age) and D8 (Net asset value) had a correlation of -0.515 while D4 (Income level) and D6 (Combined annual income) had the highest correlation with 0.766. The correlation between age and net asset value could be that as investors age, their assets will increase. The second correlation focused on income level and combined income level, this could be explained as income of individuals increases, the combined household income will also increase. This shows collinearity between the

independent variables. Collinearity can be a problem because independent variables should be independent of each other. If the degree of correlation between variables is high, it can cause a problem when you interpret results. In Table 23 it can be seen that collinearity does affect the independent variables and it is not advised to use the variables that correlate within the same analysis. Due to advice from the statistician it was advised to use all of the independent variables to ensure reliability of this study. Note that in this study dummy variables were also used to enable a single regression equation to represent multiple groups, meaning that separate equation models did not have to be formed for subgroups. For example, males and females are used in the same analysis where males are represented by “1” and females by “2”.

4.8.4 Multi-regression analysis

Although the analysis in Table 23 showed high correlations between D2 and D8, and D4 and D6, the researcher decided on the advice of the statistician, to test as many x variables as possible. Table 24 illustrates the results of the five models that had the highest adjusted R square values. Table 24 shows the various models and their adjusted R square values. The model with the highest adjusted R square value was selected as the best model that consists of the variables that had the highest effect on the FRTScore.

In a multiple regression, the FRTScore was compared with all the different variables to see what groups of variables had the highest relationship to the total risk tolerance score of Factor one (level of risk). It was determined that Factor one had a much larger effect on how financial risk tolerance is determined. *Factor two and three were, therefore, not focused on* due to this significant finding (Laerd Statistics, 2018). Each variable in a model differed from the next variable and only the most significant variables were included that had the highest effect on the FRTScore within that particular model. A multiple regression analysis was done with the FRTScore. Only the five highest adjusted R -square values were inserted in Table 24:

Table 24: A multiple regression analysis of Factor one (level of risk)

Model	Number of variables in model	Adjusted R-square	R-Square	Variables in model
1	8	0.1370	0.1398	Gender; Baby Boomers; Generation X; Millennials; Education level; Income level; Marital status and Combined income
2	9	0.1369	0.1400	Gender; Baby Boomers; Generation X; Millennials; Education level; Income level; Marital status; Combined income and Net asset value
3	9	0.1367	0.1398	Gender; Baby Boomers; Generation X; Millennials; Education level; Income level; Marital status; Combined income and Number of dependants
4	10	0.1366	0.1401	Gender; Baby Boomers; Generation X; Millennials; Education level; Income level; Marital status; Combined income; Number of dependants and Net asset value
5	7	0.1363	0.1388	Gender; Generation X; Millennials; Education level; Income level and Combined income

The adjusted *R*-squared value represented the degree to which the data fitted the regression line. When a further inspection was completed, evidence revealed that the adjusted *R*-square for all of the values were relatively close. The one with the highest adjusted *R*-square excluded the number of dependents (D7): How many individuals are in your family, besides yourself, do you fully or partially support them financially; and the value of net assets (D8): The value of the net assets of investors. In Model 1, the adjusted *R*-squared was 0.1370 and this means that 13.70% of the financial risk tolerance scores can be explained by the research variables.

A further analysis was done on Model 1 and the results are indicated in Table 25:

Table 25: Parameter estimates of Model 1

Variable	Parameter estimates				
	Parameter estimate	Standard error	t Value	Pr > t	Squared semi-partial Corr Type II
Gender (D1)	-0.22	0.04	-5.09	< 0.0001	0.009
Baby Boomers	0.35	0.07	4.92	< 0.0001	0.008

