The impact of financial literacy on risk and time preferences and financial behavioural intentions

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Submitted in fulfilment of the requirements in respect of the Doctoral degree qualification Doctor Philosophiae (PhD) Economics in the Department of Economics and Finance in the Faculty of Economic and Management Sciences at the University of the Free State.

Submitted:

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Dedication

To my Wife, Children, Siblings, Mother, Grandmother and Father.

DECLARATION

I, Calvin Mudzingiri, declare the following:

I. The Doctoral Degree research thesis that I herewith submit for the Doctoral Degree qualification Philosophiae Doctor (PhD) Economics at the University of the Free State is my independent work, and I have not previously submitted it for a qualification at another institution of higher education,

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ABSTRACT

Financial literacy plays a pivotal role in influencing financial behaviour, risk preferences as well as time preferences which in turn impact on financial life outcomes of individuals such as saving and investment. There is documented evidence on variation in financial life outcomes of people with high financial literacy when compared to individuals with low levels of financial literacy. Financial literacy is also weakly associated with individual cognitive ability, which makes it important to examine its relationship with financial behaviour, risk preferences, time preferences and individual characteristics. This study explores the impact of financial literacy on risk preferences, time preferences and financial behaviour of university students. It seeks to examine whether there are differences in financial behaviour, confidence level, risk preferences and time preferences of university students with high financial literacy when compared to those students with low financial literacy. It also investigates the determinants of financial behaviour of university students. The data used in the study was gathered from university students enrolled in undergraduate bachelor of commerce degrees at University of the Free State in South Africa. Data was collected by way of a questionnaire, multiple price list time preferences and risk preferences experimental tasks, financial literacy test as well as a binary choice time preference task. All students that scored a financial literacy test mark above average were categorised as high financial literacy group while those who score a financial literacy test mark below average were classified as low financial literacy group. The study examined descriptive statistics, used t-test and regression models in the analysis of data. Our analysis was split along financial literacy and gender. *First,* the study found out that financial literacy is associated with risk preferences and time preference choices of university students with low levels of financial literacy. The research also concluded that indecisiveness or indifference shown by multiple switching on risk preferences and time preference choice options increases as financial literacy decreases. The paper also found low levels of financial literacy among university students. *Second*, the study found out that financial behaviour, confidence, risk preferences and time preferences significantly differ between university students with low financial literacy when compared to students with high financial literacy. Low financial literacy level university students were found to be more risk loving, overconfident and more impatient compared to university students with high financial literacy. The research also concluded that confidence, risk preferences and financial literacy perceptions are significantly related to financial behaviour of categorised university students. *Third*, the study findings show that financial literacy is associated with a patient behaviour, that is, a low discount rate in university students. Highest level of education in a household was also found to be significantly related to time preferences of university students, showing a positive externality of education. *Finally*, the research concluded a reverse causality between financial literacy and time preferences. The study results show that financial literacy education benefits more university students with low levels of financial literacy than university students with high financial literacy. Providing financial literacy reduces mistakes in making risk preference and time preference choices by university students. Availing financial literacy can provide the right dose of confidence, risk aversion and patience in university students.

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CHAPTER 1: GENERAL INTRODUCTION

1.1 Background

The demand for financial literacy is global, national, organizational and individual (Schwella & van Nieuwenhuyzen, 2014). At global level financial literacy is a means for robust debate meant to make the world a better place. At national scale financial literacy helps in ensuring the functioning of markets as it increases the availability of information. At the organizational level, financial literacy can increase productivity and reduce corruption (Kim, Sorhaindo & Garman, 2006; Schwella & van Nieuwenhuyzen, 2014). At the household level, individual financial literacy can play a pivotal role in enhancing welfare. Exposure to financial literacy is known to impact on individual behaviour positively and evidence reveal that financial literates plan better for their future and retirement (Lusardi & Mitchell, 2005). Financial literacy, therefore, generates a positive externality to the global society. What is not clear is how individuals formulate financial decisions given their financial knowledge and how this correlates with their risk preferences and time preferences as well as their financial behaviour.

This study investigated the impact of financial literacy on financial behaviour, risk preference, confidence, financial literacy perceptions, decision-making status and time preferences of university students enrolled in the financial literacy module known as personal finance. Students at universities as current and future economic participants need to be exposed to financial literacy in order to be able to make beneficial financial decisions during and after their university life. A comparison of students' risk preferences, time preferences, confidence and financial behaviour taking cognisance of their financial literacy form the basis of financial literacy impact analysis. Programs offered at university have the potential to change the behaviour of students, including changes to their preferences (Hodgson, 1988). Financial literacy's effectiveness in improving welfare and financial behaviour depends on control of resources such as income, wealth and assets (Huston, 2010). University students are economic agents that may not control a lot of resources, which may warrant measuring some of their financial behaviours through their financial behavioural intentions. It is important to understand how decisions are formulated given an individual's financial knowledge and its influence on one's utility discount rate as well as risk parameter which may be vital in explaining variation in choices made by people with different informational backgrounds.

Studying risk preferences, time preferences, financial knowledge, financial behaviour and confidence of university students pursuing a financial literacy course using experiments can be an important way to understand how individuals formulate decisions on financial planning, borrowing, insurance, retirement, investment and savings. Decisions that involve investment and saving are driven by intertemporal choices which are characterized by risk preferences, time preferences and financial knowledge that shape individual financial behaviour (Laborde, Mottner & Whalley, 2013; Luksander et al., 2014; Németh, 2014).

Evidence on the effect of financial literacy training programs on citizens suggests that the impact is positive and well pronounced on poor as well as people who lack financial literacy (Lusardi & Mitchell, 2011; Meier & Sprenger, 2013). Indications also suggest that financial education received during early childhood stage is helpful in the later stages of life (Smith &

Barboza, 2014). The positive impact of financial literacy on financially literate individuals suggests that they formulate choices differently from those that are less financially literate. Financial literacy is believed to be low amongst young adults, it increases as one joins the job market and decreases as one reaches retirement (Jappelli & Padula, 2013; Lusardi et al., 2015).

Existing studies point towards the fact that financial literacy is lacking amongst even the educated citizens and university students are not an exception (Braunstein & Welch, 2002; Bernanke, 2006; Van Rooij, Lusardi & Alessie, 2011). Studies reported low levels of financial literacy in South Africa, even among university students (Roberts et al., 2012; Shambare & Rugimbana, 2012; Struwig, Roberts & Gordon, 2012; Roberts, Struwig & Gordon, 2014). Further, financial illiteracy is also rampant across, gender, tribes, region, race, demographic level, and other social strata (National Consumer Financial Education Strategy, 2013) (Roberts, Struwig and Gordon, 2016). A couple of organisations have carried out financial literacy surveys in South Africa namely Fintrust and Human Science Research Council (HSRC) and findings also show low levels of financial literacy even among students (Roberts, Struwig & Gordon, 2014)

On a broad spectrum, efforts are being made across the world to ensure more and more people acquire financial literacy through the provision of financial education. In South Africa, like the world over, financial education is offered in universities, schools, workplace, in the media, road shows and a range of financial institutions. The National Treasury is in the process of championing financial literacy, the mission being to increase the financial capability and financial well-being of all South Africans (National Consumer Financial Education Strategy, 2013) (Roberts, Struwig & Gordon, 2016). Some of the prominent challenges facing South African citizens are high levels of debt by consumers, low rates of saving, predatory lending, increase in fraudulent schemes such as money pyramids and 'Ponzi' schemes, information asymmetry on pricing of goods and services, high product service, high default penalty fees and limited knowledge of how to be reimbursed for unfair deals (Roberts, Struwig & Gordon, 2014). All these ills can affect students in universities, hence the need to understand the impact of financial literacy on financial behaviour, time preferences and risk preferences.

1.2 Problem Statement

Existing studies provide evidence of financial illiteracy at varying levels amongst citizens across the world (Chen & Volpe, 1998; Braunstein & Welch, 2002; Lusardi & Mitchell, 2011; Shambare & Rugimbana, 2012; Roberts, Struwig & Gordon, 2014). There is also evidence that suggests that financial literacy improves the welfare of citizens (Schagen & Lines, 1996; Lusardi & Mitchell, 2005; Mandell, 2008). What is not clear is whether there are differences in utility discount rates and risk parameters of the people with high financial literacy compared to people with less financial literacy. Little has been explored with regards to the understanding of the confidence of individuals with high financial literacy compared to people with low financial literacy in the South African context. Further, the impact of financial literacy on financial behaviour needs to be explored. Existing studies on financial literacy that looked at students in South Africa tend to focus on whether students have financial literacy without looking at how financial literacy is related to financial behaviour, confidence, risk preferences and time preferences (Shambare & Rugimbana, 2012; Schwella & van Nieuwenhuyzen, 2014).

Many individuals are not conversant with even the most elementary economic ideas required to make reasonable saving and investment choices that are important for present and future wellbeing. The broad implication of financial illiteracy is reduced welfare of a country's citizens, university students included. Financial literacy plays a pivotal role in influencing intertemporal choices that critically inform financial behaviour. Intertemporal choices encompass trade-offs, benefits and costs happening at different times in an individual's life cycle in a world where risk is prevalent. There is a need to have a deeper understanding on how financially literate individual decisions differ from decision formulation of individuals who lack financial literacy as a way to understand financial behaviour. Such decisions affect one's wealth, health as well as satisfaction and as Adam Smith first acknowledged, define the economic success of countries (Frederick, Loewenstein & O'donoghue, 2002). University students' financial behaviour can be measured by their intended financial behaviour. Given this background, it is important to understand and examine whether financial literacy impacts risk preferences, time preferences, financial behaviour and confidence of university students.

1.3 Rationale

The growing number of financial challenges and poor financial judgments requires deeper understanding on how financial literacy influences risk preferences, time preferences and risk tolerance of students from varied informational backgrounds (Laborde, Mottner & Whalley, 2013; Luksander et al., 2014; Németh, 2014). Existing studies agree that financial literacy is crucial with regards to improving the welfare of citizens. What possibly requires exploration is the variation in financial behaviour between those who acquired financial literacy compared to those who have less literacy. Possibly this could be the reason why financial literate individuals make less financial decision errors in a given space of time (Lusardi & Mitchell, 2007). Financial literacy's effectiveness in improving welfare depends on control of resources and access to essential financial information critical to making beneficial decisions (Huston, 2010). Students are present-day and future economic participants have the potential to control resources in the present period and in future. Therefore, there is a need to understand the influence of financial literacy on preferences and financial behaviour.

1.4 Aim

The thesis aims to investigate the impact of financial literacy on risk preferences, time preferences, and financial behaviour for university students.

1.4.1 Objectives

The study aims to achieve the following main objectives:

Paper 1:   i) To explore the impact of financial literacy on risk preferences and time preferences choices of university students.
ii) To examine the impact of financial literacy on decision-making.

Paper 2:   i) To explore whether financial behaviour, confidence levels, risk preferences, time preferences, financial literacy perception and decision-making status of university students differ by financial literacy level

ii) To investigate the impact of confidence, risk preferences, time preferences, financial literacy perceptions and decision-making status on the financial behaviour of university students.

Paper 3: i) To examine the impact of financial literacy, the highest level of education in a household and gender differences on time preferences of university students.

Paper 4: i) To investigate the impact of financial literacy on time preferences choices of university students.
ii) To examine whether there is reverse causality between time preferences and financial literacy.

1.5 The conceptual and theoretical framework

There is research evidence that shows that financial literacy influence intertemporal choices. Financially literate individuals make a low number of financial errors and are usually in better financial conditions than those who have less financial literacy (Lusardi & Mitchell, 2005; Bernanke, 2006; Meier & Sprenger, 2013). Individuals and households make risky financial decisions on a day to day basis that impact on their present and future welfare. The desire to take a particular inter-temporal choice by an individual is determined by one's risk appetite as well as one's utility discount rate. The ultimate goal for financial literacy is to achieve financial wellbeing through influencing financial behaviour. Evidence of the impact of personal financial literacy on wellbeing is clearly highlighted in the conceptual framework below (Huston, 2010). The theory of planned behaviour by Ajzen (2011) is nested in the financial literacy, knowledge, education, behaviour and wellbeing framework.
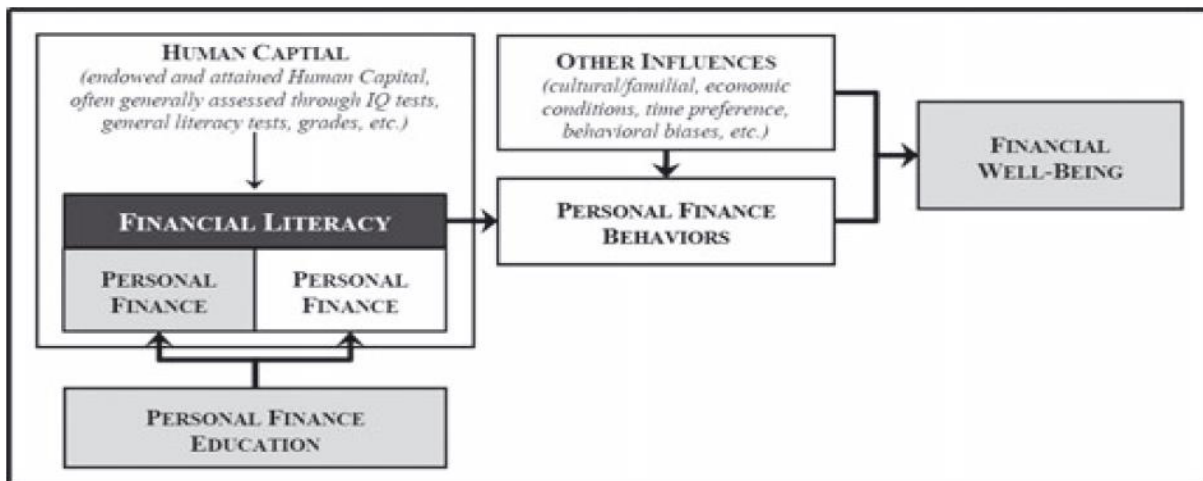
Figure 1.1: Financial Literacy, Knowledge, education, behaviour and well-being

Source: (Huston, 2010)

Figure 1.1 above shows that personal financial behaviour is influenced by preferences among other factors. Financial behaviour plays a pivotal role in shaping an individual's welfare. In addition, an individual's discount rate and risk profile can determine financial behaviour (Meier & Sprenger, 2010). The term time preferences refer, more specifically, to the preference for instant utility over delayed utility (Frederick, Loewenstein & O'donoghue, 2002). Intertemporal choices in the form of time preferences made by an individual are critical in

maximizing present and future utility. The decision makers may value not only what they get but also what they received matched with what they might have received by settling for a different choice (Frederick et al., 2002). Financial literacy also improves human capital which may, in turn, improve efficiency in production (Bernheim & Garrett, 2003; Johnson & Sherraden, 2007; Koropp et al., 2014). Time preference choices are usually made under risk situations.

Risk involves a probability of something bad happening (Németh, 2014). The idea that risk preferences and time preferences exist simultaneously lead researchers to consider joint risk preferences and time preference elicitations (Andersen et al., 2006, 2008; Harrison, Lau & Rutström, 2007). The discount rate calculated under joint risk and time preferences is for an individual's utility rather monetary incentives received in a lottery (Andersen et al., 2008). It is also important to understand whether the discount rate and risk parameter of university students differ by financial literacy level, in order to explain variation in savings, investment and financial choices.

Those who plan for the future are people who are able to hypothesize the relationship between present saving and future returns. The effective connection of current savings and future income is driven by one's intrinsic discount rate and risk parameter (Frederick, Loewenstein & O'donoghue, 2002; Loewenstein, Read & Baumeister, 2003). Saving for the future usually entails discounting current consumption in favour of future wellbeing in conditions where present consumption may have enormous emotional and social value (Clark, 2014). It, therefore, suggests that financial literate individuals have a different discount rate since they are believed to make fewer financial errors compared to those with less financial literacy (Kim, Garman & Sorhaindo, 2003). It also, therefore, suggests that financially literate students should have different characteristics compared to students that have less financial literacy.

Financial knowledge influences financial skills, perceived financial knowledge and financial behaviour. In turn, financial behaviour is related to financial knowledge and perceived financial knowledge (Figure, 1.2). For example, financial knowledge gained through past behaviour may influence future behaviour. Individuals learn more of financial aspects if they participate in financial decisions, for example, if someone is investing in the stock market that will grow his knowledge on investing in the stock market (Hung, Parker & Yoong, 2009). Formulation of decisions depends also on perceived and actual financial knowledge represented in Figure 1.2 as financial skills. Perceived knowledge may result in an individual making financial decision errors if it varies widely with ones' financial skills (Smith & Barboza, 2014). Existing studies suggest that a wide variation between financial skills and perceived financial knowledge may affect financial behaviour (Laborde, Mottner & Whalley, 2013; Luksander et al., 2014; Németh, 2014). Risk tolerance or confidence is the gap between what one knows and what they perceive they know. The gap plays a critical role in determining financial behaviour critical for financial wellbeing. The gap between actual and perceived financial knowledge can be positive or negative. Perceived knowledge can provide confidence or despair in financial decision making (Németh, 2014). Understanding the gap between actual and perceived financial knowledge provide a reason to receive or not to receive financial education (Laborde, Mottner & Whalley, 2013).
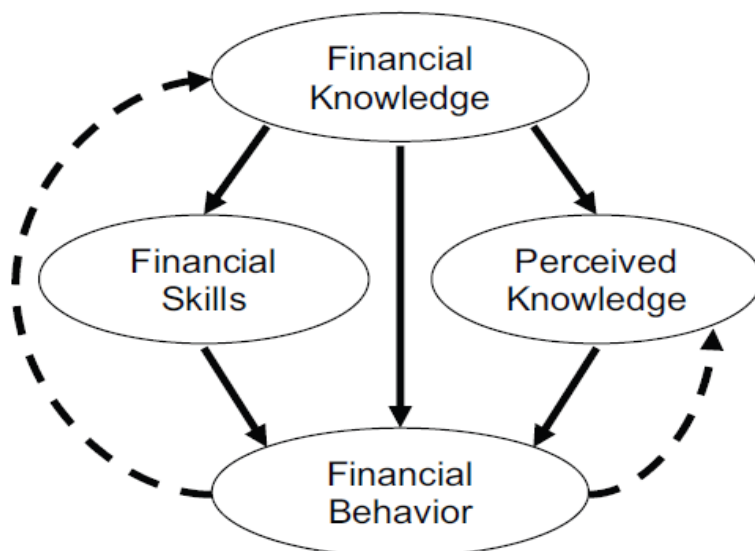
Figure 1.2: Conceptual Model of Financial Literacy

Source: (Hung, Parker & Yoong, 2009:12)

Making decisions involves a host of factors that are engraved in formal learning and environmental observation (Courtney 2001). Knowledge interacts with preferences, tastes, perceptions, norms and beliefs in shaping one's behaviour (Ajzen, 2011). The ultimate impact of financial literacy on financial behaviour is and improvement in wellbeing. The interaction of financial literacy with preferences, individual characteristics, norms, beliefs and perceptions have a role in shaping financial behaviour.