Variable	Parameter estimates				
	Parameter estimate	Standard error	t Value	Pr > t	Squared semi-partial Corr Type II
Generation X	0.58	0.08	7.51	< 0.0001	0.020
Millennials	0.76	0.08	9.99	< 0.0001	0.035
Education level (D3)	0.17	0.02	7.07	< 0.0001	0.017
Income level (D4)	0.06	0.02	2.24	0.0250	0.001
Marital status (D5)	0.11	0.06	1.72	0.0860	0.001
Combined income (D6)	0.07	0.02	2.51	0.0121	0.002

In Table 25, it is evident that the t test ($Pr > |t|$) had a value of less than 1% and indicated an overwhelming relationship. Gender (D1), Baby Boomers, Generation X, Millennials and education level (D3) obtained a p-value (t test value) of less than 1%. A p-value of less than 5% suggests a strong relationship and income level (D4) and combined income (D6) indicated, therefore, a strong relationship.

The most important value was the squared semi-partial correlation Type II. A squared semi-partial correlation is calculated between a residual value and a raw variable (Gujarati & Porter, 2010). A parameter estimate is a descriptive measure of an entire population and measures the change in the response associated with a one-unit change of the predictor. Standard error measures the accuracy of a predictor made with a regression line. A t-value finds a significant relationship between the population mean and a hypothesised value. Based on the squared semi-partial correlation, Millennials had the closest relationship to the FRTScore with Generation X second and education level (D3) third.

Millennials had a score of 3.5% and Generation X had a score of 2%. This can be an indication that this generation grew up in circumstances that could have assisted them in and prepared them for making sound financial investment decisions.

The highest education level (D3) an investor obtained and the score was 1.7%, and was, therefore, still an indicator of a financial risk tolerance score.

From Table 25, the following was to a lesser extent related to investors' risk tolerance scores:

- D1 (Gender) had a score of 0.9%.
- Baby Boomers had a score of 0.8%.
- D4 (Income level) had a score of 0.1%.
- D5 (Marital status) had a score of 0.1%.
- D6 (Combined income levels) had a score of 0.2%.

The squared semi-partial correlation indicated the proportion of the variance in y (financial risk tolerance) associated with one specific variable predictor but not any of the other predictors. The closer the squared semi-partial correlation is to 1, the higher the impact of the predictor variable on the financial risk tolerance score.

In Table 25, age was not tested, but rather the different generations that the investors were born in due to age being tested in previous analysis. The hypotheses were tested against the p-values in Table 25 and the following conclusions were made:

- Gender (D1): The p-value was < 0.0001 and below 1%. Overwhelming evidence was, therefore, found to reject the null hypothesis: H_0 (1). This implies that there is a statistical significant relationship between gender and risk tolerance. The negative correlation indicates that the risk tolerance of women is lower than men.
- Generation: The p-value was < 0.0001 and below 1%. Overwhelming evidence was, therefore, found to reject the null hypothesis: H_0 (3). This implies that there is a statistical significant relationship between each gender (Baby Boomers, Generation X and Millennials) and risk tolerance. The different generations investors are born in will impact their financial risk tolerance level.
- Education level (D3): The p-value was < 0.0001 and below 1%. Overwhelming evidence was, therefore, found to reject the null hypothesis: H_0 (4). This implies that there is a statistical significant relationship between education level and risk tolerance. The higher the level of education of an investor, the higher the financial risk tolerance level that they are willing to accept.
- Income level (D4): The p-value was < 0.0001 and below 1%. Overwhelming evidence was, therefore, found to reject the null hypothesis: H_0 (5). This implies that there is a statistical significant relationship between income level and risk tolerance. The higher the income level of an investor, the higher the financial risk tolerance level that they are willing to accept.

4.9 Reliability

Reliability (Pietersen & Maree, 2016:238) in quantitative research broadly encompasses the following three aspects: consistency over time, accurate representation of the population and repeatability of the same methodology. The following was, therefore, of utmost importance:

- Consistency over time: The data from the FinaMetrica database were considered reliable, because the information was obtained directly from FinaMetrica. The information stored in this database is historical and does not change.
- Representation of the population: Based on the limitations of this research study, the above research is only applicable to South African investors who are earning a salary and making investments with access to the Internet and the entire diversity of the South African population is not being represented in this research study.
- Repeatability yields the same results: Various statistical analyses were done; and all of the analyses generated the same results. If a similar research study was done and the same information was used; the same results would be obtained.
- An analysis of the FinaMetrica questionnaire has shown a Cronbach's Alpha score of 0.899, implying a high internal reliability of the questionnaire as instrument to calculate a FRTScore.

4.10 Validity

Validity is considered as an indication of how thoroughly research was conducted. In terms of validity, the analyses set out to determine the relationship between the selected demographic variables and financial risk tolerance by making use of SPSS statistical tools. During the data analysis process, the data were double-checked.

It can, therefore, be safely concluded that the measurement tools, methods of analyses and the results obtained were fairly represented.

4.11 Summary

To summarise the chapter, the following can be seen:

- The expected utility had been found to dominate the analyses with regard to decision-making and it would greatly assist investors and financial advisors if they know why investors make certain financial decisions. This can be seen from testing the hypothesis in the above analysis as the identified supporting variables do assist in predicting an investors financial risk tolerance score.
- Descriptive statistics assisted the researcher in understanding the data and the representation of data in the FinaMetrica database (Table 6 and 4.2).
- A corrected item-correlation assisted the researcher in identifying which of the questionnaire questions had the highest correlation to the rest of the questions and found that RT16, RT10 and RT1 had the highest correlation to the other questions (Table 12, section 4.3).
- The above-mentioned correlation also assisted the researcher in determining which of the questions had no correlation with any of the other research questions and were not deemed relevant to focus on for research purposes. RT23 (Fixed or fluctuating interest rate) and RT24 (Personal financial risk tolerance estimate) were identified (Table 12, section 4.3).
- ANOVA found a moderate correlation between investors' **total** financial risk tolerance score and their demographics (Section 4.4).
- An exploratory factor analysis grouped the questions of the questionnaire into three factors (groups) that had the highest impact on the financial risk tolerances of investors (Table 13 and Table 14, section 4.5).
- The factor or group that had the most significant effect on how the financial risk tolerance of investors was determined, was further investigated by means of communality estimates. The questions with the highest influence were identified as RT16 (Investment mix that is the most appealing) and RT7 (Feelings about financial decisions afterwards) - (Table 15, section 4.5).
- A correlation analysis was done between all three of the identified financial risk tolerance factors and the variables presenting the five variables (Table 16-18, section 4.6). This analysis aimed to test associations as indicated in the hypotheses (results was further explained in Table 26).
- A regression analysis was done to strengthen the findings and to provide more insight into what the data represented (Table 19, section 4.7).

- Pearson and Spearman correlations investigated the variables that had the highest and lowest relationship to the financial risk tolerance scores (Table 20, section 4.8.1).
- The FRTScore given to investors by FinaMetrica was compared to the FRTScore given to investors by themselves, and this indicated that investors are very inaccurate when they have to predict their own financial risk tolerance score (Table 21 and Table 22, section 4.8.2).
- A correlation analysis between independent variables confirmed that collinearity will have an effect on this study as independent variables are correlated to each other, due to advice of the statistician the correlating variables were still used in further analysis (Table 23, section 4.8.3).
- A multiple regression analysis determined which group of variables had the highest effect on the financial risk tolerance scores (Table 25, section 4.8.4). The identified variables in the most significant group was then focused on to determine their effect on financial risk tolerance (results were further explained in Table 26).

Chapter five

Conclusion and recommendations

5.1 Introduction

In this chapter, the reasons for undertaking the research, a summary of the findings, hypotheses testing, conclusions, limitations and recommendations of this research are discussed. This chapter states the reasons for undertaking the study and summarises and concludes the findings. The contributions and limitations of this research study are included. Lastly, recommendations for further research and the final remarks are provided. It assisted in reaching secondary objective five as conclusions and recommendations was drawn in this chapter, it also assisted in reaching the main objective with determining the association between the selected demographic variables on investors' expected utility values and risk tolerance.