1.6 Key concepts

1.6.1 Behavioural economics

Suboptimal choices, irrational behaviour and cognitive limitations are some of the components that behavioural economics seeks to investigate. Poor financial decision making is associated with impulsivity, awkward preferences, behavioural biases and external circumstances (Huston, 2010). Neoclassical economics suggests that displaying optimal behaviour is a feature of rational choice. The predictable irrational behaviour revealed by consumers is mainly due to financial literacy and psychological processes that generate mental "shortcuts" as well as biases (Capuano & Ramsay, 2011). Incentives attached to particular actions are the major drivers of biased financial behaviour, for example, if an individual is risk-loving then high-risk venture act as a reward to invest. Biases that reduce pressure on cognitive functioning as well as skewing rational thinking are processed in the following incentives namely loss aversion, reference dependence, hyperbolic discounting, outweighing small probabilities, mental accounting and prospect theory (Smith, McArdle & Willis, 2010).

Additional biases that skew rational thinking are information asymmetry, heuristics, inconsistent preferences, lack of self-control, postponing decisions, ambiguity aversion, inertia, information overload, framing and mental accounting (Oehler & Werner, 2008). Other biases that impair rational thinking include defaults, overconfidence, time preferences, information overload, wants, trust and loyalty, sunk costs, experience, learning and reinforcement, jealous, ego, confirmatory bias, the endowment effect, norms, including the spotlight effect, salience,

priming, preference reversals, affection, emotion, commitments, risk preferences, consumer shortsightedness and the "value of zero" (Capuano & Ramsay, 2011). According to Capuano and Ramsay (2011), the biases above can be classified to risk, decision making, time, self, the group (social norms), prominence, limited cognitive ability, property and pursuance of a route that has no pecuniary cost. The behavioural concepts mentioned above do have a crucial impact on how an individual make decisions.

1.6.2 Financial literacy

Table 1.1 Conceptual definitions of financial literacy

Source	Conceptual Definition
Hilgert, Hogarth, & Beverley (2003)	Financial knowledge
FINRA (2003)	"The understanding ordinary investors have of market principles, instruments, organizations and regulations" (p. 2).
Moore (2003)	"Individuals are considered financially literate if they are competent and can demonstrate they have used the knowledge they have learned. Financial literacy cannot be measured directly so proxies must be used. Literacy is obtained through practical experience and active integration of knowledge. As people become more literate they become increasingly more financially sophisticated and it is conjectured that this may also mean that an individual may be more competent" (p.29).
National Council on Economic Education (NCEE) (2005)	"Familiarity with basic economic principles, knowledge about the U.S. economy, and understanding of some key economic terms" (p. 3).
Mandell (2007)	"The ability to evaluate the new and complex financial instruments and make informed judgments in both choices of instruments and extent of use that would be in their own best long-run interests" (pp. 163-164).
Lusardi and Mitchell (2007)	[Familiarity] with "the most basic economic concepts needed to make sensible saving and investment decisions" (p. 36).
Lusardi and Tufano (2008)	Focus on debt literacy, a component of financial literacy, defining it as "the ability to make simple decisions regarding debt contracts, in particular how one applies basic knowledge about interest compounding, measured in the context of everyday financial choices" (p. 1).
ANZ Bank (2008), drawn from Schagen (2007)	"The ability to make informed judgements and to take effective decisions regarding the use and management of money" (p. 1).
Lusardi (2008)	"Knowledge of basic financial concepts, such as the working of interest compounding, the difference between nominal and real values, and the basics of risk diversification" (p. 2).

Source: (Hung, Parker & Yoong, 2009:6)

Existing studies have tried to define the term financial literacy in a number of ways. Lusardi and Mitchell (2011) defines financial literacy as a process by which financial consumers or investors improve their appreciation of financial products and ideas, through information, instruction, and objective advice, build skills and confidence to become more conscious of financial risks and opportunities so as to come up with beneficial choices and being able to

identify sources of financial help in a bid to improve their financial wellbeing. The definition suggests that a financial literate individual exudes behaviour different from financially illiterates. Financial literacy has a wider scope that includes financial capability. Financial capability includes three important components that make financial literacy an effective instrument in welfare enhancement, namely knowledge, skills and attitudes (Atkinson et al., 2007). Table 1.1, also provided a number of definitions of financial literacy suggested by a wide range of researchers.

Huston (2010) referred financial literacy as determining how well an individual can appreciate and use the information to do with personal finance. The explanation makes it clear that for someone to be financial literate, one should be able to make use of the knowledge to improve one's welfare. Understanding financial concepts can assist students and community at large in making use of financial instruments. If society comprehends how financial markets operate they can take advantage of benefits by investing in the instruments at stake. The definitions by Huston (2010) suggests that financial literacy is only recognized when individuals contribute positively to society and are able to gainfully use the skills acquired. This fact is emphasized by Gallery *et al* (2011) and Schagen and Lines (1996) who considered financial literacy as the ability to take effective decisions regarding the use and management of money as well as making informed choices. These decisions are critical for an individual's daily life transactions. Good money management decisions are highly associated with an improvement of wellbeing (Lusardi & Mitchell, 2011). Good money management means channelling finances to the most productive activities which will cumulatively grow the economy.

The terms financial knowledge, financial literacy and financial education are frequently used interchangeably in the literature and media. Financial education is a vehicle used to provide financial knowledge, financial knowledge is an indicator of financial literacy (Hung, Parker & Yoong, 2009). Other researchers view financial literacy as a more general appreciation of economics and how household choices are impacted by economic situations and circumstances (Worthington, 2006). Financial literacy has also been defined as a focus on elementary money management tools such as budgeting, saving, investing and insurance (Hilgert, Hogarth & Beverly, 2003; Mandell & Klein, 2009). The Ministerial Council for Education, Early Childhood Development, and Youth Affairs (MCEECDYA) in Australia pointed out that financial literacy is the application of knowledge, understanding, skills and values in financial situations that improve the welfare of individuals as well as the society (Cull & Whitton, 2011). This suggests that there is a positive externality generated by financial literacy to the community. Imparting financial knowledge to students is most likely going to help improve welfare of the communities that the university students as young adults live.

A society with financially literate and capable individuals is likely going to derive greater welfare benefits. To gain financial literacy one should be exposed to financial education. Financial education helps individual to understand financial products and concepts in order to make informed choices and actions (Lyons et al., 2006). Therefore, financial education is a means to financial literacy.

1.6.3 Financial behaviour

Financial behaviour is a set of observable financial activity (Bergner, 2011). Financial behaviour (FB) can be captured by the following scientific specification.

FB=f (Identity, Want, Know, know-how, Performance, Achievement, Personal Characteristics, Significance) (Bergner, 2011)

To understand an individual's financial behaviour it is important to ascertain the identity of the individual or group exhibiting a particular financial behaviour. People engage in a particular financial behaviour are motivated by certain 'wants' that they would like to achieve as a way to improve the specific strategic position. A major characteristic of financial behaviour is the cognitive parameter, 'know' which allow an individual to make permissible actions. This typical feature goes hand in glove with how competent or skilled 'know-how' an individual is. The observable activity that an individual exhibit is mainly driven by the individual's ability to execute the actions (De Meza et al., 2008).

Observable processes that take place in financial behaviour are better explained as performance. The prime goal for performance is to realize an outcome. A distinct feature of financial behaviour is a financial outcome, better referred to as 'achievement'. Outcomes may or may not be desirable to wants. Achievement of outcomes depends on 'personal characteristics' which entail traits, attitudes, knowledge, interests and others. Financial behaviour outcome should show 'significance' of the observable activity. Financial education could have an impact on the behaviour of individuals (Bergner, 2011).

Financial behaviour is influenced by internal and external factors. Internal factors include psychological and cognitive state while external factors encompass social and economic conditions (Capuano and Ramsay, 2011). Internal and external factors are critical in determining optimal and sub-optimal financial behaviour. Optimal financial behaviour refers to a situation where an individual behaves rationally and maximize financial utility. Huston (2010) noted that sub-optimal financial behaviour entails individual acting irrationally thereby failing to maximize financial utility. There is no consensus on factors that lead to sub-optimal irrational financial behaviour among individuals since they cut across internal and external factors (Huston, 2010). Irrational financial behaviour is inclined to poor ways of processing information, failing to test theories and probabilities as well as the inability to compare choices and options.

 Sub-optimal consumer financial behaviour identified in other financial literacy researches include low or absence of long term savings, inability to budget, failure to plan ahead, for example, planning for retirement, accumulating avoidable debts, failure to consider as well as avoid fees and charges. Credit card fees for late repayment, inertia in financial markets, investing in inappropriate financial products, lack of confidence when dealing with financial issues, failure to consider important features of financial products, failure to take note of the terms and conditions of products, buying without comparing prices and quality are behaviour associated with sub-optimal behaviour. Inability to assess suitability of already owned products, inability to take note of investment goals, short-sightedness, compartmentalization of money, failure to seek or receive independent advice, inability to gather or review

information concerning finances, use of non-professional sources of information and failure to buy insurance when it is needed may increase income losses (Capuano and Ramsay, 2011). A deeper understanding of factors that result in suboptimal behaviour might suggest corrective measures that can improve individual welfare.

1.6.4 Time preferences

Time preferences reflect one's level of patience, perseverance and self- control, which is a crucial component in making an investment and future welfare choices. The desire of immediate consumption, as opposed to the displeasure of future consumption is mainly driven by the conditions that a decision maker finds oneself in (DellaVigna, 2009; Frederick et al., 2002; Loewenstein et al., 2003; Rae and Mixter, 1905). Time may sometimes alter people's preferences. Goals set by individuals change on daily bases and consumers tend to exhibit a bias towards particular accomplishments at certain times. Over time set goals are re-evaluated and at times may appear less desirable in the future period. Individuals tend to have a high discount rate over a short horizon than long horizon and this behaviour is characteristic of hyperbolic discounting (Andersen et al., 2008). In hyperbolic discounting, people often become impatient and engage in suboptimal behaviour by accepting a lower pay off in the short horizon although the return may be lower than long horizon pay off (Laibson, 1997). Consumers may incur losses in order to gain a current benefit.

The change in preferences over time makes indecision a costly action. The lack of self- control results in the disruption of goals before they are realized and may result in failure to achieve long term goals. Consumption patterns that change over time short of new information provided are known as time inconsistent preferences (Frederick et al., 2007). The bias that may be caused by short term aspirations of gratification may result in suboptimal behaviour such as reduced long term savings and insurance coverage (Schmid, 2008). Presently biased preferences cause consumers to prefer current consumption at the expense of future consumption. A characteristic of optimal financial behaviour is optimizing savings, investment, living within means and having a future inclined mindset (Dalal & Morduch, 2010).

Laboratory experiments on time preferences concluded that discount rates are steeper in the near future than in distant future (Loewenstein, Read & Baumeister, 2003). Individuals are patient over a long horizon of time but become impatient as the distant future draws near.

Formalized preferences that use (β,δ) give the overall utility *U* at time *t* as;

$$U_t = u_t + \beta\delta u_{t+1} + \beta\delta^2 u_{t+2} + \beta\delta^3 u_{t+3} + \cdots \qquad (1.1)$$

Where δ is the discount factor, β≤1 parameter captures self-control problems, if β<1 the discounting between the present and the future is higher than between any future periods and if β=1the model reduces to a standard model (Laibson, 1997; Frederick, Loewenstein & O'donoghue, 2002; Pollak, 2005; DellaVigna, 2009).

A model showing expectation about future preferences encompasses over-confidence about the future self-control challenges of agents. ' A partially naïve (β, δ) agent expects in the future period *t+s* to have the following utility function' (Rabin, O'Donoghue & others, 1999; DellaVigna, 2009).

$$\widehat{U}_{t+s} = u_t + \hat{\beta}\delta u_{t+s+1} + \hat{\beta}\delta^2 u_{t+s+2} + \hat{\beta}\delta^3 u_{t+s+3} + \cdots \qquad (1.2)$$

$\beta \geq \hat{\beta}$ the agent may be sophisticated about the self-control, if $\beta = \hat{\beta}$ fully naïve, and $\beta = 1$ somewhere in between. The model combines self-control problems, a form of over-confidence and naiveté about future self-control (Rabin, O'Donoghue & others, 1999).

Individual actions across the whole economy determine levels of wealth accumulation. According to Rae (1834), the effective desire of accumulation, a psychological factor which is mostly captured in the discount rate in the field of economics differ across countries and it determines a society's level of savings and investment. The pleasure produced by the prospect of current consumption and the related displeasure of deferring such existing satisfaction are some of the factors that influence choices (Rae & Mixter, 1905; Frederick, Loewenstein & O'donoghue, 2002). A further argument suggests that consumers can only defer current consumption to future time if the future utility has a higher reward on the current satisfaction, that is;

$$U^t(c_t^*, \dots c_T^*) > U^t(c_t, \dots c_T) \qquad (1.3)$$

If we include the budget *B(E)* for an individual, the discounted utility model, a person should accept prospect X if:

$$\max_{(c_{t,\dots c_T})\in B(E_0 \cup X)} \sum_{\tau=t}^{T} [\frac{1}{1+\delta}]^{\wedge \tau-t} c(c_\tau) > \max_{(c_{t,\dots c_T})\in B(E_0)} \sum_{\tau=t}^{T} [\frac{1}{1+\delta}]^{\wedge \tau-t} c(c_\tau) \qquad (1.4)$$

B(E) denote individual budget, δ represents the individual pure rate of time preferences (one's discount rate, meant to show the collective effects of the "psychological" motives (Frederick, Loewenstein & O'donoghue, 2002). There is a need to understand what really influence the discount rate across individuals given the assertion that financially literate people generally make better financial decisions compared to those deprived of financial literacy.

Alternative models of inter-temporal choice that provide additional arguments to individual behaviour are habit formation models, anticipatory utility models, reference point models, and visceral influences models (Frederick et al., 2007). These models play a pivotal role in influencing inter-temporal choice as they assume the state in which an individual is found in, affect their decision making. Understanding and framing of the behaviour of individuals assumed to be making choices under certain states might provide insight into individual

financial behaviour. It is also important to understand the intrinsic discount rate and risk preferences parameter of an individual in a given state.

Frederick et al (2007) noted that anticipatory utility involves variation in inter-temporal choice behaviour due to variation in individual abilities to visualize the future and conditions that promote or impede such mental images. They further point out that near-term consumption provides only consumption utility while future consumption brings both consumption utility and anticipatory utility. This provides a possible clue as to why individuals discount different goods at varied rates. Utility from anticipation generates a downward bias on predicted discount rates, and this downward bias is believed to be enormous for goods that provide more anticipatory utility (Andersen et al., 2008). Considering the role played by financial literacy in influencing intertemporal choices, variation in students' discount rates if any could be explained by the anticipatory utility.

Diminishing marginal utility is an instantaneous concave utility function that encourages an individual to spread consumption over time, which is contrary to the positive time preference discount rate that motivates an individual to concentrate consumption in the immediate period (Frederick, Loewenstein & O'donoghue, 2002; Harrison, Lau & Rutström, 2007; Andersen et al., 2008). Caring and not caring for future is mainly driven by the diminishing marginal utility on resources and income. Time preferences are believed to be characterized by a constant discounted utility but further researches submit that discount rates are not constant and can be represented in a hyperbolic discounting function. Hyperbolic discounting is frequently used to describe a person with a decreasing rate of time preference and usually the implicit discount rate over longer time horizons is smaller than the implicit discount rate over immediate time horizons (Benzion, Rapoport & Yagil, 1989; Chapman, 2000; Frederick, Loewenstein & O'donoghue, 2002).

1.6.5 Risk preferences
A risk preference choice involves a decision with a known probability of losses or gains while an uncertain choice involves a decision with an unknown probability of a gain or a loss (Tversky & Kahneman, 1992). There are a number of ways of eliciting risk preferences that depend on what one wants to elicit from the subjects. The methods that have been commonly used are the Balloon Analogue Risk Task (BART), a single choice of how much to apportion between a safe and risky asset, for example, multiple price list choices, the single choice between gambles and non-incentivized questionnaires (Charness et al., 2013). The major aim of measuring risk preferences using the methods above is to try to determine whether the outcomes correlate with the real world human attitudes and behaviour. Charness et al., (2013) submit that the choice of an instrument to be used to elicit risk preferences depends on the level of knowledge and abilities to comprehend questions by subjects.

When individuals make decisions they face risk on the choices under consideration. There is a growing need to understand individual risk as a way of providing beneficial guidance in improving the welfare of individuals. There is consensus on the fact that risk changes in line with incentives (Frederick et al., 2007). Potentially low returns from action are associated with loss aversion behaviour. Individuals would like to avoid regret at all cost. The contextual

framework in which an individual's preferences are formulated alters the risk preferences resulting in different behaviour on situations that may be identical (Tversky and Thaler, 1990). If people are loss averse, contextual factors such as assurance of a return can increase chances of taking the risk. The variance in the reward is the risk associated with preferences. Risk is also associated with emotions and self-gratification. Risk preferences are also affected by overweighting small probabilities (Chen and Jia, 2005). The complex nature of financial decisions makes decisions irrational due to the prevalence of shortcuts. Investors may have an inclination to avoid embarrassment and regret as well as seeking pride and praise resulting in them holding loss-making investments (Capuano and Ramsay, 2011).

In addition, people prefer the risk that is known over unknown risk (Ahn et al., 2014). The errors that individuals make when they make decisions result in choices that are biased with reference to their wealth and income. Suboptimal financial choices are realised due to changing reference points in a trial and error process (Politser, 2008). According to Polister (2008), some sub-optimal choices are due to the prospect theory that involves editing and evaluation. People may take a risky decision because they simplify the transaction without considering the net worth.

In brief, the utility function of risk preferences is given as $U(\frac{x_i}{r}, s)$ where x_i is a risk choice of a lottery, r is the reference point and s is the state one is found in (DellaVigna, 2009). Risk preferences are sometimes influenced by learning, reinforcement and experience. Only parts of valued memories are remembered when individuals make financial choices. More so, experience increases precision in making financial decisions and reduces memory exaggeration. Given their experience, individuals can recall their emotions about a condition more correctly with little variation in their perceptions while taking cognizance of value (Schmid, 2008).

1.7 Components of financial literacy

Financial literacy is usually categorized into four content areas namely, borrowing, saving or investing, personal finance basics and protection (Huston, 2010). Literature over the last decade has used four distinct content areas at varying degrees. Personal finance basics include management of money, time value of money, inflation and personal finance concepts such as budgeting among others (Huston, 2010; Shockey and Seiling, 2004). These concepts are critical when evaluating and appraising investments as well as other inter-temporal choices. Inter-temporal transfers of income between time periods include borrowing which involves bringing future resources into the present consumption by use of credit vehicles such as consumer loans or mortgages. Investment, as well as saving, involves future use of resources, this could be through stocks, cash, bonds, mutual funds and other commodities. Protection of assets include either insurance instruments or other risk management strategies (Huston, 2010). The scope for financial literacy can be widened to cover financial planning, taxes, retirement and debt (Schwella and van Nieuwenhuyzen, 2014).

A critical aspect of financial literacy domains is that they involve an aspect of risk associated with probabilities of losses that are known or are uncertain. Another clear feature synonymous with financial literacy is the inherence of time preferences (Meier and Sprenger, 2010). These

characteristics are prevalent when individuals are involved in borrowing, money management, retirement, savings and investment decisions among others. The inter-temporal choices are mainly determined by discount rates attached to time preferences as well as risk parameter linked to risk preferences (Andersen et al., 2008).

1.8 Empirical Literature review

1.8.1 Financial Literacy and students

The demand for financial literacy is a reality in the present world, which is characterized by information asymmetry, market concentration and a continuously evolving world. Offering financial literacy in learning institutions has some economies of scale considering the high cost of providing financial education. What is not clear about financial literacy of students is its impact on financial behaviour, financial knowledge, confidence, risk preferences and time preferences. Researchers are also keen to understand the impact of financial literacy on financial behaviour considering an individual's financial knowledge, perceptions, attitudes, characteristics and background. Some of the debated characteristics that has gain prominence in financial literacy research on students are; gender, field of study, type of residence, class rank, employment status, work experience, parents' education, type of school for student, education loan (debt), cognitive ability, behaviour intentions, race, religion, age, saving and investment, income, marital status, knowledge versus perceived knowledge, confidence, use of credit cards, social and economic structure and attitudes among others (Mandell, 2008; Cull & Whitton, 2011; Shambare & Rugimbana, 2012; Laborde, Mottner & Whalley, 2013; Németh, 2014).

A number of studies used survey data to investigate the level and impact of financial literacy amongst students. A major conclusion is that there are low levels of financial literacy amongst students across the whole world (Lusardi, Mitchell & Curto, 2010; Shambare & Rugimbana, 2012; Luksander et al., 2014; Németh, 2014; Schwella & van Nieuwenhuyzen, 2014). Students have been found to over or understate their perceived knowledge compared to their actual knowledge (Laborde, Mottner & Whalley, 2013; Luksander et al., 2014; Németh, 2014). Studies also found low levels of financial literacy in certain population subgroups, especially female students, people from particular economic and social background, and race, among others (Chen & Volpe, 2002; Lusardi, Mitchell & Curto, 2010; Luksander et al., 2014; Németh, 2014). To the contrary, some studies found no differences in financial literacy across gender, the area of study and secondary school education among others (Cull & Whitton, 2011; Taylor & Wagland, 2013). Findings to date suggest the impact and levels of financial literacy amongst students vary from one instance to another.

A couple of researchers have also employed experiments in conjunction with questionnaires. Students exposed to financial literacy showed positive financial behaviour and attitudes (Carlin & Robinson, 2012; Batty, Collins & Odders-White, 2015). Batty et al (2014) carried out experimental research on fourth and fifth grades they concluded that students who acquire financial education were financially literate after a year. In a separate experimental study, Carlin and Robinson (2012) concluded that students exposed to financial education were financially savvy when compared to students not exposed to financial education. In a related experimental study Meir and Sprenger (2013), investigated the time preferences of individuals

participating in a volunteer income tax assistance (VITA) credit counselling program offered by Boston city in conjunction with credit firm. They used the standard incentivized experimental method of multiple price list to conclude that individuals who participated in the information session had a higher discount factor.

Cognitive abilities, increase the propensity to read financial news and increased savings were some of the outcomes of financial literacy (Becchetti, Caiazza & Coviello, 2013; Sayinzoga, Bulte & Lensink, 2014). Becchetti et al (2013) in experimental research that had a treated and control group of high school students concluded that financial education benefitted those that had little financial knowledge at the beginning. In addition, Sayinzoga et al. (2014) in experimental research with small scale farmers found that farmers who received financial literacy increase savings and had a high business start-up. Research on comparing risk and time preferences amongst students has not been clearly exhausted, Bernheim, Garrett & Mak (2001) found no differences across students in the USA. There is a need to have an appreciation of the impact of financial literacy on university students' attitudes, perceived financial knowledge and actual financial knowledge as a way to determine their effect on financial decisions and behaviour.

1.9 Measurement of Financial literacy

Huston (2010) highlighted the importance of defining and appropriately measuring financial literacy. Understanding educational impact, as well as barriers to beneficial financial choice, is critical in financial literacy public policy appraisal. Research on financial literacy uses mainly surveys, aptitude tests, questionnaire, content test, behaviour intentions and experiments to elicit data. Popular tools that have been used to investigate the presence of financial literacy in students are self-assessment, content/aptitude/performance test, experimental approaches, saving and investment intentions, debt, preferences measuring instruments and cognitive skills that include numeracy among others (LaBorde et al., 2013; Lee and Mueller, 2014; Németh, 2014; Sabri et al., 2010; Shahrabani, 2013, 2012).

Lusardi and Mitchell (2011) developed a financial literacy measuring tool which focuses on ascertaining where people get information that they use to make financial decisions and how they plan for retirement. The tool also measures an individual's knowledge, understanding of the financial literacy concepts and principles underpinning effective financial decision-making. Lusardi and Mitchell (2011) were also interested in respondents' risk preference profile and their ability to differentiate between various levels of risk in relation to expected returns. Financial literacy and knowledge indicators can be used as inputs to the model that focusses on financial education and might explain differences in financial outcomes such as savings, investing and debt behaviour (Lyons et al., 2006).

1.10 Data

The data used in the study was gathered from the University of the Free State students based on Bloemfontein and Qwaqwa Campuses. The choice of the subjects used in the experiment was mainly driven by the fact that the subjects were a convenient sample to the researcher. In addition, the high cost of running an experiment restricted the researcher in spreading the study across a number of universities.

Paper 1, paper 2 and paper 4 data were gathered from the Bloemfontein Campus. Bloemfontein Campus has more students enrolled in the Economic and Management Sciences Faculty when compared to Qwaqwa Campus. Variation in the methods used to measure preferences in the experiments prompted the researcher to collect and analyse data separately from the two university campus. A total of 192 students completed a questionnaire, multiple price list time preference and risk preferences tasks as well as a financial literacy test. The Multiple Price List (MPL) experimental procedure used in the research was modified to suit South African currency and context by the Research Unit in Behavioural Economics and Neuroeconomics (RUBEN) at the University of Cape Town in South Africa (Harrison et al., 2005; Holt and Laury, 2002; Andersen et al., 2008). Subjects completed (four) risk aversion and (four) time preference tasks. Each task had 10 binary choices meaning each subject completed 80 choices and the whole group completed 15 360 risk and time preferences choices. Ten per cent of the participants were selected and paid for one of the eight tasks they played that was randomly chosen (Andersen et al., 2008).

Paper 3 data was collected from the Qwaqwa Campus. A total of 85 university students completed a questionnaire and a binary choice experimental game that used tokens allocated over time. A simple binary choice time preference task was used to collect students' individual discount rates. In the time preference task, the subjects were asked to allocate five tokens between two periods; that is, after 2 weeks or after 6 weeks- resembling an investment or savings venture.

1.11 Methods
The study uses STATA software to execute a wide range of data methodology analysis. Paper 1 used a full information maximum likelihood (FIML) estimation on expected utility exponential function focusing on homogeneous and heterogeneous preferences as well as ordinary least squares (OLS) regression. The dependent variables are risk preferences and time preference variables for the maximum likelihood model. The OLS model dependent variable is financial literacy. Paper 2 used t-test and OLS regression. The dependent variable in the OLS model is financial behaviour. Paper 3 used a negative binomial regression model (NBRM) and OLS in the data analysis and dependent variables are discount rate and time preferences index respectively. Finally, paper 4 used t-test, ordered probit regression model, probit model and OLS model. The dependent variables are individual discount rate and financial literacy chronologically.

1.12 The organisation of the thesis
This study is made up of six chapters. Chapter 1 above, gives a brief background of financial literacy, financial behaviour, time preferences and risk preferences. It also gives a brief background of some researches on financial literacy and how financial literacy is usually measured. Chapters 2 to 5 are individual research papers. Chapter 2 focusses on the impact of financial literacy on risk preferences and time preferences of university students. The chapter explores financial literacy policy interventions that can improve the wellbeing of citizens. It also investigates the probable major beneficiaries of a financial literacy education program. Chapter 3, examines whether risk preferences, time preference, financial behaviour, confidence and financial literacy of university students differ by financial literacy level. It also explores

factors that influence the financial behaviour of university students. The conceptual frame work of chapter 3 is based on the framework of financial literacy model. The chapter examines how financial literacy can improve wellbeing. Chapters 4 and 5, dwell on the impact on financial literacy on time preferences. Chapter 4 uses tokens to measure time preferences while chapter 5 uses multiple price lists unique initial switching point to measure time preferences. Chapters 4 and 5 looks at intertemporal and financial literacy. Intertemporal decisions help individuals to accumulate wealth. The chapters examined the relationship between intertemporal choice and financial literacy in a bid to understand how individuals' wellbeing can be improved. Chapter 6, which is the closing chapter presents the thesis findings.

1.13 References

Ajzen, I. 2011. The theory of planned behaviour: Reactions and reflections. *Psychology & Health*. 26(9):1113–1127. DOI: 10.1080/08870446.2011.613995.

Andersen, S., Harrison, G.W., Lau, M.I. & Rutström, E.E. 2006. Elicitation using multiple price list formats. *Experimental Economics*. 9(4):383–405.

Andersen, S., Harrison, G.W., Lau, M.I. & Rutström, E.E. 2008. Eliciting risk and time preferences. *Econometrica*. 76(3):583–618. Available: http://onlinelibrary.wiley.com/doi/10.1111/j.1468-0262.2008.00848.x/abstract.

Atkinson, A., McKay, S., Collard, S. & Kempson, E. 2007. Levels of Financial Capability in the UK. *Public Money and Management*. 27(1):29–36.

Batty, M., Collins, J.M. & Odders-White, E. 2015. Experimental Evidence on the Effects of Financial Education on Elementary School Students' Knowledge, Behavior, and Attitudes. *Journal of Consumer Affairs*. 49:69–96.

Becchetti, L., Caiazza, S. & Coviello, D. 2013. Financial education and investment attitudes in high schools: evidence from a randomized experiment. *Applied Financial Economics*. 23(10):817–836.

Benzion, U., Rapoport, A. & Yagil, J. 1989. Discount rates inferred from decisions: An experimental study. *Management science*. 35(3):270–284. Available: http://pubsonline.informs.org/doi/abs/10.1287/mnsc.35.3.270.

Bernanke, B.S. 2006. Financial literacy. *Testimony before the Committee of Banking, Housing and Urban Affairs of the United States Senate. May*. 23. Available: http://www.federalreserve.gov/newsevents/testimony/bernanke20060523a.htm.

Bernheim, B.D. & Garrett, D.M. 2003. The effects of financial education in the workplace: evidence from a survey of households. *Journal of Public Economics*. 87(7):1487–1519.

Bernheim, B.D., Garrett, D.M. & Maki, D.M. 2001. Education and saving:: The long-term effects of high school financial curriculum mandates. *Journal of Public Economics*. 80(3):435–465. Available: http://www.sciencedirect.com/science/article/pii/S0047272700001201.

Braunstein, S. & Welch, C. 2002. Financial literacy: An overview of practice, research, and policy. *Fed. Res. Bull.* 88:445. Available: http://heinonlinebackup.com/hol-cgi-bin/get_pdf.cgi?handle=hein.journals/fedred88&section=158.

Capuano, A. & Ramsay, I. 2011. What causes suboptimal financial behaviour? An exploration of financial literacy, social influences and behavioural economics. *An Exploration of Financial Literacy, Social Influences and Behavioural Economics (March 23, 2011). U of Melbourne Legal Studies Research Paper*. (540). Available: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1793502.

Carlin, B.I. & Robinson, D.T. 2012. What Does Financial Literacy Training Teach Us? *Journal of Economic Education*. 43(3):235–247. DOI: 10.1080/00220485.2012.686385.

Chapman, G.B. 2000. Preferences for improving and declining sequences of health outcomes. *Journal of Behavioral Decision Making*. 13(2):203–218. Available: http://onlinelibrary.wiley.com/doi/10.1002/(SICI)1099-0771(200004/06)13:2%3C203::AID-BDM317%3E3.0.CO.

Chen, H. & Volpe, R.P. 1998. An analysis of personal financial literacy among college

students. *Financial services review*. 7(2):107–128. Available: http://www.sciencedirect.com/science/article/pii/S1057081099800067.

Chen, H. & Volpe, R.P. 2002. Gender differences in personal financial literacy among college students. *Financial Services Review*. 11(3):289–307.

Clark, G.L. 2014. Financial literacy in context: A rejoinder. *Economic Geography*. 90(1):29–31.

Courtney, James F. 2001. "Decision Making and Knowledge Management in Inquiring Organizations: Toward a New Decision-Making Paradigm for DSS." *Decision Support Systems* 31(1): 17–38. https://www.sciencedirect.com/science/article/pii/S0167923600001172 (January 26, 2019).

Cull, M. & Whitton, D. 2011. University Students' Financial Literacy Levels: Obstacles and Aids. *Economic and Labour Relations Review*. 22(1):99–114. DOI: http://search.informit.com.au/browseJournalTitle;res=IELBUS;issn=1035-3046.

Dalal, A. & Morduch, J. 2010. *The psychology of microinsurance: Small changes can make a surprising difference*. ILO, New York. Available: http://www.oit.org/public/english/employment/mifacility/download/mpaper5_psychology_en.pdf.

DellaVigna, S. 2009. Psychology and Economics: Evidence from the Field. *Journal of Economic Literature*. 47(2):315–372. Available: http://www.ingentaconnect.com/content/aea/jel/2009/00000047/00000002/art00001.

Frederick, S., Loewenstein, G. & O'donoghue, T. 2002. Time Discounting and Time Preference: A Critical Review. *Journal of Economic Literature*. 40(2):351–401. DOI: 10.1257/jel.40.2.351.

Frederick, S., Loewenstein, G., Donoghue, T.O., Literature, E. & Jun, N. 2007. Time Discounting and Time Preference : A Critical Review. *Journal of economic literature*. 40(2):351–401. Available: http://www.jstor.org/stable/2698382.

Harrison, G.W., Lau, M.I. & Rutström, E.E. 2007. Estimating risk attitudes in Denmark: A field experiment*. *The Scandinavian Journal of Economics*. 109(2):341–368.

Hodgson, G.M. 1988. Economics and institutions. *Journal of Economic issues*. 40(1):1–25. Available: http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.121.8035 [2018, September 24].

Hung, A., Parker, A. & Yoong, J. 2009. Defining and measuring financial literacy. *RAND Working Paper Series WR-708*. Available: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1498674 [2018, September 24].

Huston, S.J. 2010. Measuring financial literacy. *Journal of Consumer Affairs*. 44(2):296–316. Available: http://onlinelibrary.wiley.com/doi/10.1111/j.1745-6606.2010.01170.x/full.

Jappelli, T. & Padula, M. 2013. Investment in financial literacy and saving decisions. *Journal of Banking & Finance*. 37(8):2779–2792. DOI: 10.1016/j.jbankfin.2013.03.019.

Johnson, E. & Sherraden, M.S. 2007. From Financial Literacy to Financial Capability among Youth. *J. Soc. & Soc. Welfare*. 34:119.

Kim, J., Garman, E.T. & Sorhaindo, B. 2003. Relationships among credit counseling clients'

financial wellbeing, financial behaviors, financial stressor events, and health. *Journal of Financial Counseling and Planning*. 14(2). Available: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2265623.

Kim, J., Sorhaindo, B. & Garman, E.T. 2006. Relationship between financial stress and workplace absenteeism of credit counseling clients. *Journal of Family and Economic Issues*. 27(3):458–478. Available: http://link.springer.com/article/10.1007/s10834-006-9024-9.

Koropp, C., Kellermanns, F.W., Grichnik, D. & Stanley, L. 2014. Financial Decision Making in Family Firms An Adaptation of the Theory of Planned Behavior. *Family Business Review*. 0894486514522483.

Laborde, P.M., Mottner, S. & Whalley, P. 2013. Personal Financial Literacy : Perceptions of Knowledge , Actual Knowledge and Behavior of College Students. *Journal of Financial Education*. 39(3/4):1–31. DOI: 10.2307/23608645.

Laibson, D. 1997. Golden eggs and hyperbolic discounting. *The Quarterly Journal of Economics*. 443–477. Available: http://www.jstor.org/stable/2951242.

Loewenstein, G., Read, D. & Baumeister, R.F. 2003. *Time and Decision: Economic and Psychological Perspectives of Intertemporal Choice*. Russell Sage Foundation.

Luksander, A., Béres, D., Huzdik, K. & Németh, E. 2014. Analysis of the Factors that Influence the Financial Literacy of Young People Studying in Higher Education. *Public Finance Quarterly (0031-496X)*. 59(2):220–241. Available: http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=99002994&site=ehost-live.

Lusardi, A. & Mitchell, O.S. 2005. Financial literacy and planning: Implications for retirement wellbeing. *Michigan Retirement Research Center Research Paper No. WP*. 108. Available: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=881847.

Lusardi, A. & Mitchell, O.S. 2007. Baby boomer retirement security: The roles of planning, financial literacy, and housing wealth. *Journal of monetary Economics*. 54(1):205–224. Available: http://www.sciencedirect.com/science/article/pii/S0304393206002467.

Lusardi, A. & Mitchell, O.S. 2011. Financial literacy around the world: an overview. *Journal of Pension Economics and Finance*. 10(04):497–508. Available: http://journals.cambridge.org/abstract_S1474747211000448.

Lusardi, A., Mitchell, O.S. & Curto, V. 2010. Financial literacy among the young. *Journal of Consumer Affairs*. 44(2):358–380. Available: http://onlinelibrary.wiley.com/doi/10.1111/j.1745-6606.2010.01173.x/full.

Lusardi, A., Michaud, P.-C., Mitchell, O.S. & others. 2015. *Using a Life Cycle Model to Evaluate Financial Literacy Program Effectiveness*. Available: http://cirano.qc.ca/files/publications/2015s-14.pdf.

Lyons, A.C., Palmer, L., Jayaratne, K.S.U. & Scherpf, E. 2006. Are we making the grade? A national overview of financial education and program evaluation. *Journal of Consumer Affairs*. 40(2):208–235. Available: http://onlinelibrary.wiley.com/doi/10.1111/j.1745-6606.2006.00056.x/full.

Mandell, L. 2008. Financial literacy of high school students. In *Handbook of consumer finance research*. Springer. 163–183. Available: http://link.springer.com/chapter/10.1007/978-0-387-75734-6_10.

Mas-Colell, A., Whinston, M.D., Green, J.R. & others. 1995. *Microeconomic theory*. V. 1. Oxford university press New York.

Meier, S. & Sprenger, C. 2010. Present-biased preferences and credit card borrowing. *American Economic Journal: Applied Economics*. 193–210. Available: http://www.jstor.org/stable/25760198.

Meier, S. & Sprenger, C.D. 2013. Discounting financial literacy: Time preferences and participation in financial education programs. *Journal of Economic Behavior & Organization*. 95:159–174.

Németh, K.H.-D.B. 2014. An Empirical Study of Financial Literacy versus Risk Tolerance Among Higher Education Students. *Public Finance Quarterly*. 4:445. Available: http://www.asz.hu/public-finance-quarterly-articles/2014/an-empirical-study-of-financial-literacy-versus-risk-tolerance-among-higher-education-students/a-huzdik-beres-nemeth-2014-4.pdf.

Oehler, A. & Werner, C. 2008. Saving for retirement—a case for financial education in Germany and UK? An economic perspective. *Journal of Consumer Policy*. 31(3):253–283.

Pollak, R.A. 2005. *Bargaining power in marriage: Earnings, wage rates and household production*. National Bureau of Economic Research. Available: http://www.nber.org/papers/w11239.

Rabin, M., O'Donoghue, T. & others. 1999. Doing it now or later. *American Economic Review*. 89(1):103–124. Available: https://ideas.repec.org/a/aea/aecrev/v89y1999i1p103-124.html.

Rae, J. & Mixter, C.W. 1905. *The sociological theory of capital*. Macmillan Company. Oxford

Roberts, B., Struwig, J., and Gordon, S.2016. Financial Literacy in South Africa: Results from the 2015South African Social Attitudes Survey round. *Report prepared by the Human Sciences Research Council on behalf of the Financial Services Board. Pretoria: Financial Services Board.*

Roberts, B., Struwig, J., Gordon, S., Viljoen, J. & Wentzel, M. 2012. Financial Literacy in South Africa: Results of a baseline national survey. *Report prepared by the Human Sciences Research Council on behalf of the Financial Services Board. Pretoria: Financial Services Board*.