The research study consists of five chapters starting with Chapter one providing the introduction and background. Chapter two focuses on the literature review. Chapter three highlights the research methodology. Chapter four provides the data analyses and interprets the data. Chapter five concludes with the findings, recommendations and conclusions.

Validity and reliability were of the utmost importance to be able to present final conclusions. The data were obtained from a valid database and were tested and checked throughout the research. Validity and reliability were strengthened by a Cronbach's Alpha of 0.899 that supported the research study and ensured that the data were reliable. The research was done objectively and without bias while accuracy was applied throughout the study to ensure that the data were analysed consistently.

5.2 Reason for undertaking the research study

The main reason for undertaking this study was to contribute to the literature on estimating the financial risk tolerance of South African investors and the possible variables that supports the study. FinaMetrica's database was sourced, and it was interesting to see how investors

estimated their own financial risk tolerance and how this estimation differed from the scores calculated by FinaMetrica.

The literature review focuses on the five selected variables that supported the main objective and the aim was to determine whether one, none or more than one of the variables had a significant effect on the financial risk tolerance of investors. The findings of this research study will assist investors, brokers and financial advisors when investment options must be selected to ensure correct decisions with regard to risk appetite and investment decisions are made based on demographics. The study determined whether the expected utility of investors can be connected to their demographics and whether identified demographics can help predict their expected utility value.

5.3 Summary of the findings and discussions

5.3.1 Summary of literature

In Chapter one, the research approach was identified. The research objectives and hypotheses were set to guide the researcher. The methodology of the study was briefly introduced and a layout of the further chapters was provided.

In Chapter two, the literature supporting the five identified variables were conceptualized (first secondary objective) to determine the impact of previous research on the identified research topics and the conclusion drawn in the past. Past conclusions found the five identified variables to have an effect on how financial decisions are made. Literature was then used to guide this study in a South African context, as the variables were found to have an effect on the investment decisions made by investors.

In Chapter three, the research methodology was evaluated to reach the second secondary objective. The research onion assisted in identifying methods to analyse the FinaMetrica data. Quantitative research and deductive reasoning was the appropriate methodological research process for the study. Since, the study followed a survey research design method.

5.3.2 Summary of empirical results

Chapter four's aim was to reach the third and fourth secondary objectives, to analyse risk tolerance and the five demographic variables and to analyse the association between the former and the latter, respectively. Various statistical methods were applied, including descriptive statistics, corrected item-total correlation, analysis of variance, exploratory factor analysis, correlation and regression analysis.

In Chapter four, where the results of the statistical analyses and hypothesis testing were discussed, there was found that the distribution of gender, age, education level and income level was done to assist the reader in understanding what the data consisted of. Descriptive analysis was done so that the reader can understand the data represented in the FinaMetrica database.

A corrected-item correlation analysis was done to determine which of the FinaMetrica questions were related to each other to determine if a question had an influence on the FRTScore. It was found that RT16 (most appealing types of investments) and RT 10 (degree of risk) had the highest correlation to the other questions. The above-mentioned correlation also assisted the researcher in determining which of the questions had no correlation with any of the other research questions and were not deemed relevant to focus on for research purposes. RT23 (Fixed or fluctuating interest rate) and RT24 (Personal financial risk tolerance estimate) were identified.

ANOVA analysis found that there is a moderate correlation between investors demographic variables and financial risk tolerance scores. This guided the researcher into further analysis to determine which if the identified variables had an effect on financial risk tolerance.

An exploratory factor analysis determined which three groups of questions had the highest effect on the financial risk tolerance scores of investors. These three identified factors were then analysed to evaluate the research hypotheses to be able to draw conclusions. Factor one (level of risk) consisting of 10 questions had the highest effect on how financial investment decisions are made. It can thus be concluded that if these 10 questions are analysed it could assist in more accurately predicting the level of financial risk investors are willing to tolerate.