Roberts, B., Struwig, J. & Gordon, S. 2014. Financial Literacy in South Africa: Results from the 2013 South African Social. Pretoria. Available: http://benefitsbarometer.co.za/wp-content/uploads/2015/02/Financial-Literacy-Report.pdf.

Van Rooij, M., Lusardi, A. & Alessie, R. 2007. *Financial literacy and stock market participation*. National Bureau of Economic Research. Available: http://www.nber.org/papers/w13565.

Sayinzoga, A., Bulte, E. & Lensink, R. 2014. Financial Literacy and Financial Behavior: Experimental Evidence from Rural Rwanda. *The Economic Journal*. 1–29. DOI: 10.1111/ecoj.12217.

Schagen, S. & Lines, A. 1996. *Financial literacy in adult life: a report to the Natwest Group Charitable Trust*. NFER. Available: https://www.nfer.ac.uk/publications/91091/91091.pdf.

Schwella, S. & van Nieuwenhuyzen, B. 2014. Measuring financial literacy: Developing and testing a measurement instrument with a selected group of South African military officers.

Africa Education Review. 11(3):365–385. DOI: 10.1080/18146627.2014.934993.

Shambare, R. & Rugimbana, R. 2012. Financial Literacy Among the Educated : An Exploratory Study of Selected University Students in South Africa By. *Feature Article*. 4425(4):581–590. DOI: 10.1002/tie.

Smith, C. & Barboza, G. 2014. The Role of Trans-Generational Financial Knowledge and Self-Reported Financial Literacy on Borrowing Practices and Debt Accumulation of College Students. *Journal of Personal Finance*. 13(2):28. Available: http://search.proquest.com/openview/5c7378f8f8e46cd7d823ba9e979975aa/1?pq-origsite=gscholar.

Smith, J.P., McArdle, J.J. & Willis, R. 2010. Financial decision making and cognition in a family Context*. *The Economic Journal*. 120(548):F363–F380. Available: http://onlinelibrary.wiley.com/doi/10.1111/j.1468-0297.2010.02394.x/full.

Struwig, J., Roberts, B. & Gordon, S. 2012. Financial Literacy in South Africa. *Results of a*. Available: http://www.hsrc.ac.za/en/research-outputs/ktree-doc/13821.

Taylor, S. & Wagland, S. 2013. The Solution to the Financial Literacy Problem: What is the Answer? *Australasian Accounting Business & Finance Journal*. 7(3):69–89. Available: http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=91792238&site=ehost-live.

Tversky, A. & Kahneman, D. 1992. Advances in prospect theory: Cumulative representation of uncertainty. *Journal of Risk and Uncertainty*. 5(4):297–323. DOI: 10.1007/BF00122574.

CHAPTER 2:

Risk preferences, time preferences, indecisiveness and financial literacy: Laboratory evidence[1]

Abstract

The aim of this study is to investigate the impact of financial literacy on risk preference and time preference choices of university students. The study collected data using a questionnaire, implemented a multiple price list risk preference and time preference experiment, and administered a financial literacy test on 192 university students (female=53%). A maximum of 15 360 risk preference and time preference choices were elicited from the subjects. The research categorized students who scored a mark above average in the financial literacy test as high financial literacy group and those that scored marks below average as low financial literacy group. The study employed a full information maximum likelihood joint estimation on an expected utility exponential function focusing on homogeneous and heterogeneous preferences for students. Research results showed that financial literacy is significantly related to risk preferences and time preferences of university students with low financial literacy after controlling for individual characteristics. The paper, therefore, concluded that financial education is beneficial if targeted on university students with low financial literacy. High financial literacy among university students is associated with patience attitude. The study found significant risk aversion and impatience among university students. The study also concluded a significant structural risk preference and time preference behavioural error. The study observed low levels of financial literacy among university students. An ordinary least squares regression model show that indifference or indecisiveness on lottery choices increases as financial literacy decreases. Providing financial literacy to university students reduces indecisiveness in preference choices.

Keywords: Risk preferences, Time preferences, financial literacy, indecisiveness, experiment, multiple price list

JEL Classification: D14; D99; G11; I22

2.1 Introduction

Financial decisions involve making choices that may have risk preferences and time preference choice outcomes. Economic agents faced with risk preference and time preference choices are known to exhibit varied behavioural outcomes mainly driven by cognitive ability, affection, habit formation, visceral influences, temptation, and anticipatory utility (Van Rooij et al., 2007; Frederick, 2005; Frederick et al., 2002). The quest to understand the difference in financial life outcomes that prevail between high financial literacy and low financial literacy individuals require a clear assessment of how economic agents make risk preference and time preference choices. Research evidence shows that individuals are prone to making financial errors (Lusardi and Mitchell, 2011). The prevalence of errors in making risk preference and time preference choices by individuals need to be examined in the context of their financial literacy.

The prominent question that requires an empirically tested behavioural finance outcome is, 'are there variations in risk preference and time preference choices exhibited by people with different levels of financial literacy?' An answer to this question will provide a deeper understanding of the role financial literacy play in shaping individual financial life outcomes. The aim of this study is to explore whether financial literacy level impacts on one's risk preferences and time preferences choices. The study also examines if the level of financial literacy has impact on financial decision making. Our evidence comes from a laboratory experiment with university students as the subjects. These subjects were enrolled in a Bachelor of Commerce degree in the Economic and management Sciences Faculty at the University of the Free State in South Africa. A total of 192 subjects participated in multiple price list (MPL) risk preference and time preference experiment.

The university students also filled in a questionnaire that collected their personal information and wrote a financial literacy test to gauge their financial literacy level. The subjects completed a total of four MPL risk preference and four MPL time preference tasks or games. In total, the subjects made a maximum of 15 360 choices from the 8 tasks completed, which were used in the analysis. The study uses expected utility function maximum likelihood and ordinary least squares regression models to analyse data. Ten per cent of the participants were paid actual value of money for their choices in a chosen game. The use of money incentives restricts subjects to make choices on one good (Harrison et al., 2005). Our study focusses on lottery measured risk aversion and patience for subjects given their levels of financial literacy. All subjects who score a mark above average in the financial literacy test are categorised as high financial literacy group while those who score a mark below average are classified as low financial literacy group.

Our results from the maximum likelihood regression analysis show that financial literacy is associated with risk preference and time preference choices of students with low financial literacy after controlling for individual characteristics. The whole group was risk loving and patient when we included multiple switching and after factoring out indifference (multiple switching on lotteries), the whole group was risk-averse and impatient. The expected utility exponential function maximum likelihood regression show that indifference or indecisiveness is significant in making risk preference choices. An ordinary least squares regression model shows that indifference or indecisiveness increases as the level of financial literacy decrease, showing that students with low financial literacy are more likely to struggle to make risk preference and time preference choices. Our findings show that financial literacy plays an important role in financial decision making. The paper concluded that indifference (multiple

switching on lotteries) or indecisiveness is significantly more prevalent in risk preferences tasks than in time preference tasks. Indecisiveness increases as the level of financial literacy decreases, showing that providing financial literacy improves financial decision making. Our results also show that subjects with higher levels of financial literacy had a higher proportion of larger later (patient) choices compared to subjects with lower financial literacy, showing that financial literacy makes subjects with higher financial literacy more patient, increasing the probability of them earning a higher return from their choices.

The possibility that the level of financial literacy could be correlated with risk and time preferences is important for a minimum of two reasons. First, differences in behaviour biases due to the level of financial literacy can sum up to market outcomes which may make it possible for authorities to design public policies to reduce the negative effects. Secondly, the evidence is critical in assessing short run psychological behaviour (temptation) and long-run optimization of an individual with different levels of financial literacy (Benjamin et al., 2013; Brocas and Carillo, 2006; Burks et al., 2009).

Financial knowledge, numeracy, ability to make beneficial financial decision and capability to use financial skills are aspects of cognitive ability (Delavande et al., 2008). Risk preferences entail making choices with a chance of a gain or a loss while time preferences encompass intertemporal choices, that is, choices over time (Frederick, 2005). Indecisiveness is an exhibition of doubt or indifference concerning two or more possible choices (Eliaz and Ok, 2006). A number of studies have explored the impact of cognitive ability on risk preferences and time preferences. Benjamin et al. (2013) in a Chilean high school students study conclude that subjects with higher mathematics score exhibited less small-stakes risk aversion. There is evidence of a strong correlation between cognitive ability and risk aversion when measurement error in risk aversion is corrected for (Huck and Weizsäcker, 1999). In addition, Dohmen et al. (2010) conclude that people with lower IQs are more risk averse and impatient. Another study found out that cognitive load increases risk aversion (Whitney et al., 2008). On the other hand, Frederick (2005) found differences in time preferences across gender while Benjamin et al (2013) noted that students who are good in mathematics are more patient. Jacobson and Petrie (2009) in an experimental study with an adult population in Rwanda that focused on how mistakes over risk preferences explain financial decisions concluded that risk aversion and inconsistent lottery choices interact significantly. Prasad and salmon (2013) used a principal-agent experiment and found that subjects who make consistent choices earn more money than those who make inconsistent choices.

Inconsistent choices are a clear movement away from the assumptions of the expected utility theory. Research under expected utility theory has frequently ignored inconsistent behaviour and treated it as unobserved and uninformative noise (Jacobson and Petrie, 2009). The use of MPL risk and time preference games in our study allowed subjects to make a single decision at a goal (Andersen et al., 2008; Holt and Laury, 2002). Identifying the level of risk aversion and patience is important in determining university students' attitudes in making financial decisions.

Our study is unique in that to the best of our knowledge it is the first to make use of MPL experimental methodology to examine the impact of financial literacy on risk preference and time preference choices in South Africa. Previous studies have used cognitive instruments such as IQ tests to examine the impact of cognitive ability on risk preferences and time preferences.

Some of the studies that examined the relationship between risk preferences and time preferences with cognitive ability are (Benjamin et al., 2013; Dohmen et al., 2010; Huck and Weizsacker, 1999;Parker and Fischhoff, 2005). This is the first study to investigate the impact of financial literacy on decision making using the joint estimation of multiple price list (MPL) risk preferences and time preferences tasks. Studies on financial literacy in South Africa have mainly focused on the level of financial literacy among citizens and a number of the studies reported low levels of financial literacy (Shambare & Rugimbana, 2012; Roberts, Struwig & Gordon, 2014).

Our findings can be compared with the studies below. Risk-averse subjects were found to be more likely to take up experimentally provided education financing (Eckel et al., 2007). Lusardi and Mitchell (2007) found out that financial education is beneficial to people with low financial literacy. Becchetti et al (2013) in an experimental study with high school students found out that financial literacy education helped students who initially had a low level of financial literacy. Jacobson and Petrie (2009) found out that subjects more likely to make mistakes were less likely to belong to savings group as they became more risk averse. Dohmen et al. (2010) concluded that lower IQs subjects are risk averse. Prasad and salmon (2013) in their experiment found out that subjects that make consistent choices are more likely to earn higher rewards. Huck and Weizsacker (1999) found a strong correlation between cognitive ability and risk aversion. The mixed outcome of results could be due to the fact that some studies ignore background risk (Harrison et al., 2007). Our study employs joint estimation of risk preferences and time preferences which caters for choice under risk.

The paper is organized as follows. The next section looks at the experimental procedure and summary statistics, theoretical issues and statistical specification followed by results and findings. Discussion and conclusion form the final section.

2.2 Experimental procedure and summary statistics.

Our study draws data from a total of 192 students at the University of the Free State in South Africa. About 53% of the subjects were female and all the participants were enrolled for a Bachelor of Commerce Degree made up of Bachelor of commerce in economics, investment, law, administration, accounting, entrepreneurship, marketing, business management and human resources. All the students were enrolled for a Personal Finance module taught during August 2016 to December 2016. In short, the data was collected from the students before they were taught content on the Personal Finance module which is basically a financial literacy course.

The study uses Multiple Price List (MPL) experimental procedure modified to suit South African currency and context by the Research Unit in Behavioural Economics and Neuroeconomics (RUBEN) at the University of Cape Town in South Africa (Harrison et al., 2005; Holt and Laury, 2002; Andersen et al., 2008). Subjects completed (four) risk aversion and (four) time preference tasks. Each task had 10 binary choices meaning each subject completed 80 choices and the whole group completed 15 360 choices. Ten per cent of the participants were selected and paid for one of the eight tasks they played that was randomly chosen (Andersen et al., 2008).

The selection process for payment was by quota random sampling where an equal number of tickets equivalent to the number of participants were put in a hat and 10% were winning tickets. After picking a winning ticket, subjects toss a 10 sided dice until a number between 1 and 8

inclusive appears. If a number between 1-4 inclusive appeared after tossing a dice, the subject was paid for a time preference task, where '1' represented Task 1 and '4' represented Task 4. If the participant tosses a dice and a number between 5-8 appeared, they were paid for a risk preference task. Where a '5' represents the choice of risk preferences 'task 1' and '8' is the choice of risk preferences 'task 4'. The subjects were asked to tosses a 10 sided dice so that they can select one row from the task or game chosen. We paid subjects the actual amount of money depicted in the row chosen according to the instructions of the task. All the subjects were paid 50 rands participation fee.

Subjects also completed a questionnaire which captured their personal information, financial perceptions and financial behaviour. The Questionnaire was adapted from the National Financial Capability Study (NFCS) (Lusardi and Mitchell, 2011). The subjects also completed a 30 question financial literacy test that was part of the questionnaire. Questions in the financial literacy test were adopted from Jumpstart, Dollar sense, Knowledge Assessment Survey Questions and NFCS (Lusardi and Mitchell, 2011; LaBorde et al., 2013; Mandell, 2008). The participant(s) with the highest score in the test was rewarded a money prize of R200. The announcement of the R200 prize to be won was made before students participated in the experiment.

The research enlisted the services of two research assistants who assisted in distributing the document that included experimental tasks, questionnaire and a financial literacy test (Appendix, B). Students were instructed to sit one seat away from each other by creating a gap between the seats in the venue. The research assistants then distributed the document to the participants. The subjects were asked to fill in a consent form which indicated that participation in the study was voluntary. The researcher then read the instructions on how to play the time preference games and the participants were given time to play a demo game before playing the actual four games. This was followed by the reading of the instruction on how to play risk preference games and the subjects were given time to play a demo game before playing the actual four tasks. The games had written instructions included in the document and for clarity, the researcher read them first before the participants completed the tasks. Subjects then completed a personal information questionnaire and wrote a financial literacy test.

2.2.1 Measuring time preferences
Our study used MPL time preferences with two lotteries A and B where Option A represented impatient behaviour shown by choosing a small sooner (SS) choice and Option B represented patience signified by choosing larger later (LL) choice (Harrison et al., 2015; Andersen et al., 2008)

Each MPL game had ten decision rows with two choice options A or B and subjects had an option of choosing small sooner (SS) choice or Larger Later (LL) choice and all in all one subject made 40 choices of time preferences. The design of the MPL tables row 1 are as follows (Appendix, B). Table A/ task 1, subjects were asked to make a choice to receive R250 in one week (t=0) or R254.20 in one month and one week(τ =1), Table B, subjects were asked in row 1 to make a choice to receive R250 in one week (t=0) or R256.33 in three months and one week (τ =3), Table C, subjects were asked in row 1 to make a choice to receive R250 in one week (t=0) or R262.82 in six months and one week (τ =6) and Table D, subjects were asked in row 1, to make a choice to receive R250 in one week (t=0) or R276.29 in one year and one week (τ =12). The interest for the future period (larger Later) ranged from 10% in row 1 up to 100%

in row 10. In short the individual discount rates given as $IDR_{(t, \tau)}$ where (t) is present time choice SS paid in a week and τ is future time delivery larger later (LL). The LL time horizon in the experiment were 1 month, 3months, 6months and 12 months (Table 2.1).

Table 2.1: Typical payoff matrix for the time preference experiments

	Lottery A	Lottery B	Choose A or B	
row	Payment in one week	Payment in one month and one week		
1	R250	R250+ 10% interest=R252.09	A	B
2	R250	R250 +20% interest=R254.20	A	B
3	R250	R250+30% interest=R256.33	A	B
4	R250	R250+40% interest=R258.47	A	B
5	R250	R250+50% interest=R260.63	A	B
6	R250	R250+60% interest=R262.81	A	B
7	R250	R250+70% interest=R265.00	A	B
8	R250	R250+80% interest=R267.22	A	B
9	R250	R250+90% interest=R269.45	A	B
10	R250	R250+100% interest=R271.70	A	B

The participation fee and the risk preference game winners were paid on the day of the experiments and all the other payments were paid using *e-wallet* according to instructions in the games. *E-wallet* is an online banking system used by a South African financial institution. With the *e-wallet* online banking money is paid through a mobile phone number and the receiver does not incur a cost to withdraw the money from the bank. All subjects were asked to provide phone numbers on the payment forms which made it possible to send the prizes that were won. All time preferences winners were paid after a week to deal with present time bias (Harrison et al., 2004; Alan and Ertac, 2015).

2.2.2 Measuring risk preferences

Table 2.2: Typical payoff matrix for the risk aversion experiments

	Lottery A				Lottery B						
row	p	Rands	p	Rands	p	Rands	p	Rands	EV$_A$ in rands	EV$_B$ in rands	Difference in rands
1	0.1	60	0.9	50	0.1	100	0.9	25	51	32.5	18.5
2	0.2	60	0.8	50	0.2	100	0.8	25	52	40	12
3	0.3	60	0.7	50	0.3	100	0.7	25	53	47.5	5.5
4	0.4	60	0.6	50	0.4	100	0.6	25	54	55	-1
5	0.5	60	0.5	50	0.5	100	0.5	25	55	62.5	-7.5
6	0.6	60	0.4	50	0.6	100	0.4	25	56	70	-14
7	0.7	60	0.3	50	0.7	100	0.3	25	57	77.5	-20.5
8	0.8	60	0.2	50	0.8	100	0.2	25	58	85	-27
9	0.9	60	0.1	50	0.9	100	0.1	25	59	92.5	-33.5
10	1	60	0	50	1	100	0	25	60	100	-40

The subjects had an option of either choosing one row for either lottery A or lottery B. Choosing lottery B in row 1 shows a high degree of risk loving/seeking attitude while choosing lottery A in row 10 is a reflection of the high degree of risk aversion attitude. The four risk aversion tasks have four different prizes that appear follows; task/game 1(A1: 60 rands, 50 rands; B1: 100 rands, 25 rands), task/game 2 (A1:70 rands, 45 rands; B1: 110 rands, 10 rands), task/game 3 (A1: 200 rands, 120 rands; B1: 300 rands, 50 rands), task/game 4 (A1: 250 rands, 150 rands;

B1: 400 rands, 10 rands) (Appendix, B). The probabilities of winning in the tasks were the same for all tasks (Table 2.2). At the time of the experiment, the exchange rate was at 1USD: 12. 99 rands and the prizes won ranged between USD 1.54 (20 rands) to USD30.80 (400 rands).

2.3 Theoretical issues and statistical specification

The study follows the methodology applied by Harrison et al., (2015) and Andersen et al., (2008). The research data is analyzed using full information maximum likelihood structural models of unobserved choices processes (Harrison et al., 2015; Andersen et al., 2008). The risk preference and time preference models record the unobserved choice processes. Preferences analyses may involve an unobservable trade-off between short-run temptation (risk preferences) and long run optimization (time preferences) (Fudenberg and Levine, 2006; Benhabib and Bisin, 2005). The study used observed choice data from risk preference and time preference tasks to estimate the discount rates and risk preference parameters using the maximum likelihood models. The strength of the full information maximum likelihood models is that they use all the available data on risk and time preferences to estimate the parameters. It therefore means that each and every choice made a subject is used to calculate their risk preference parameter and their discount rate. Our analysis is premised on the canonical cases of expected utility (EU) and exponential (E) discounting.

The background consumption is set at zero for all subjects. Negative discount rates in our analysis showing the absence of background consumption are normal and are an indication of low discount rates for the subjects (Andersen et al., 2008). The research assumed a risk-neutral discounting model to allow us to calculate the individual discount rate of subjects for the MPL time preferences games (Andersen et al., 2008). Equating the two lotteries indicates that the subject is indifferent on the lotteries which allow us to calculate the individual discount rate at the level. The study specified the following equation:

$$M_t = (1/(1 + \delta)^\tau)M_{t+\tau} \qquad (2.1)$$

Where M_t is the monetary outcome at time t present time that provides a smaller sooner (SS) consumption, $M_{t+\tau}$ is the monetary outcome at time $t + \tau$ that yields a larger later (LL) future period consumption and δ is the individual discount rate. The paper calculated δ using the lottery prizes given in the MPL tables. Discount rates can only be inferred if one knows an individual's risk attitudes therefore discount rate experiments were not estimated separately but in conjunction with risk preference experiments. This catered for choice under risk situation in making time preference choices (Andersen et al., 2008).

The utility of income is given by the power utility function which shows constant relative risk aversion (CRRA) (*r*) as shown in (equation, 2.2):

$$U(M) = (\omega + M)^{(1-r)}/(1 - r) \qquad (2.2)$$

Where r≠ 1 , and if *r<0* the utility function is convex, showing risk loving or seeking behaviour, when *r=0* the utility function is linear, showing a risk neutrality behaviour and for *r>0* the utility function is concave revealing some risk aversion attitude. The paper assumed that the background consumption (ω) is zero. The shape of the utility function determines risk preferences under EU. Risk aversion has been concluded in a number of field and laboratory experiments for small and huge amounts offered on lotteries (Holt and Laury, 2002;Harrison et al., 2007). There is evidence of present biasedness when individuals are offered amounts of

money in the present time, but the passion disappears over choices of amounts offered on varied dates in future (Andersen et al., 2008). The study implemented a front-end-delay by paying all present-day choices after 7 days for the time preference experiment ruling the possibility of temptation and hyperbolic discounting. Subjects participating in a risk preference task are susceptible to temptation since the payment is disbursed on the present day that is, the day the games were played, assuming the absence of self-control.

Our tasks have two outcomes in each lottery and the EU for each risk preference lottery is

$$EU_i = \sum_{j=1,2}(p(M_j)XU(M_j/\eta)) = \sum_{j=1,2}(p(M_j)XU(M_j)) \qquad (2.3)$$

The paper assumes $\eta = 1$, in the risk aversion task, income earned instantaneously is thought to be divided over η periods of time. All risk preference tasks were paid on the day the experiment was carried leading to the assumption that income is divided in one period. The study calculated the EU for each lottery pair for estimate r using a simple stochastic specification by Holt and Laury (2002) by specifying the following ratio:

$$\nabla EU = EU_B^{1/u}/(EU_A^{1/u} + EU_B^{1/u}) \qquad (2.4)$$

Where EU_A stands for Option A, EU_B stands for Option B and u is a structural 'noise parameter' for the risk preference task (Wilcox, 2011). The index ∇EU is associated with choices made by subjects, the specification $\phi \nabla EU > 1/2$ is predicted if option B is selected in the lottery. The observed choices as well as the estimate of r and u determine the likelihood of risk aversion responses, conditional on the EUT and CRRA specification being true. The conditional log likelihood for the risk preference response is:

$$\ln L^{RA}(r;\mu;y;\omega;X) = \sum_i((\ln(\nabla EU)|y_i = 1) + (\ln(1 - \nabla EU)|y_{i=} = -1)) \qquad (2.6)$$

Where $y_i = 1(-1)$ stands for the choice of Option B(A) lottery in the risk preference lottery task i. The individual characteristics, that is, financial literacy, age, gender, financial decision-making status, multiple switching, and income are represented by variable X.

The paper specified an index of the difference between the present values conditional on r and δ for the time preference model as follows:

$$\nabla PV = PV_B^{1/v}/(PV_A^{1/v} + PV_B^{1/v}) \qquad (2.7)$$

Where v represents structural 'noise parameter' for the time preference choices. The conditional log likelihood for time preference is given as:

$$\ln L^{DR}(\delta;r;\mu;v;y;\lambda;X) = \sum_i((\ln(\nabla PV)|y_i = 1) + (\ln(1 - \nabla PV)|y_{i=} = -1)) \qquad (2.8)$$

Where $y_i = 1(-1)$ stands for the choice of Option B (A) lottery in the time preference lottery task i. The parameter λ defines the number of periods over which the delayed monetary amounts in the discount rate choices are divided over time (Andersen et al., 2008).

The joint likelihood estimation of the time and risk preferences responses is specified as follows:

$$\ln L(\delta;r;\mu;v;y;\lambda;X) = \ln L^{RA} + \ln L^{DR} \qquad (2.9)$$

The study ran an expected utility exponential function full information maximum likelihood regression analysis on homogenous preferences and then on heterogeneous preferences where the research controlled for individual characteristics. Harrison et al., (2015) recommended the use of full information maximum likelihood regression model in analysing multiple price experiment data. Single data point estimation fail to analyse all the information provided by the subjects in the experiment. The research also controlled for indifference in choices shown by individuals engaging in multiple switching over lotteries in the analysis for the total group of university students. The dummy variable of an individual multiple switching was coded '1' for multiple switching on a lottery and '0' otherwise. Multiple switching on lotteries is when subjects switch more than once between lotteries.

2.4 Results and findings

Of the 192 university students that participated in the study, about 53% of the subjects were females. A total of 15 360 risk preference and time preference choices were collected from the university students and used in the analysis. The average score in the financial literacy test was 40%, showing that there are low levels of financial literacy amongst university students. The lowest and the highest marks scored in the financial literacy test were 3% and 80% respectively. Roberts, Struwig and Gordon (2014) also reported low levels of financial literacy among South African citizens. The study asked the subjects to give the estimate of the amount of money they spend per month in the questionnaire. The average income spend in a month by each subject was R1543. The average age of the participants was 22.3 years, the oldest participant was 44years and the youngest was 18 years old.

Table 2.3: Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
female	192	0.53	0.4993	0	1
age	192	22.28	3.2346	18	44
income	192	1543.49	1189.03	500	10000
literacy	192	40.00	16.32	3.3	80

Other variables that were used in the analysis are financial decision-making status. The study asked students a question which required them to indicate if they made a financial decision on their own, made a financial decision jointly with somebody or they were non-financial decision makers. Students also indicated their geographical location whether they lived in urban or rural areas. The paper captured multiple switching on risk preference (switchR) and time preferences (switchIDR) with a dummy variable '1' multiple switching '0' otherwise.

2.4.1 Time preferences choices by financial literacy level

The study recorded all choices made by the subjects for all the time preferences and risk preference tasks played. If a subject chose option A it was coded choice '1' and if the subject chose option B we code the choice '0'. The research split the subjects by their financial literacy level. Subjects that scored a mark below average in the financial literacy test were categorised as low financial literacy group while subjects that scored a mark above average were categorised as high financial literacy group. Low financial literacy subjects stood at 52% while high financial literacy subjects constituted 48% of the participants. An average mark in a test reflects the mean score of the subjects in an assessment and can be used to represent the general performance of the whole group (Hilmer & Hilmer , 2014). All the 192 students made a total of 7680 (time preference) choices.
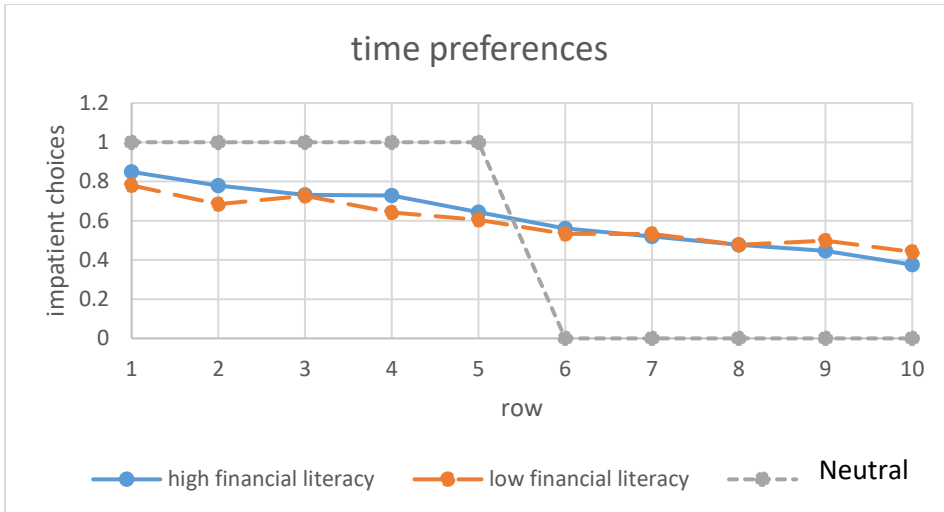
Figure 2.1: Time preferences choices for all tasks

The 7 680 choices for all time preferences tasks are represented in Figure 2.1. The study recorded the proportion of impatient choices selected by subjects (Figure 2.1). An individual who is neither patient nor impatient is expected to trace the 'neutral' curve. In all the tasks played, individuals with higher financial literacy were generally more impatient at low stakes of the lottery with the maximum proportion of impatient choices of about 90% selected in row 1 compared to 80% of low financial literacy group. High financial literacy students were more patient than low financial literacy at higher prize stakes, although the variation in patience attitude is not significant (also see Appendix A).

2.4.2 Risk preferences choices by financial literacy level
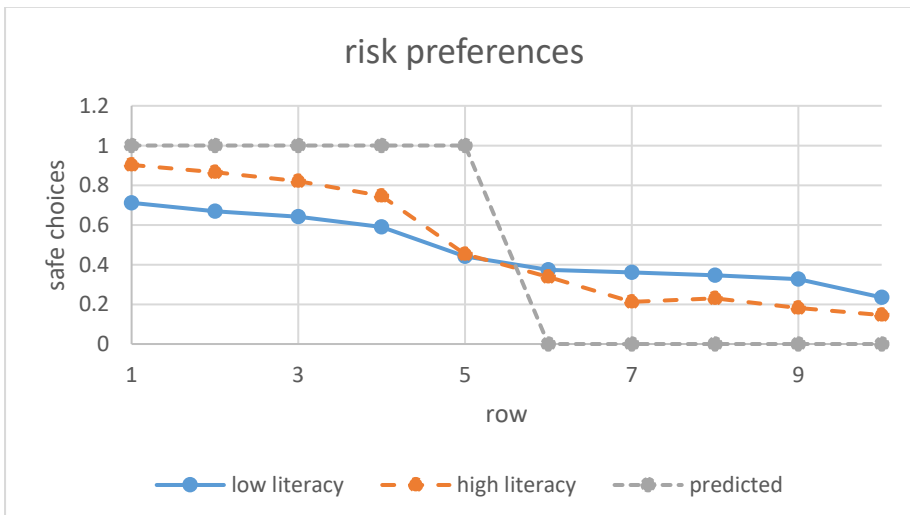
Figure 2.2: risk preferences choices for all tasks

The paper recorded a total of 7680 risk preference choices from selections made by a total of 192 students. All choices for option A in all the risk preference lotteries played were coded '1' and all choices for option B are coded '0'. Choosing option 'A' in row 1 is selecting a safe lottery and the study recorded proportion of safe choices made by subjects categorised by financial literacy. Figure 2.2 shows that subjects with high financial literacy were more risk averse when compared with low financial literacy subjects, although the variation in risk

attitudes is not significant. All in all, 90% of students with high financial literacy chose lottery A in row 1 for all tasks completed compared to 70% of the subjects with low financial literacy. High financial literacy subjects are more likely to trace the predicted safe choices when compared to low financial literacy subjects. The 'predicted' curve shows the choices a risk neutral individual is expected to make in the risk preference task.

2.4.3 Multiple switching between binary lotteries

Measuring risk preferences using MPL procedure has its own challenges and advantages (Frederick, 2005; Harrison et al., 2005). Measuring the individual level of risk aversion is only possible if the subject exhibits a unique switching point on the given binary choices. Multiple switching on option A or B in the tasks played is a sign of indifference or indecisiveness. The study split the subjects across financial literacy level and arranged the games according to the size of the prizes they offered, where task 1 or game 1 has a low prize and game 4 has the highest price (Table 2.4).

Looking at all the four risk preferences games played, an average of 43% all the participants, 49 % of subjects with low financial literacy and 34% of subjects with high financial literacy exhibited multiple switching across the binary choices lottery A or B. On average 45% of male subjects had multiple switching between lotteries A or B with a higher number of those with low financial literacy (49%) exhibiting the multiple switching traits compared to a lower number of those with high financial literacy (37%). On average 41% of all females, 48% of females with low financial literacy and 31% of females with high financial literacy switched multiple times that is, more than once between the lottery A or B. In all cases, that is, for games 1 to 4, subjects with low financial literacy exhibited a higher percentage of multiple price switching compared to their counterparts with high financial literacy. In game 4, male subjects with high and low financial literacy had the same percentage of multiple switching (47%), showing that as the prize became larger indecision between binary lotteries increased for all male subjects.

Table 2.4: Percentage of multiple switching subjects in the risk preference tasks.

Task	subjects	Average multiple Switching %	Low fin literacy Multiple switching	High fin Literacy Multiple switching
Composite all games played	All	43%	49%	34%
	male	45%	49%	37%
	female	41%	48%	31%
Task/Game 1- Table E	All	41%	50%	27%
	male	44%	49%	34%
	female	38%	51%	23%
Task/Game 2- Table F	All	43%	49%	34%
	male	44%	52%	30%
	female	41%	45%	36%
Task/Game 3- Table H	All	42%	49%	39%
	male	45%	48%	40%
	female	39%	44%	32%
Task/Game 4- Table G	All	45%	47%	43%
	male	47%	47%	47%
	female	43%	50%	34%

Moving on to all the four time preferences games played, 34% of all participants in the study exhibited multiple switching across the binary choices. Comparing the subjects by financial literacy level, subjects with low financial literacy had an average of 40% multiple switching, whereas subjects with higher levels of financial literacy had an average of 26% multiple switching. This shows that use of MPL method of eliciting time preferences and risk preferences is more suitable for people with higher cognitive ability. A higher percentage of multiple switching by lower financial literacy shows that university students are more likely to face indecision in making preference choices shown by indifference between lotteries. Indifference shows indecisiveness in making risk preferences and time preferences choices. If this behaviour is true in the real world, low financial literacy subjects will fail to optimize return from their preference choices. There was a higher percentage of multiple switching on lotteries for the risk preferences tasks as compared to time preferences which suggest that indifference or indecisiveness is higher when individuals are asked to make choices on risk tasks. It also shows that a risk preference task requires higher cognitive ability to complete (Andersen et al., 2008). Andersen et al. (2008) also pointed out that the risk preference behavioural error, that is, 'structural error' between lotteries is larger than the one for time preferences. Our study confirms their argument in as far as the behavioural error is concerned.

Table 2.5: Percentage of multiple switching subjects in the time preference tasks.

Task	subjects	Average multiple Switching %	Low fin literacy Multiple switching	High fin Literacy Multiple switching
Composite all games played	All	34%	40%	26%
	male	34%	37%	27%
	female	34%	42%	25%
Task/Game 1- Table A	All	34%	39%	27%
	male	36%	40%	29%
	female	33%	39%	26%
Task/Game 2- Table B	All	31%	38%	20%
	male	30%	34%	23%
	female	32%	43%	18%
Task/Game 3- Table C	All	36%	40%	31%
	male	33%	35%	29%
	female	39%	44%	32%
Task/Game 4- Table D	All	35%	42%	26%
	male	36%	40%	29%
	female	35%	44%	23%

Our findings are quite insightful. Lower financial literacy is highly associated with indifference and indecisiveness between the binary lotteries. The findings provide a laboratory observation of subjects with a different level of financial literacy and how they respond to risk financial decisions. Our results show that subjects with low financial literacy exhibited sub-optimal behaviour as they are more likely to struggle to choose a lottery that maximizes their utility. A *t-test* analysis showed a significant difference of risk preference choices by financial literacy level for all the four tasks (results can be provided on request). The variable financial literacy is represented as a dummy variable which made it possible to analyse a *t-test*. Our results are not unique, other studies have also concluded a high number of subjects making mistakes in binary choices tasks. Jacobson and Petrie (2009) in an experimental study with Rwanda adult population found that 50% of the subjects that participated in the study made at least one mistake in their choices. In our study, we treated multiple switching between lottery

A or B as committing financial decision mistakes or indecisiveness, although a number of studies have equated the action to indifference between lottery A and B (Meier and Sprenger, 2013;Harrison et al., 2005).

2.4.4 Financial literacy and indifference on lotteries

The study specified an Ordinary Least Squares regression model below:

$$FL = \alpha + \beta_1 D + \beta_2 R + \varepsilon \qquad (2.10)$$

Where FL is the financial literacy score, D is a dummy variable for multiple switching (SwitchIDR) in the time preference tasks coded '1' if individual multiple switches and '0' otherwise and R is a dummy variable for multiple switching (SwitchR) in the risk preference games coded '1' if individual multiple switch and '0' otherwise. The variable ε is an error term that is assumed to be random and normally distributed. The research investigated whether there is an association between subjects who engaged in multiple switching and financial literacy.

An ordinary least squares (OLS) regression analysis for all subjects without controlling for personal characteristics show that multiple switching between time preference and risk preference tasks significantly increases with low levels of financial literacy (Table 6, column 2). The coefficient of multiple switching on binary lotteries of the time preference tasks is (-1.63) and it is significant as 1% level. Students with low level of financial literacy are indecisive in making time preference choices. In addition, the coefficient of multiple switching on binary lotteries of risk preferences (-2.03) and it is significant at 1% level. The findings reveal that university with low financial literacy are more likely to be indecisive when making risk preference choices. Indecision in making choices might result in subjects making suboptimal and inconsistent choices that might not maximize their utility and benefits. There is evidence that suggest that financial literacy education is only beneficial to people who lack it (Lusardi & Mitchell, 2007).

Becchetti et al (2013) observed that financial literacy education is helpful to those with low levels of financial literacy, revealing that providing financial literacy to university students will reduce indecisiveness and commission of financial errors. There is research evidence that confirm that committing mistakes reduces benefits from choices. Jacobson and Petrie (2009) found out that subjects more likely to make mistakes were less likely to belong to savings group, as they became more risk averse. Prasad and salmon (2013) in their experiment found out that subjects that make inconsistent choices are more likely to earn low rewards. The research findings confirm that university students with low levels of financial literacy are more likely to make suboptimal choices. As they multiple switch across lotteries, they switch between lotteries with higher and low expected return vice-versa. Risk aversion for all subjects significantly increases with high levels of financial literacy at 5% level while impatience significantly increases at 10% level as financial literacy decreases. Research results from other studies on risk aversion and impatience are mixed. People with low IQ were found to be impatient and risk averse (Dohmen et al., 2010). Another study found a strong correlation between risk aversion and cognitive ability (S Huck & Weizsäcker, 1999).