A communality estimate assisted in determining the questions with the highest correlation with the FRTScore of investors and found that RT16 (most appealing types of investments) and RT7 (investors feelings after financial decisions) had the highest correlation. A regression analysis with beta starred was done and concluded that the income level had the highest beta.

A correlation analysis was done between the FRTScore awarded to the investors by FinaMetrica and the FRTScore the investors awarded to themselves in the questionnaire. This analysis was necessary to determine whether investors make accurate assumptions with regard to their FRTScore. Alarmingly it was found that investors gave themselves a very different score than the one given to them by FinaMetrica.

Further, a correlation matrix was done to determine if the variables correlated with each other and if the variables were effective in determining the relation between financial risk tolerance and demographic variables. This was done to confirm that independent variables do have a correlation to each other. It found that income level (D4) and combined income level (D6) could be associated as well as age (D2) and value of net assets (D8). Due to advice from a statistician it was decided to include all of the independent variables (D1-D8) to ensure reliability of this study.

A regression analysis was done and found that the variable with the strongest beta was the income level of investors. The income level received a beta of 0.243 which indicates a strong relationship with the financial risk tolerance scores of investors.

A Pearson and Spearman correlation was done and found that D1 (Gender), D3 (Education level), D4 (Income levels) and D6 (Combined income levels) had the closest relation to the FRTScore.

The correlation between the FRTScore determined by FinaMetrica and the FRTScore investors could have given themselves in RT25 was investigated and found that investors was inaccurate in estimating their own FRTScore.

A correlation analysis was done between independent variables and confirmed that collinearity will not affect this study as independent variables were not related.

A multiple regression analysis was done to determine which variables had the highest effect when the financial risk tolerance score of investors. These identified variables were then used to do a parameter estimate, to determine which of the individual variables had a significant effect on the financial risk tolerance scores of investors.

5.4 Discussion of hypotheses tested

The main objective of this research report was to analyse the association between selected demographic variables and the expected utility values and risk tolerance of investors. Therefore, hypotheses were identified and tested in Chapter four. In the first three rows of Table 26, the financial risk tolerance score of each of the investors was tested with each factor. Age was tested rather than generation, as generation was only tested in the multiple regression analysis in row four. With rows one to three the correlation was tested between the three factors and the four variables. In row four, the correlation was tested between the financial risk tolerance scores of the investors and the selected independent variables. The hypotheses were then tested and a summary of the findings is provided in Table 26:

Table 26: Summary of the findings and hypotheses

	Gender	Age	Generation	Education	Income
Factor one (Level of risk):	H_0 (1) was rejected and H_1 (1) was accepted.	H_0 (2) was rejected and H_1 (2) was accepted.	Not tested.	H_0 (4) was rejected and H_1 (4) was accepted.	H_0 (5) was rejected and H_1 (5) was accepted.
Factor two (Past experiences):	H_0 (1) was rejected and H_1 (1) was accepted.	H_0 (2) was not rejected.	Not tested.	H_0 (4) was rejected and H_1 (4) was accepted.	H_0 (5) was rejected and H_1 (5) was accepted.

Factor three (Personal attitudes and feelings):	H_0 (1) was rejected and H_1 (1) was accepted.	H_0 (2) was not rejected.	Not tested.	H_0 (4) was rejected and H_1 (4) was accepted.	H_0 (5) was rejected and H_1 (5) was accepted.
Multiple regression analysis	H_0 (1) was rejected and H_1 (1) was accepted.	Not tested.	H_0 (3) was rejected and H_1 (3) was accepted.	H_0 (4) was rejected and H_1 (4) was accepted.	H_0 (5) was rejected and H_1 (5) was accepted.