Moving on to female university students, multiple switching on time preferences 'switchIDR' significantly increases at 1% level as financial literacy decreases. Impatience for female university students increases at 1% level of significance as financial literacy increases. Multiple switching on risk preferences lotteries 'switchR' significantly increases at 1% level as financial literacy decreases.

Table 2.6 : OLS Regression: Financial literacy, indifference on lotteries and determinants

	determinants	All	female	male	High literacy	Low literacy
switchIDR	-1.45***	-1.63***	-2.17***	-1.06***	-0.79***	-0.25***
	(0.103)	(0.106)	(0.139)	(0.160)	(0.122)	(0.071)
impatient	0.033**	-0.027*	0.070***	-0.14***	-0.023	-0.11***
	(0.013)	(0.014)	(0.021)	(0.017)	(0.015)	(0.008)
switchR	-1.36***	-2.03***	-2.38***	-1.45***	-0.85***	-0.62***
	(0.101)	(0.106)	(0.145)	(0.152)	(0.111)	(0.067)
Risk aversion	0.076***	0.039**	0.12***	-0.089***	-0.023	-0.070***
	(0.017)	(0.018)	(0.027)	(0.023)	(0.022)	(0.010)
female	0.59***					
	(0.080)					
age	-0.066***					
	(0.013)					
African	3.10***					
	(0.162)					
Asian	-1.17***					
	(0.261)					
colored	5.28***					
	(0.306)					
urban	1.26***					
	(0.085)					
single	3.57***					
	(0.141)					
divorced	2.64***					
	(0.146)					
investment_deg	-0.97***					
	(0.107)					
Law_deg	11.3***					
	(0.174)					
Admin_deg	-1.63***					
	(0.119)					
Accounting_deg	1.87***					
	(0.420)					
interpre_deg	5.20***					
	(0.300)					
Marketing_deg	-3.99***					
	(0.259)					
Mgnt_deg	-1.07***					
	(0.203)					
Hrm_deg	1.55***					
	(0.193)					
Non_decision	-2.09***					
	(0.108)					
Joint_decision	-2.14***					
	(0.099)					
income	0.0000027					
	(0.000)					
constant	7.70***	12.7***	12.9***	12.5***	17.3***	8.87***
	(0.422)	(0.086)	(0.131)	(0.111)	(0.099)	(0.046)
N	13909	15341	8079	7262	6144	8008
R^2	0.279	0.033	0.053	0.022	0.014	0.026

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

On the other hand, risk aversion for female respondents significantly increases at 1% level as financial literacy increases. Male respondents' indecisiveness or multiple switching on time preference lotteries significantly increases at 1% level as financial literacy decreases. Impatience among male university students significantly increases at 1% level as financial literacy decreases. Similarly, indecisiveness on risk preference lotteries for male university students significantly increases at 1% level as financial literacy decreases. The OLS results show that risk aversion in male participants significantly increases at 1% level as financial literacy decreases. Male students with low financial literacy are more likely to be risk averse.

The study classified participants with a financial literacy test score above average as high financial literacy group while those with a test score below average were low financial literacy group. Indecisiveness on time preference lotteries by students with high financial literacy significantly increased at 1% level as financial literacy of the students decreases. In addition, indecisiveness on risk preference binary lotteries by university students with high financial literacy increased as their financial literacy decreases. Impatience and risk aversion are not significantly associated with financial literacy of university students with high financial literacy. The results show that financial literacy reduces risk aversion and impatience among university students. Indecisiveness on time preference lotteries by university students with low financial literacy significantly increases at 1% level as financial literacy decreases, showing that students with lower levels of financial literacy are more likely to be undecided when making preferences. Further, impatience of university students with low financial literacy significantly increases at lower levels of financial literacy. Multiple switching on risk preference lotteries by university students with low financial literacy significantly increases at 1% level as financial literacy decreases. Finally, risk aversion for university students with low financial literacy significantly increases at 1% level at low levels of financial literacy.

The study included other student characteristics to investigate variables that are significantly associated with financial literacy in university students (Table 6, Column 1). Indecisiveness on time preference and risk preference lotteries by university students significantly increases at 1% level as the level of financial literacy decreases. Again confirming that students with lower levels of financial literacy are more likely to be indecisive when making risk and time preferences choices. Impatience and risk aversion of university students significantly increases with higher levels of financial literacy. Female university students were more likely to have high financial literacy at 1% level of significance. As age increases, university students were more likely to have low financial literacy at 1% level of significance. Belonging to the race African and Colored were significantly associated with high financial literacy while being Asian is significantly associated with low level of financial literacy at 1% level.

Geographical location of university students is associated with their financial literacy. Students residing in urban centres are more likely to have significantly high financial literacy at 1% level when compared to those from rural areas. Single and divorced students were more likely to have significantly high financial literacy at 1% level. The research examined the degree programs that are associated with high or low levels of financial literacy. Students enrolled in the investment degree, public administration degree, marketing degree and bachelor of commerce degree were more likely to have significantly low levels of financial literacy at 1% level. On the other hand, students pursuing bachelor of commerce law, accounting, entrepreneurship or industrial psychology degrees were more likely to hold significantly high levels of financial literacy at 1%.

The study explored the impact of financial decision status on influencing financial literacy. Given that a student is a financial decision maker, university students who are non-financial decision makers or joint financial decision makers were more likely to hold significantly low level of financial literacy at 1% level. The results show that actively participating in financial decision-making increase financial knowledge among university students. Van Rooij, Lusardi & Alessie (2011) found out that individuals who invested on the stock market had higher levels of financial literacy when compared to those that did not participate on the market. The study found no significant relationship between income and financial literacy.

2.4.5 Expected utility exponential function maximum likelihood estimations
The study results are based on a set of risk preferences and time preferences expected utility models which assume a utility function to be a constant relative risk aversion (CRRA) specification. The research investigated whether financial literacy impact risk preference and time preference choices. The study focused first on the risk preferences model then turned on to a joint estimation model with risk preference and time preference choices. Time preferences can only be elicited if we understand one's risk aversion parameter which stipulated the concavity of the utility function, hence our analysis focused on risk preferences first (Andersen et al., 2008). The paper further split the subjects based on their financial literacy and ran a maximum likelihood regression on subjects with high and low financial literacy separately.

The research initially ignored all subjects that had multiple switching between lottery options A or B in the analysis. The estimate of $r=0.679$ the CRRA parameter which is highly significant at 1% level show that there is a high level of risk aversion among the group of university students under consideration (Table 2.7). Our results show that the university students made behavioural errors (μ) in the risk preference task. The estimate of $(\mu) = -0.394$ is negative and highly significant at 1% level. The behavioural errors can be associated with 'structural error' that happens when subject make choices on lotteries.

Table 2.7: Expected utility theory ML estimates Homogenous risk preferences

	Coefficient	Std. Err.	z	P>z	95% Conf. Interval	
r	0.679	0.067	10.06	0.0000	0.5464	0.811
Error (μ)	-0.394	0.031	-12.61	0.0000	-0.788	-0.332
N=4431						
log pseudolikelihood = -2657.12						

Results account for clustering at the individual level

The paper estimated heterogeneous preferences by controlling for individual characteristics for subjects under consideration. The maximum likelihood regression allowed us to make risk parameter r a linear function of the individual characteristics of university students. Such that r= $r_0 + r_\beta X$ where r_0 is fixed parameter and r_β is a coefficient vector linked to individual characteristics (X) (Harrison et al., 2015). The study investigated whether financial literacy measured by the financial literacy test score is significantly associated with risk preferences. Our results show that the point estimate for financial literacy is -0.009 and the standard error 0.014 is not significantly associated with risk preferences (Table 2.8). The results show that financial literacy on its own without controlling for other individual characteristics does not influence risk preferences.

Table 2.8: Expected utility theory ml estimates heterogeneous risk preferences

	Coefficient	Std. Err.	z	P>z	95% Conf. Interval	
r						
literacy	-0.009	0.012	-0.77	0.439	-0.032	0.014
constant	0.784	0.163	4.82	0.000	0.465	1.103
Error (μ)	-0.394	0.031	-12.60	0.000	-0.456	0.333
N=4151						
log pseudolikelihood = -1912.66						

The study controlled for race, geographical location, gender, decision-making status, financial literacy, age and income subjects (Table 2.9). Our results show a weak impact of financial literacy on university students risk preferences. The point estimate of financial literacy is -0.007 and standard error of 0.004 with a probability value of 10.7%. Turning on to financial decision-making status variable, being a non-decision-maker has a risk preference point estimate of -0.077, standard error of 0.046 and is significantly related with risk preferences choices at 10% level.

On the other hand, being a joint-decision-maker is significantly associated with risk preferences at 5% level. The risk parameter point estimate of a joint-decision-maker is -0.082 and standard error of 0.042. Findings from financial decision-making status show that participation in financial decision making generally reduces risk aversion behaviour among university students. The variable age's risk preference point estimate is -0.025 and is significant at 5%. Age of the university students under spotlight significantly reduced their risk aversion. Turning on to the variable income, its risk preference parameter point estimate is 0.0001 and is significant at 1% level. Monthly income expenditure of the university students increased their risk aversion behaviour. Our findings on the relation between income and risk preferences might be a reflection of income challenges faced by university students. The maximum likelihood regression analysis in Table 2.9 shows a significant prevalence of behavioural error (μ) at 1% level. The risk preference behavioural error point estimate is -0.108 and standard error of 0.014.

Table 2.9: Expected utility theory ml estimates heterogeneous risk preferences

	Coefficient	Std. Err.	z	P>z	95% Conf. Interval	
r						
female	0.0304	0.039	0.78	0.434	-0.046	0.107
urban	0.059	0.045	1.32	0.186	-0.028	0.146
african	-0.018	0.093	0.2	0.844	-0.163	0.200
Asian	-0.054	0.123	-0.44	0.663	-0.295	0.187
colored	-0.029	0.085	-0.34	0.734	-0.195	0.138
non_decision_maker	-0.077	0.046	-1.67	0.095	-0.167	0.013
joint_decision_maker	-0.082	0.042	-1.98	0.048	-0.164	-0.001
literacy	-0.007	0.004	-1.61	0.107	-0.015	0.001
age	-0.025	0.012	-2.16	0.031	-0.047	-0.002
income	0.0001	0.000	2.91	0.004	0.0000	0.0001
_cons	3.321	0.297	11.18	0.000	2.739	3.903
Error (μ)	-0.108	0.014	-7.69	0.000	-0.135	-0.080
N=4146						
log pseudolikelihood = -1987.70						

Results account for clustering at the individual level

The homogenous expected utility time preference model assumes choice under risk and uses years as the time horizon. The estimate of CRRA for the whole group is r= 0.674 and is highly significant at 1% level, showing that the subjects in the whole group are risk averse. The risk preference behavioural error point estimate $(\mu) = -0.233$ is highly significant at 1% level.

Table 2.10: Discounting ml estimates expected utility theory and homogenous preferences

	Coefficient	Std. Err.	z	P>z	95% Conf. Interval	
r	0.674	0.079	8.5	0.000	0.519	0.830
delta _cons(δ)	0.731	0.111	6.57	0.000	0.513	0.950
noiseRA _cons(μ)	-0.233	0.019	-12.54	0.000	-0.467	-0.197
noiseDR _cons (v)	-10.902	6.035	-1.81	0.071	-22.730	0.926
N=8802						
log pseudolikelihood = -6134.23						

Results account for clustering at the individual level

The point estimate of $\delta = 0.731$ for the whole group shows a high discount rate and is significant at 1% level (Table 2.10). The whole group of university students are significantly impatient, that is, they are highly impatient. They are generally more likely to choose a small sooner (SS) choice for the time preference task. Our findings show that university students in general are less likely to save and invest their income, in fact, they fall in the larger category of South Africans who save less and spend more (Schwella and van Nieuwenhuyzen, 2014). The point estimate of the time preference behavioural error $v = -10.90$ is significant at 1% level. The study controlled for gender, race, geographical location, decision making status, literacy, age and income in a bid to investigate heterogeneous preferences for university students. Our results show a marginal decline of CRRA estimate to $r = 0.632$ and is significant at 1% level, showing that subjects are risk averse.

Table 2.11: Discounting ml estimates expected utility theory and heterogeneous preferences.

	Coefficient	Std. Err.	z	P>z	95% Conf. Interval	
r_cons	0.632	0.081	7.83	0.000	0.474	0.790
delta(δ)						
female	0.059	0.148	0.4	0.692	-0.231	0.348
urban	-0.106	0.157	-0.67	0.5	-0.414	0.202
african	-0.019	0.332	-0.06	0.955	-0.669	0.632
Asian	-0.208	0.677	-0.31	0.758	-1.536	1.119
colored	0.027	0.479	0.06	0.955	-0.911	0.965
non_decision_maker	-0.218	0.188	-1.16	0.247	-0.587	0.151
joint_decision_maker	-0.197	0.192	-1.02	0.306	-0.5738	0.1800
literacy	-0.012	0.013	-0.9	0.369	-0.0378	0.0140
age	0.022	0.018	1.22	0.221	-0.013	0.057
income	0.000	0.0001	-0.64	0.524	-0.0001	0.0001
_cons	0.613	0.632	0.97	0.332	-0.626	0.851
noiseRA _cons(μ)	-0.230	0.019	-12.17	0.000	-0.267	-0.193
noiseDR _cons (v)	-7.780	4.499	-1.73	0.084	-16.597	1.038
N=8802						
log pseudolikelihood = -4929.03						

Results account for clustering at the individual level

The risk preference behavioural error $\mu = -0.230$ is highly significant at 1% level. Our results show a time preference behavioural error with point estimate $v = -7.780$ is significant at 10% level (Table 2.11). Our findings show that the risk preference behavioural error is more significant than the time preference behavioural error. The findings confirm that a risk preference task requires more cognitive input in completing it than a time preference task (Andersen et al., 2008). All variables controlled for, including financial literacy, are not significantly associated with time preferences.

2.4.6 Low financial literacy, risk preferences and time preferences
The study categorised university students by their financial literacy level.

Table 2.12: Expected utility theory ML estimates Homogenous risk preferences

	Coefficient	Std. Err.	z	P>z	95% Conf. Interval	
r _cons	0.761	0.147	5.18	0.000	0.473	1.049
noise_cons(μ)	-0.294	0.035	-8.49	0.000	-0.361	-0.226
N=2050						
log pseudolikelihood = -1145.25						

Results account for clustering at the individual level

The paper ran a maximum likelihood estimates expected utility exponential function model on homogenous risk preferences for university students with low financial literacy. The estimate of CRRA parameter r=0.761 is significant at 1% level and shows that the subjects in the group are risk averse. The point estimate of the risk preference behavioural error is negative and significant at 1% level (Table 2.12). The research investigated heterogeneous risk preference choices in an expected utility exponential function by controlling for individual characteristics of university students. The point estimate of financial literacy is -0.057 and is highly significant at 1% level. Financial literacy significantly reduces risk aversion. The study findings show that financial literacy is significantly related to risk preferences of low financial literacy subjects.

Table 2.13: Expected utility theory ML estimates Heterogeneous risk preferences

	Coefficient	Std. Err. z	Z	P>z	95% Conf. Interval	
r						
female	0.035	0.050	0.7	0.482	-0.063	0.134
urban	-0.006	0.063	-0.1	0.922	-0.129	0.117
Asian	-0.040	0.078	-0.51	0.609	-0.194	0.114
colored	-0.122	0.097	-1.26	0.207	-0.311	0.067
non_decision_maker	-0.036	0.072	-0.49	0.621	-0.178	0.106
joint_decision_maker	-0.058	0.064	-0.9	0.366	-0.183	0.067
literacy	-0.057	0.019	-3.01	0.003	-0.094	-0.020
age	-0.030	0.018	-1.67	0.095	-0.065	0.005
income	0.0001	0.00003	3.74	0.000	0.00005	0.0002
cons	4.097	0.496	8.26	0.000	3.124	5.069
noise _cons(μ)	-0.139	0.024	-5.79	0.000	-0.186	-0.092
N=1890						
log pseudolikelihood = -1016.85						

Results account for clustering at the individual level

The impact of financial literacy on risk preferences is prominent for the low financial literacy group but not on the high financial literacy group. Our results confirm findings by Lusardi and

Mitchell (2007) and Betchetti et al (2013) who pointed out that financial literacy education benefits more people who lack it. Age is significantly associated with the risk aversion at 10% level while income significantly increases risk aversion amongst university students with low financial literacy at 1% level. Experience which is normally represented by age plays a significant role in making risk preference choices. Previous experiences in risk preferences determine how one makes future risk preference selections (Appendix A). Risk preferences of subjects with high financial literacy are not significantly associated with financial literacy, which shows that financial literacy has little impact on those who already have it as they behave in a similar way (Table 2.21). Risk preference choice of individuals with high financial literacy is related to other factors other than financial literacy. If everyone else has financial literacy the effect of financial literacy on risk preference choices cannot be easily determined.

Table 2.14 presents discounting model results assuming an expected utility exponential function on homogenous time preferences. University students are risk averse with a risk aversion parameter estimated as r=0.765 and it is significant at 1% level. The whole group of university students with low financial literacy have significantly high discount rate δ=0.824, showing that they are generally impatient. The discount rate is higher than the total group discount rate δ=0.731. The risk preference behaviour error is negative and highly significant at 1% level. On the other hand, the time preferences behavioural error is not significant.

Table 2.14: Discounting ml estimates expected utility theory and homogenous preferences

	Coefficient	Std. Err.	z	P>z	95% Conf. Interval	
r _cons	0.765	0.145	5.29	0.000	0.482	1.048
delta _cons(δ)	0.824	0.222	3.71	0.000	0.388	1.259
noiseRA_cons(μ)	-0.294	0.035	-8.49	0.000	-0.361	-0.226
noiseDR_cons(v)	-24.164	24.148	-1	0.317	-71.494	23.166
N=4501						
log pseudolikelihood = -2944.64						

Results account for clustering at the individual level

Table 2.15 presents discounting model results assuming an expected utility exponential function on heterogeneous time preferences. The total group of low financial literacy students is significantly risk averse at 1% level with an estimate of risk aversion r=0.655, showing that joint estimation reduces the risk preference parameter and the discount rate (Andersen et al., 2008). The point estimate of financial literacy is negative and significant at 5% level. The results show that financial literacy is significantly associated with discount rates of university students with low financial literacy. Financial literacy is associated with a lower discount rate δ=-0,132, showing that financial literacy increases patience among university students with low financial literacy.

Our findings show that financial literacy is significantly associated with risk preferences and time preferences of university students with low financial literacy, which explains why financial literacy education benefits people with low levels of financial literacy more than people who already have financial literacy (Lusardi and Mitchell, 2007). Financial literacy is significantly related to risk preferences and time preferences of university students who lack financial literacy than those who already have it. Our analysis on risk preferences and time preferences of subjects with high financial literacy found no individual characteristics which are significantly related to their risk aversion and discount rates (Table 2.21 in Appendix A).