It is clear from the above-mentioned findings and from the literature review that the identified variables have an effect on the financial risk tolerance scores of investors and how they make their financial decisions.

After all of the analyses have been completed, the demographic variables were identified that had an effect on the financial decisions of investors. The significance between some of the demographic variables was found to be high and it was concluded that demographic variables influence investors when they make investment decisions.

5.5 Conclusions

The practical value of this research was to determine whether previously identified variables affect how investors make financial decisions. This information can assist investors and financial advisors to determine the factors to focus on when investors have an expected utility and how this utility can be reached. It would be easier to reach an expected utility if investors know what factors affect them when they make investment decisions, for example, a female knows that her gender influences her to make lower risk investments. Knowledge of this phenomenon can encourage her to accommodate higher investment risks.

Knowledge about demographic variables can assist women to decrease poverty in their old age or investors suffering huge financial losses due to the way demographic variables affect

their investment decisions. If a variable can affect the way in which financial decisions are made, investors and financial advisors would be able to make better financial investment decisions that would benefit investors. These decisions will then be more aligned with their expected returns and risk appetite.

It was found in literature that women are significantly more risk averse than men. Grable (2013) said that women have a lower risk willingness than men. This study concludes that gender plays a significant role when the financial risk tolerance scores of investors are determined. Due to a negative correlation existing between genders, it was found that men invest in riskier investments than women, and that women are more risk averse.

Age was found in previous research to have an effect on the way investors make their investment decisions. Yoa *et al.* (2011) found that risk tolerance generally decreases with a person's age. It can, therefore, be concluded that within Factor one (level of risk), age was found to be significant when the financial risk tolerance scores of investors are determined. Factor one found that as investors age, the level of risk they are willing to tolerate also increased. Factor two and three did not reject the null hypothesis, as age did not have an effect on the financial risk tolerance of investors.

Generation was tested with a multiple regression analysis and parameter estimate and these two analyses confirmed the literature. Yoa *et al.* (2011) said that generations play a pivotal role in risk tolerance decisions. This study found that there is a significant relationship between generation and the financial risk tolerance scores of investors. Thus confirming that the different generations that investors are born into and the different experiences that generation lives through will affect the amount of financial risk they are willing to tolerate.

The level of education was expected to have an effect, based on research done in the past. Grable (2009) presumed that education is positively associated with risk tolerance. This was found to be accurate and it can, therefore, be concluded that financial risk tolerance has a significant relationship with the education level of investors. The relationship between education level and financial risk indicates that the higher the level of education an investor has, the higher the financial risk tolerance level they are willing to accept.

The level of income investors earn was found to have an effect on the level of risk that investors are willing to accept. Kannadhasen (2015) stated that investors with a higher annual income tend to be more risk tolerant. Based on the analysis done, it can be confirmed that the income level of investors has a significant relationship with the financial risk tolerance scores of investors. As income levels of investors increase, their financial risk tolerance level will also increase.

It can, therefore, be concluded that the demographic variables found to be significant in previous research are also significant in a South African context. “The expected utility theory chooses between risky and uncertain prospects by comparing their expected utility values” (Davis *et al.*, 1997). *The expected utility theory is strengthened* when investors demographic variables are identified and will support and help predict the value investors receive from their investments, these variables are in line with the risk appetite of investors and their expected return.

5.6 Limitations

The following limitations were found and assumptions were made during this research study:

- No psychological biases were present when the population completed the FinaMetrica questionnaire.
- Not all South African's have access to computers to complete the FinaMetrica survey. The research study included a limited audience from South Africa who have access to technology.
- All investors made rational decisions and accurately completed the questionnaire.
- The population of respondents used from the FinaMetrica database answered all of the questions truthfully.
- The data was a meaningful representation of the population as the entire population was used.
- The population was limited to 3473 responses from South African participants, gathered from a secondary data analysis. It is important to note that the conclusions made in this study cannot be generalised to the broad public, as only wealthy South African individuals completed FinaMetrica's questionnaire.

- The population was amended when investors above the age of 65 was excluded from this study as they will not be working and earning a salary anymore.
- Not every level of education has been taken into consideration in determining the financial risk tolerance scores of investors. According to the South African Qualification Authority (2012), there are currently ten NQF levels of education that investors can obtain and not only the four levels that were taken into consideration.
- The data in this research were limited to 3473 respondents and these investors consisted primarily of investors who have Internet access and have access to financial information. These guidelines can be used as indicators for future research when a larger population with a greater level of diversification of the South African population is used for research.
- The income values of the respondents did not change, as inflation did not have an effect on the monetary values in the database.

5.7 Recommendations

Various findings exist in previous research concerning the identified variables and their effects on the financial risk tolerance of investors in specific countries. A possible solution is a tailor-made questionnaire, according to specific demographic variables applicable in a South African setting to identify the risk appetite of South African investors.

This study found that gender has a significant effect on financial risk tolerance. It is, therefore, recommended that gender should be tested for diversity in a South African population to determine whether gender will continue to have a significant effect on financial risk tolerance.

Age was found to be significant for Factor one of this study only. It is, therefore, recommended that age should be analysed for diversity in a South African population by acquiring the risk choices employed investors make. This information should then be used to determine whether there is a significant relationship between the risk choices of investors and their age.

Generation was found to have a significant effect on financial risk tolerance. Research should be done again where the data of more Millennials are gathered. More Millennials will now be

working and earning a salary and making investment decisions and can have an effect on the results gathered as the population changes every year.

Education was found to have an effect on financial risk tolerance. However, further research must focus on diversity in a South African context. Only investors with access to technology in South Africa were used in this study. It is, therefore, recommended that data from a more diverse population should be used to focus the impact of the education level on financial risk tolerance.

Income level was found to have an effect on the financial risk tolerance scores of investors. The same limitation applies here as mentioned in the previous paragraph; only South African investors who have access to technology were used for this research study. It is, therefore, recommended that the level of income is tested again when a broader representation of the South African population is used.

Future studies can focus on the diverse population of South Africa and not just investors who have access to financial advisors and the Internet. The demographic variables and identified variables must focus more on the diversity in South Africa, such as investors from different income levels, education levels, races, and different cultures. Data must be gathered more broadly and not just from a certain group in South Africa. The diversity of the South African population must be taken into consideration and a study must not only focus on all investors of this country.

5.8 Final remarks

Some of the identified demographic variables were found to have a significant effect on the way investors make financial investment decisions in a South African context. If financial advisors and investors are aware of the factors influencing investment decisions, they would be able to make more informed financial investment decisions. Gender, education, income and generations was found to have an effect on financial investment decisions. Age was found to have an effect when analysis was done with Factor one, further analysis done with age concluded that age did not have a significant relationship with financial risk tolerance.

The expected utility theory can assist and predict what the needs of investors are with regard to investments and their risk appetite and demographic variables must be taken into consideration.

The objectives of this research was, therefore, reached as South African investors and brokers can now make more accurate investment decisions when they take into consideration the way in which investors make investment decisions. The decisions of investors can perhaps change when they know which demographic variable affects them.

It was both interesting and alarming when it was established that investors predict their own FRTScore inaccurately, as the financial risk tolerance scores determined by FinaMetrica do not align with the perceptions of the investors.

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Appendix A

A summary of the questions in the FinaMetrica database:

1. You have to rate your willingness to take financial risk.
2. You have to state how easily you adapt when things go wrong financially.
3. When you think of the word “risk” in a financial context, which of the words comes to mind first: Danger; Uncertainty; Opportunity of Thrill.
4. Have you ever invested a large sum in a risky investment mainly for the “thrill” of seeing whether it went up or down in value?
5. If you had to choose between more job security with a small pay increase and less job security with a big pay increase, which would you pick?
6. When faced with a major financial decision, are you more concerned about possible losses or possible gains?
7. How do you feel about financial decisions after making them?
8. If you were in a job where you could choose to be paid a salary, commission or a mix of both. What would you pick?
9. What degree of risk would you have taken with your financial decisions in the past?
10. What degree of risk are you currently prepared to take with your financial decision?