Table 2.15: Discounting ml estimates expected utility theory and heterogeneous preferences

	Coefficient	Std. Err.	z	P>z	95% Conf. Interval	
r _cons	0.655	0.150	4.36	0.000	0.361	0.950
delta(δ)						
female	-0.215	0.214	-1.00	0.316	-0.635	0.205
urban	-0.227	0.321	-0.71	0.48	-0.857	0.403
colored	-0.207	0.321	-0.64	0.52	-0.836	0.422
non_decision_maker	-0.372	0.325	-1.14	0.252	-1.008	0.265
joint_decision_maker	-0.168	0.317	-0.53	0.596	-0.790	0.453
literacy	-0.132	0.060	-2.21	0.027	-0.250	-0.015
age	0.042	0.052	0.81	0.418	-0.060	0.145
income	0.00002	0.0001	0.19	0.846	-0.0002	0.0002
_cons	1.346	1.255	1.07	0.283	-1.113	3.806
noiseRA _cons(μ)	-0.283	0.034	-8.25	0.000	-0.351	-0.216
noiseDR _cons(ν)	-9.771	10.582	-0.92	0.356	-30.511	10.970
N=4071						
log pseudolikelihood = -2430.57						

Results account for clustering at the individual level

The risk preference behavioural error is negative and significant at 1% level while the time preference behavioural error is not significant. Only the risk preference parameter, homogeneous preference discount rate and the risk preference behavioural error were significant at 1% level for university students with high financial literacy (Table 2.20& 2.21, Appendix A).

2.4.7 Multiple switching, risk and time preferences.

Table 2.16: Expected utility theory ML estimates Homogenous risk preferences

	Coefficient	Std. Err.	z	P>z	95% Conf. Interval	
r _cons	0.679	0.067	10.06	0.0000	0.546	0.811
noise_cons(μ)	-0.394	0.031	-12.61	0.0000	-0.789	-0.333
N=7680						
log pseudolikelihood = -4671.14						

Results account for clustering at the individual level

In Table 2.17, the study presented results on all subjects including those who made multiple switching over lotteries. The paper recorded a total of 15 360 risk preferences and time preferences choices made by the subjects. The homogeneous risk preferences expected utility exponential function maximum likelihood estimation shows that the university students are significantly risk averse, *r=0.679* at 1% level. The risk preference choice behavioural error for the university students is negative and significant at 1% level. The research controlled for individual characteristics in a bid to estimate the heterogeneous risk preference expected utility exponential function. Our results show that financial literacy does not is not significantly related to risk preference choices of the total group of university students. The paper also controlled for multiple switching in the risk preference tasks.

Table 2.17: Expected utility theory ML estimates Heterogeneous risk preferences

	Coefficient	Std. Err. z	Z	P>z	95% Conf. Interval
r					
female	-0.006	0.032	-0.18	0.858	-0.067 0.056
urban	0.010	0.032	0.33	0.739	-0.051 0.072
african	-0.060	0.092	-0.66	0.511	-0.240 0.119
Asian	-0.117	0.114	-1.02	0.308	-0.342 0.108
colored	-0.056	0.092	-0.61	0.542	-0.236 0.124
non_decision_maker	-0.033	0.032	-1.04	0.299	-0.095 0.029
joint_decision_maker	-0.003	0.032	-0.11	0.915	-0.066 0.059
literacy	-0.001	0.003	-0.34	0.73	-0.007 0.005
age	0.001	0.006	0.23	0.819	-0.011 0.014
income	0.00001	0.00001	1.32	0.188	-0.000 0.000
switchR	0.142	0.031	4.62	0.000	0.082 0.203
_cons	3.401	0.208	16.39	0.000	2.995 3.808
noise _cons(μ)	-0.298	0.022	-13.46	0.000	-0.341 -0.255
N=7075					
initial: log pseudolikelihood = -4216.87					

Results account for clustering at the individual level

Multiple switching on risk preference lotteries A or B 'switchR' is significantly associated with risk preferences choices at 1% level. Multiple switching across risk preference choices A or B increased risk aversion amongst all university students under consideration. Multiple switching shows indifference on lottery choices and in this research case we treated them as indecisiveness (Charness et al., 2013). The risk preference behavioural error (μ) is significantly related to risk preference choices of university students. The behavioural error is negative. Other individual characteristics are not significantly associated with risk preference choices of university students (Table 2.18).

The study estimated the homogeneous preferences discounting model for all the subjects in Table 2.18. The estimate of risk aversion is negative and significant at 1% level. When the paper included subjects that engage in multiple switching between lotteries A or B, the whole group of university students became risk seeking. On the other hand, the estimate of the discount rate is negative and significant at 1% level. Multiple switching across lotteries reduced the overall discount rate of the subjects. Our findings show that multiple switching on lotteries is associated with risk seeking and patience among university students. The risk preferences and time preferences behavioural errors were negative and also significant at 1% level.

Table 2.18: Discounting ml estimates expected utility theory and homogenous preferences

	Coefficient	Std. Err.	z	P>z	95% Conf. Interval
r _cons	-0.000007	0.00000006	-11.6	0.000	-0.000001 -0.0000006
delta _cons(δ)	-0.000006	0.000000006	-91.27	0.000	-0.000001 -0.0000006
noiseRA_cons(μ)	-0.559	0.046	-12.09	0.000	-1.117 -0.468
noiseDR_cons(v)	-0.000004	0.00000004	-10.84	0.000	-0.0000009 -0.0000004
N=15360					
log pseudolikelihood = -10192.116					

Results account for clustering at the individual level

Table 2.19: Discounting ml estimates expected utility theory and heterogeneous preferences

	Coefficient	Std. Err.	z
r _cons	-0.0000007***	0.00000009	-7.36
delta(δ)			
female	-0.00000003	0.00000008	-0.42
urban	0.00000006	0.00000008	0.76
african	0.00000009	0.0000003	0.31
Asian	0.0000002	0.0000004	0.57
colored	0.00000008	0.0000003	0.26
non_decision_maker	0.0000001	0.00000009	1.12
joint_decision_maker	0.0000001	0.00000009	1.24
literacy	0.000000002	0.000000008	0.27
age	-0.00000002	0.00000001	-1.34
income	0.000000000009	0.00000000003	0.26
_cons	-0.0000004	0.0000004	-0.89
noiseRA _cons(μ)	-0.523***	0.042	-12.45
noiseDR _cons(v)	-0.0000004***	0.00000006	-6.86
N=14160			
log pseudolikelihood = -9103.59			

Results account for clustering at the individual level. Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The research presented the heterogeneous preferences discounting model in Table 2.19. The estimate of risk aversion is negative and significate at 1% level, showing that subjects were risk seeking. The risk preferences and time preference behavioural errors are significant at 1% level and are negative. All other variables are not significantly related to discount rate of university students when the paper considered heterogeneous time preferences.

2.4.8 Financial literacy and discounting behaviour
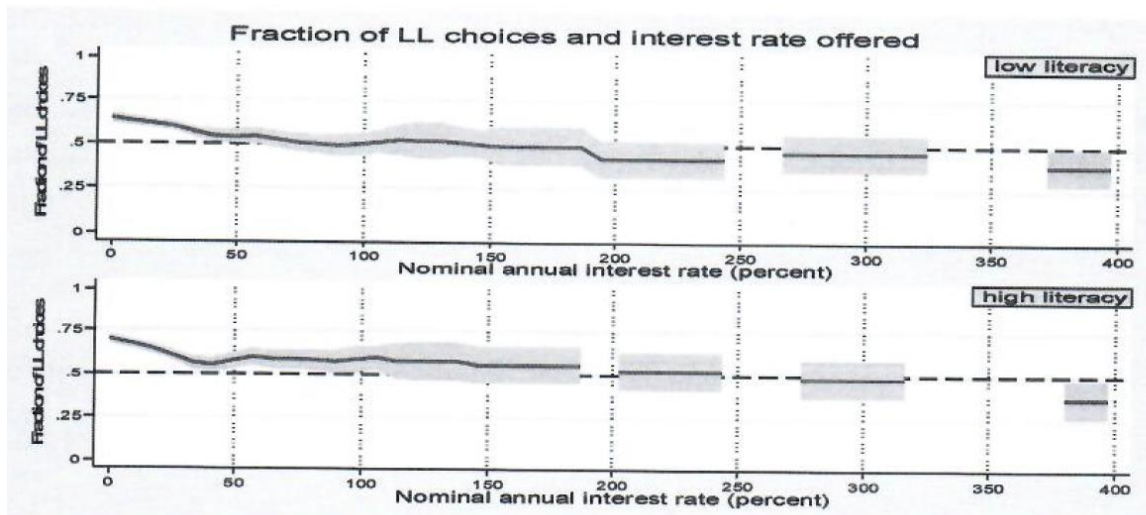
Figure 2.3: Fraction of Large Later choices and interest rate offered

The paper plotted the Larger later choices made by university students categorised by their financial literacy level. Figure 2.3 shows a kernel-weighted local polynomial regression, with

a 95% confidence interval, of the fraction of larger later (LL) choices by low financial literacy and high financial literacy university students for the nominal annual interest rates on offer in the time preference tasks. At each interest rate, the point estimate of the fraction of LL choices by lower financial literacy students is less than the point estimate of the fraction of LL choices by high financial literacy students, and the 95% confidence intervals do overlap. This suggests that low financial literacy subjects discount more than high financial literacy subjects, although there is no statistical significance. In short, high financial literacy subjects are more patient when compared to low financial literacy subjects. There are studies that have concluded that an increase in education makes individuals patient (Lawrance, 1991; Van der Pol, 2011). Our results confirm that high financial literacy is associated with perseverance and patience in the short and medium time horizon but not in the long time horizon of 12 months. The proportion of LL choices decline as the time horizon increases going against the assumption that university students could have to engage in quasi-hyperbolic discounting. The study findings contradict conclusions by Andersen et al., (2008), they found quasi-hyperbolic discounting behaviour among Danish subjects in an experiment carried out in Denmark.

2.5 Conclusion

The research examined the impact of financial literacy on risk preference and time preference choices of university students using multiple price list incentivized experimental method and a joint estimation approach to data analysis. In our data analysis, we followed joint estimation methodology that was applied by Harrison et al., (2015) and Andersen et al., (2008), which characterizes time preferences over utility flows instead of flows of money. Our analysis used maximum likelihood estimation on expected utility exponential function focusing on homogeneous and heterogeneous preferences for the university students. The study initially ignored subjects who made multiple switching choices between lotteries in our analysis. The paper then split the subjects according to their financial literacy level where students that scored a financial literacy test mark above average were categorised as high financial literacy while those who scored a mark below average were classified as low financial literacy. The research spread the analysis to the whole group controlling for multiple switching in the risk preference task. The paper also plotted a fraction of larger later choices made by high and low financial literacy subjects on the time preference tasks. The study also explored the relationship between indifference or indecisiveness on risk preferences as well as time preferences and financial literacy.

The study observed that financial literacy is significantly associated with risk preferences and time preferences of university students with low financial literacy, showing that financial literacy education should be targeted more on university students with low financial literacy. Providing financial literacy education to university students with high financial literacy might not accrue benefits to them. An investigation by Lusardi and Mitchell (2007) shows that financial literacy education benefitted more people who had low financial literacy. This shows that variation in risk preferences and time preferences choices due to financial literacy is more prominent for low financial literacy group when compared to the high financial literacy group. Financial literacy is associated with a reduction in risk aversion and the low discount rate for subjects with low financial literacy, revealing that financial literacy is associated with some patient attitude among university students with low financial literacy. The paper did not find the impact of financial literacy on risk preferences and time preferences choices of the high financial literacy group and the total group for university students.

In addition, our findings on the whole group show that multiple switching is significant for the risk preference tasks, revealing that indifference or indecision is prevalent in making risk preferences. Our ordinary least squares regression analysis show that indecisiveness or indifference increases on risk preferences and time preferences choices as financial literacy decreases, reflecting that university students with low financial literacy are more likely to make mistakes when they complete risk preferences and time preferences choices, showing that providing financial literacy education to university students with low financial literacy will help them to reduce mistakes when making risk preference and time preference choices.

Further, the study found that risk preference behavioural error is significantly greater than time preference behavioural error for all instances showing that risk preference task required higher cognitive ability. In all our analyses except where the study incorporated multiple switching on lotteries, the subjects had generally high discount rate and were risk averse, showing that the whole group of university students were generally risk averse and impatient. Our findings show that university students are less likely to save and invest their income as they are impatient. University students are less likely to take the risk. There is a need to inculcate the culture of saving and investment among university students. When the research included subjects who engaged in multiple switching on lotteries subjects became generally risk seeking and had a low and negative discount rate. The paper also concluded that subjects with low financial literacy made fewer proportions of larger later 'patient' choices in the time preference task compared to university students with high financial literacy, reflecting that higher financial literacy is associated with patience.

This study is one of the few studies that include utility function curvature in the estimation of time preference models. It is also the first study in South Africa to investigate the impact of financial literacy on risk preferences and time preferences of subjects using multiple price list incentivized experiment method. The paper also shows in an experimental setting that university students with low financial literacy have difficulties in making risk preference and time preferences choices hence they have a significant indifference over lotteries. If these findings can be confirmed in other studies, this will go a long way in explaining why people with low financial literacy do not generally achieve better financial life outcomes. In our exploration, research also found out that age, income and decision making status are significantly related to risk preferences of university students. Income was found to significantly increase risk aversion.

Our research has its own set of limitations. University students studying an undergraduate commercial degrees' financial literacy cannot be representative of the financial literacy levels of the South African population. Comparing the results of our findings with the total population of South Africa might not portray a true picture. It is also difficult to tell whether incentivized risk preference and time preferences rewards can elicit the true attitudes of individuals. However, this study provides a starting point to carry further research with a representative population of South Africa using the methodology and tools applied in the research.

Setting aside these limitations, our study provides an outline of ways to analyse the relationship between financial literacy, risk preferences and time preferences. Further studies can focus on investigating the impact of financial literacy on risk preferences and time preferences, particularly on a representative South African population. If these results can be confirmed; we will have a deeper understanding of how financial literacy interact with preferences.

2.6 References

Alan, S., Ertac, S., 2015. Patience, self-control and the demand for commitment: Evidence from a large-scale field experiment. J. Econ. Behav. Organ. 115, 111–122.

Andersen, S., Harrison, G.W., Lau, M.I., Rutström, E.E., 2008. Eliciting risk and time preferences. Econometrica 76, 583–618.

Becchetti, L., Caiazza, S. & Coviello, D. 2013. Financial education and investment attitudes in high schools: evidence from a randomized experiment. *Applied Financial Economics*. 23(10):817–836.

Benhabib, J, and A Bisin. 2005. "Modeling Internal Commitment Mechanisms and Self-Control: A Neuroeconomics Approach to Consumption–saving Decisions." Games and economic behavior 52: 460–92. https://www.sciencedirect.com/science/article/pii/S0899825604001630 (July 22, 2018).

Benjamin, D.J., Brown, S.A., Shapiro, J.M., 2013. Who is "behavioral"? Cognitive ability and anomalous preferences. J. Eur. Econ. Assoc. 11, 1231–1255. doi:10.1111/jeea.12055

Brocas, I., Carillo, J.D., 2006. The Brain as a Hierarchical Organization By The Brain as a Hierarchical Organization. Econ. Policy 1312–1346. doi:10.1257/aer.98.4.1312

Burks, S. V., Carpenter, J.P., Goette, L., Rustichini, A., 2009. Cognitive skills affect economic preferences, strategic behavior, and job attachment. Proc. Natl. Acad. Sci. 106, 7745–7750. doi:10.1073/pnas.0812360106

Charness, G., Gneezy, U., Imas, A., 2013. Experimental methods: Eliciting risk preferences. J. Econ. Behav. Organ. 87, 43–51. doi:10.1016/j.jebo.2012.12.023

Delavande, A., Rohwedder, S., Willis, R.J., 2008. Preparation for Retirement, Financial Literacy and Cognitive Resources. SSRN Electron. J. doi:10.2139/ssrn.1337655

Dohmen, T., Falk, A., Huffman, D., Sunde, U., 2010. Are Risk Aversion and Impatience Related to Cognitive Ability? Am. Econ. Rev. 100, 1238–1260. doi:10.1257/aer.100.3.1238

Eckel, C.C., Johnson, C., Montmarquette, C., Rojas, C., 2007. Debt aversion and the demand for loans for postsecondary education. Public Financ. Rev. 35, 233–262. doi:10.1177/1091142106292774

Eliaz, K., Ok, E.., 2006. Indifference or indecisiveness? Choice-theoretic foundations of incomplete preferences. Games Econ. Behav. Elsevier 56, 61–86.

Frederick, S., 2005. Cognitive Reflection and Decision Making. J. Econ. Perspect. 19, 25–42. doi:10.1257/089533005775196732

Frederick, S., Loewenstein, G., O'donoghue, T., 2002. Time Discounting and Time Preference: A Critical Review. J. Econ. Lit. 40, 351–401. doi:10.1257/jel.40.2.351

Fudenberg, Drew, and David K Levine. 2006. "A Dual-Self Model of Impulse Control." The American Economic Review 96(5): 1449–76. http://www.jstor.org/stable/30034982.

Harrison, G.W., Harstad, R.M., Rutström, E.E., 2004. Experimental methods and elicitation of values. Exp. Econ. 7, 123–140.

Harrison, G.W., Lau, M.I., Rutström, E.E., 2007. Estimating risk attitudes in Denmark: A

field experiment*. Scand. J. Econ. 109, 341–368.

Harrison, G.W., Lau, M.I., Rutström, E.E., Sullivan, M.B., 2005. Eliciting risk and time preferences using field experiments: Some methodological issues. pp. 125–218. doi:10.1016/S0193-2306(04)10005-7

Harrison, W.G., Hofmeyr, A., Ross, D., Swarthout, T., 2015. Risk preferences, time preferences and smoking behaviour. CEAR Work. Pap. 2015-11.

Hilmer, C. E. & Hilmer, M. J. 2014. Practical econometrics. data collection, analysis and application.McGrall-Hill, New York. https://doi.org/9780071318518

Holt, C.A., Laury, S.K., 2002. Risk aversion and incentive effects. Am. Econ. Rev. 92, 1644–1655.

Huck, S., Weizsäcker, G., 1999. Risk, complexity, and deviations from expected-value maximization: Results of a lottery choice experiment. Psychol. J. Econ. Elsevier 20, 699–715.

Jacobson, S., Petrie, R., 2009. Learning from mistakes: What do inconsistent choices over risk tell us? J. Risk Uncertain. 38, 143–158. doi:10.1007/s11166-009-9063-3

LaBorde, P.M., Mottner, S.W., 2013. Personal Financial Literacy: Perceptions of Knowledge, Actual Knowledge and Behavior of College Students. J. Financ. Educ. 39, 1–30.

Lawrance, Emily C. 1991. "Poverty and the Rate of Time Preference: Evidence from Panel Data." *Journal of Political Economy* 99(11): 54–77. http://www.journals.uchicago.edu/doi/10.1086/261740 (March 28, 2018).

Lusardi, A., Mitchell, O.S., 2011a. Financial literacy around the world: an overview Financial literacy around the world : an overview. J. Pension Econ. Financ. 10, 497–508. doi:10.1017/

Lusardi, A., Mitchell, O.S., 2011b. Financial literacy around the world: an overview. J. Pension Econ. Financ. 10, 497–508.

Mandell, L., 2008. Financial Literacy of High School Students. New York 163–183.

Meier, S., Sprenger, C.D., 2013. Discounting financial literacy: Time preferences and participation in financial education programs. J. Econ. Behav. Organ. 95, 159–174.

Parker, A.M., Fischhoff, B., 2005. Decision-making competence: External validation through an individual-differences approach. J. Behav. Decis. Mak. 18, 1–27. doi:10.1002/bdm.481

Prasad, K., Salmon, T.C., 2013. Self Selection and market power in risk sharing contracts. J. Econ. Behav. Organ. 90, 71–86. doi:10.1016/j.jebo.2013.03.007

Roberts, B., Struwig, J. & Gordon, S. 2014. Financial Literacy in South Africa: Results from the 2013 South African Social. Pretoria. Available: http://benefitsbarometer.co.za/wp-content/uploads/2015/02/Financial-Literacy-Report.pdf.