11. Have you ever borrowed money to make an investment (other than for a home)?

12. How much confidence do you have in your abilities to make good financial decisions?

13. Suppose that 5 years ago you bought stock in a highly regarded company. The same year the company experienced a severe decline in sales due to poor management. The price of the stock dropped drastically and you sold at a substantial loss.

The company has been restricted under new management, and most experts now expect it to produce better than average returns. Given your bad past experience with the company, would you buy stock now?

14. Investments can go up and down in value, and experts often say you should be prepared to weather the downturn. By how much could the total value of all your investments go down before you would begin to feel uncomfortable?

15. Assume that a long-lost relative dies and you inherit a house which is in a poor condition but is located in a suburb that is becoming popular.

As is, the house would probably sell for R3 000 000, but if you were to spend about R1 000 000 in renovations, the selling price would be around R6 000 000. However, there is some talk of construction a major highway next to the house, and this would lower its value considerably. What would you do?

16. Most investment portfolios have a mix of investments - some of the investments may have high expected returns but with high risk, some may have medium expected returns and medium risk, and some may have low risk/ low return. (For example, stocks and real estate would be high-risk/ high-return whereas cash and CDs (certificates of deposit) would be low-risk/ low-return.)

Which mix of investments do you find most appealing? Would you prefer all low-risk/ low-return, all high-risk/ high-return, or somewhere in between?

17. You are considering placing one-quarter of your investment funds into a single investment. This investment is expected to earn about twice the CD (certificate of deposit) rate. However, unlike CD, this investment is not protected against loss of the money invested.

How low would the chance of a loss have to be for you to make the investment?

18. With some types of investment, such as cash and CDs (certificate of deposit), the value of the investment is fixed. However, inflation will cause the purchasing power of this value to decrease.

With other types of investments, such as stocks and real estate, the value is not fixed. It will vary. In the short term it may even fall below the purchase price. However, over the long term, the value of the stocks and real estate would certainly increase by more than the rate of inflation.

With this in mind, which is more important to you - that the value of your investment does not fall or that it retains its purchasing power?

19. In recent years, how have your personal investments changed?

20. When making investments, risk and return usually go hand-in-hand. Investments which produce above average returns are usually above average risk. With this in mind, how much of the funds you have available to invest would you be willing to place in investments where both return and risk are expected to be above average?

21. Think of the average rate of return you would expect to earn on an investment portfolio over the next ten years. How does this compare with what you think you would earn if you invested the money in one-year CDs (certificates of deposit)?

22. People often arrange their financial affairs to qualify for a government benefit or obtain a tax advantage. However, a change in legislation can leave them worse off than if they had done nothing.

With this in mind, would you take a risk in arranging your affairs to qualify for a government benefit or obtain a tax advantage?

23. Imagine that you are borrowing a large sum of money at some time in the future. It is not clear which way interest rates are going to move - they might go up, they might go down, no one seems to know.

You could take a variable interest rate that will rise and fall as the market rate changes. Or you could take a fixed interest rate which is 1% more than the current variable rate but which will not change as the market rate changes. Or you could take a mix of both.

How would you prefer your loan to be made up?

24. Insurance can cover a wide variety of life's major risks - theft, accident, illness, death etc. How much coverage do you have?

25. This questionnaire is scored on a scale of 0 to 100. When the scores are graphed they will follow the familiar bell-curve of the normal distribution. The average score is 50. Two-thirds of all scores are within 10 points of the average. Only 1 in 1000 is less than 20 or more than 80.

What do you think your score will be?