Schwella, E., van Nieuwenhuyzen, B., 2014. Measuring financial literacy: Developing and testing a measurement instrument with a selected group of South African military officers. Africa Educ. Rev. 11, 365–385. doi:10.1080/18146627.2014.934993

Shambare, Richard, and Robert Rugimbana. 2012. "Financial Literacy among the Educated:

An Exploratory Study of Selected University Students in South Africa." Thunderbird International Business Review 54(4): 581–90. http://doi.wiley.com/10.1002/tie.21485 (January 26, 2019).

Van der Pol, M., 2011. Health, education and time preference. Health Econ. 20, 917–929. doi:http://dx.doi.org/10.1002/hec.1655

Van Rooij, M, A Lusardi, and R Alessie. 2011. "Financial Literacy and Stock Market Participation." Journal of Financial Economics 101(2): 449–72. https://www.sciencedirect.com/science/article/pii/S0304405X11000717 (August 6, 2018).

Whitney, P., Rinehart, C.A., Hinson, J.M., 2008. Framing effects under cognitive load: The role of working memory in risky decisions. Psychon. Bull. Rev. 15, 1179–1184. doi:10.3758/PBR.15.6.1179

Wilcox, N.T., 2011. 'Stochastically more risk averse:'A contextual theory of stochastic discrete choice under risk. Journal of Econometrics 162, 89–104.

2.7 Appendix A

1. Time preference tasks
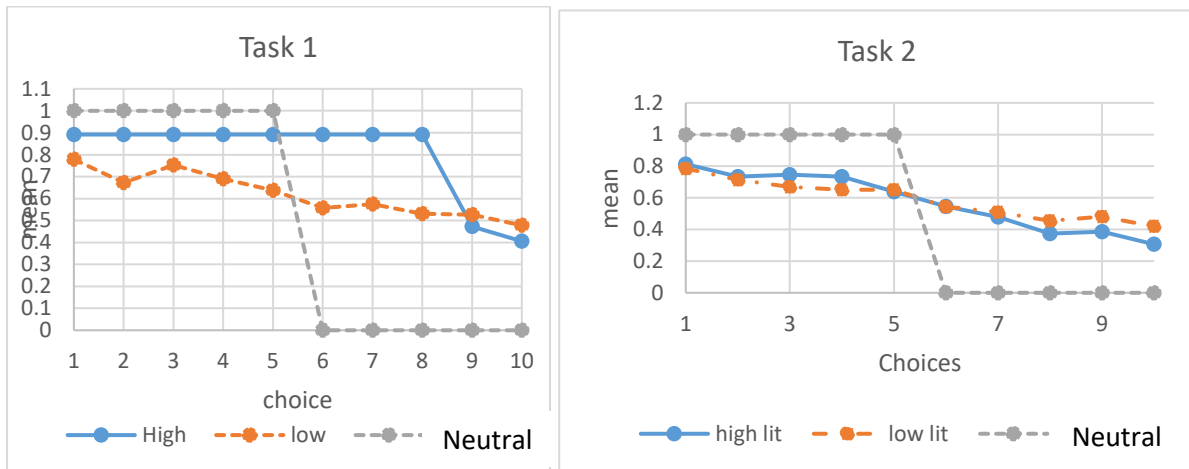
Figure 2.4 & 0.5: Time preferences task 1&2
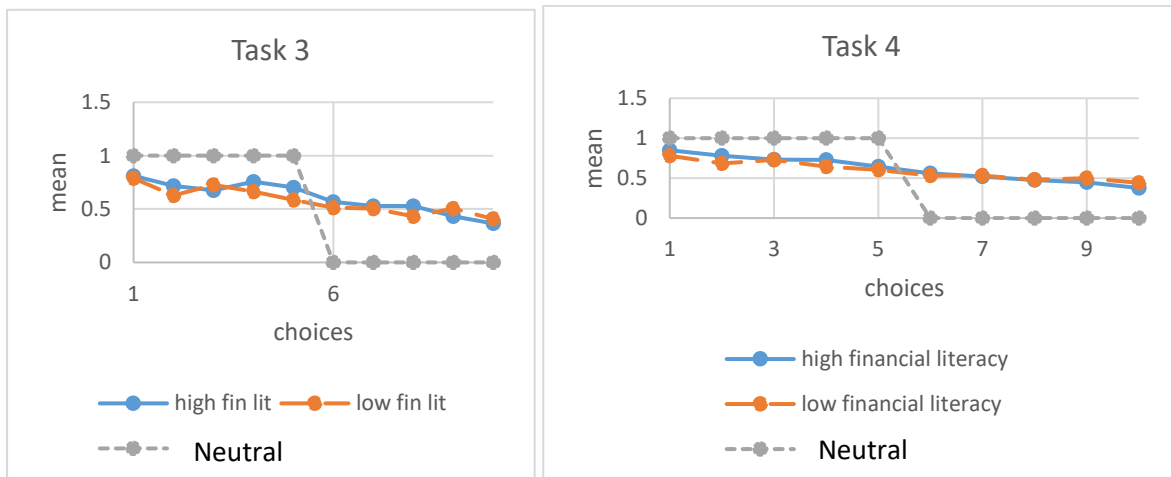
Figure 2.6 & 2.7: Time preferences task 3&4

2. risk preference tasks
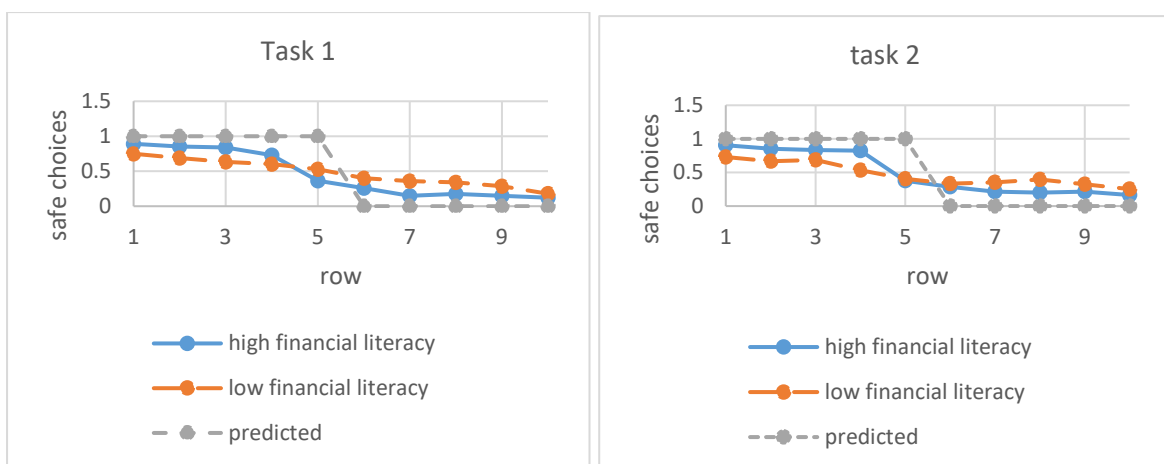
Figure 2.8 & 2.9: Risk preferences task 1&2

61
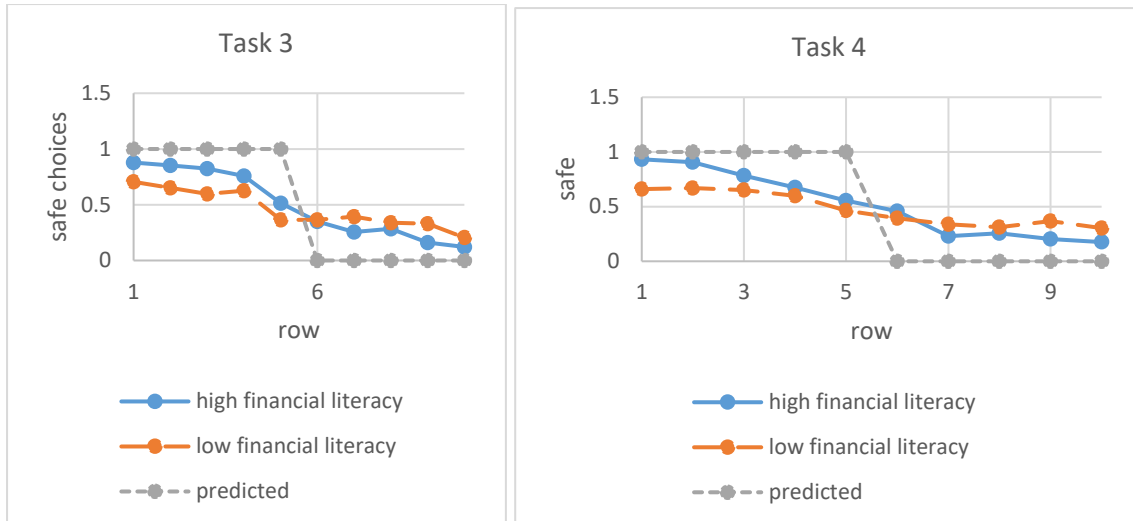
Figure 2.10 & 2.11: Risk preferences task 3&4

High financial literacy, risk preferences and time preferences

Table 2.20: Expected utility theory ML estimates Homogenous risk preferences

	Coefficient	Std. Err.	z	P>z	95% Conf. Interval	
r _cons	0.594	0.093	6.37	0.000	0.411	0.776
noise_cons(μ)	-0.189	0.021	-8.85	0.000	-0.230	-0.147
N=2381						
log pseudolikelihood = -1023.05						

Results account for clustering at the individual level

Table 2.21: Expected utility theory ML estimates Heterogeneous risk preferences

	Coefficient	Std. Err. z	Z	P>z	95% Conf. Interval	
r						
female	0.008	0.061	0.31	0.895	-0.111	0.127
urban	0.053	0.056	0.95	0.343	-0.056	0.162
African	-0.025	0.090	-0.27	0.786	-0.201	0.152
Asian	-0.042	0.197	-0.21	0.831	-0.428	0.344
colored	-0.077	0.080	-0.96	0.336	-0.233	0.079
non_decision_maker	-0.088	0.071	-1.24	0.216	-0.228	0.052
joint_decision_maker	0.023	0.043	0.55	0.584	-0.060	0.107
literacy	-0.004	0.008	-0.58	0.563	-0.019	0.011
age	-0.010	0.013	-0.78	0.437	-0.037	0.016
income	0.00003	0.00002	1.17	0.241	-0.00002	0.0001
_cons	2.929	0.365	8.02	0.000	2.213	3.644
noise _cons(μ)	-0.069	0.010	-6.93	0.000	-0.088	-0.049
N=2256						
log pseudolikelihood = -943.32						

Results account for clustering at the individual level

CHAPTER 3:

Financial behaviour, confidence, risk preferences and financial literacy of university students[2]

Abstract

This study investigates the determinants of financial behaviour of university students at a university in South Africa. It examines whether financial behaviour, confidence, time preferences, risk preferences and financial literacy perceptions of university students differ by financial literacy level. Data were gathered via a questionnaire that included personal information, financial behaviour, financial perceptions and financial knowledge responses as well as a multiple price list risk preferences and time preferences experiment tasks. A convenient total sample of 191 students (females=53%) participated in the study. A *t-test* analysis showed that financial behaviour, risk preferences, confidence levels, time preferences and financial literacy perceptions of university students significantly differed by financial literacy level. Our results show that university students with low financial literacy levels are more overconfident, risk-loving and impatient; such financial behaviour is synonymous with major causes of financial crises across the world. An OLS regression model analysis showed that the risk preferences index, financial literacy perception index and confidence are significantly associated with the financial behaviour of categorized university students. The risk preference index is significantly related to the debt financial behaviour of categorized university students. In order to understand the financial behaviour of university students, one should take cognizance of their preferences, financial knowledge, confidence and personal characteristics.

Key Words: financial behaviour; confidence; risk preferences; financial literacy; university students

JEL: C91; G4; G41; I22

3.1 Introduction

Financial behaviour can play a pivotal role in influencing the welfare of individuals in a household, society, nation and the world at large. A set of observable financial activities by an economic agent best describes financial behaviour. Such evident behaviour is mainly influenced by one's identity, wants, knowledge, performance, achievement, personal characteristics, significance and psychological factors (Bergner, 2011; García, 2013). Individuals who exhibit financial knowledge and can execute financial activity to improve their welfare are known to be financially literate. The quest to understand what drives financial behaviour is invaluably critical - especially considering the advent of financial crises, which generally negatively affect the welfare of individuals across the social divide (Bernanke, 2006).

Economics literature suggests that when agents make decisions, they tap into all available information to make choices that maximize their utility, profit and wellbeing. Further, the rational expectation theory of Robert Lucas holds that economic agents have an unlimited ability to process information – which enables them to make well-informed choices (Sargent, 1986). Behavioural finance literature has since refuted this assertion (Thaler and Sunstein, 2008; García, 2013). Behavioural economists believe that market systems are riddled with imperfections, risk, uncertainty and rigidities that prevent information from being readily available. Behavioural economics contends that making decisions in such an environment is susceptible to 'cognitive biases' and 'bounded rationality' (García, 2013).

Internal factors that affect financial behaviour are cognitive ability and psychological factors, while external factors include social and economic conditions (Capuano & Ramsay, 2011). The theory of planned behaviour contends that financial knowledge interacts with financial attitudes, subjective norms and perceptions to stimulate financial behaviour (Koropp, Kellermanns, Grichnik, & Stanley, 2014). Financial literacy is exhibited through financial knowledge and the capability to make use of acquired financial knowledge to improve one's welfare (De Meza et al., 2008; Atkinson et al., 2007). Financial literacy traits are highly associated with cognitive abilities (Delavande et al., 2008; Lusardi and Mitchell, 2008). This makes it plausible to represent financial knowledge as cognitive abilities exhibited by university students. This study is framed around the theory of planned behaviour by Ajzen (2011) where we explore interactions between financial knowledge, perceptions, individual characteristic, attitudes and financial behaviour.

This study seeks to explore factors that are linked to the financial behaviour of university students. The research examines factors that impact financial behaviour across the financial literacy level and gender of university students. We explore whether confidence and psychological aspects such as risk preferences and time preferences are significantly related to students' financial behaviour. Our study seeks to answer the following questions; i) Are there variations in financial behaviour, confidence levels, risk preferences, time preferences, financial literacy perception and decision-making status of university students with different levels of financial literacy? ii) Is confidence, risk preferences, time preferences, financial literacy perceptions and decision-making status associated with the financial behaviour of university students?

A total of 191 students at the University of the Free State in South Africa participated in a multiple price list (MPL) risk preferences and time preferences eliciting experiment on 27 August 2016 (Holt & Laury, 2002; Andersen, Harrison, Lau, & Rutström, 2008). The students

also completed a questionnaire that documented personal information, financial behaviour, financial perceptions and financial knowledge. Financial knowledge was measured using a 30-question financial literacy test which was included in the questionnaire. We constructed variables confidence, a risk preference index (RPI), time preferences index (TPI) and financial literacy perception index (FLPI) from the data collected. Our study is confined to three financial behaviour outcomes of university students; namely, personal finance behaviour, saving and investment behaviour, and debt behaviour. The choice of financial behaviour outcomes is informed by their relevance to university students.

There is evidence that South African citizens are faced by high levels of consumer debt, low saving rates, the proliferation of fraudulent financial schemes, high product service and penalty fees, lack of available and comparable pricing information as well as limited information on recourse mechanisms (Struwig, Roberts, & Gordon, 2013). About 40% of respondents of the Gauteng City-Region Observatory Quality of Life Survey 2015 indicated that they had some form of debt in their name (Joseph & Culwick, 2015). It is therefore important to understand the determinants of financial behaviour of South African citizens and university students are not exceptions. There is a need to understand what drives personal finance and debt behaviour of university students in light of their financial literacy.

The gap between one's level of financial literacy and perceptions of one's financial literacy generate the level of confidence one holds. Higher perception levels coupled with very low levels of financial literacy make one overconfident, while the reverse leaves one to be less confident (Allgood and Walstad, 2016). Being overconfident or less confident may result in an individual ignoring crucial market signals that may be pivotal in making financially beneficial decisions. Skewed confidence levels may result in an individual having 'cognitive biases' and may take short cuts in decision making.

Evidence on financial literacy confidence levels of economic agents are mixed. Barber and Odean (2001) conclude that overconfidence leads to investing in riskier stock positions. In an experimental study, entrepreneurs who were overconfident invested in business with low probability of success (Camerer & Lovallo, 1999). Financial confidence is important in making investment and savings decisions. Hung et al. (2009) contend that confidence in financial knowledge helps individuals make better financial decisions. In addition, there are mixed findings on financial perceptions, knowledge and financial behaviour available. Parker and Stone (2014) found that perceived and actual knowledge positively influence retirement planning. Lusardi and Mitchell (2011) established a positive correlation between actual knowledge and perceived knowledge among US citizens. Conversely, Agnew and Szykman (2005) concluded that actual and perceived knowledge of investment varied greatly based on individual characteristics.

Financial behaviour has been linked to individual risk preferences, time preferences, knowledge, perceptions, personal characteristics and other psychological factors (Lusardi and Mitchell, 2011; Meier and Sprenger, 2013). Forms of cognitive bias that create bounded rationality (better known as heuristics or shortcuts in financial decision making) are essentially driven by individual preferences and financial literacy (García, 2013). Furthermore, there is evidence in neuro-economics research that brain areas generating emotional states process information about risk, suggesting that emotions impact financial decisions (Kuhnen & Knutson, 2011).

A number of studies have concluded variation in risk preferences and time preferences across individuals, gender and groups. Women were found to be risk averse in a laboratory experiment (Fehr-Duda, De Gennaro, & Schubert, 2006). Baker & Nofsinger (2002) found that higher cognitive ability is associated with investing in higher risk stocks. Individuals unwilling to receive financial education were found to be impatient (Meier & Sprenger, 2013). Van Rooij, Lusardi, & Alessie (2011), in turn, found that subjects who invested on the stock market were more financially literate than others, showing that participation in financial decisions increase financial knowledge. What has not been determined so far, though, is whether there is variation on financial behaviour, risk preferences, confidence, decision-making status and time preferences for university students with different levels of financial literacy. In addition, there is need to examine factors that are linked to financial behaviour of university students.

Our study can be compared with the following studies: Allgood and Walstad (2016), LaBorde, Mottner and Whalley (2013) and Németh (2014). In a national survey among United States adults, Allgood and Walstad concluded that financial behaviour is influenced by actual and perceived financial literacy. On the other hand, in a survey conducted in Hungary, Nemeth found that higher education students are generally overconfident and risk averse. In a study focusing on undergraduate students, LaBorde, Mottner and Whalley found that financial perceptions are generally higher than actual financial literacy. People with low IQs were found to be impatient and risk averse (Dohmen, Falk, Huffman, & Sunde, 2010). Our study is unique in that it collects data on financial behaviour, actual and perceived financial literacy knowledge and then intertwines the evidence with MPL experimentally elicited risk preferences and time preferences attitudes. The study adds a psychological dimension to factors that influence financial behaviour of university students (Koch & Nafziger, 2015).

Our study concluded that confidence, risk preferences and financial literacy perceptions are significantly related to the financial behaviour of categorised subjects. Low financial literacy university students are more overconfident, more risk loving and more impatient. Risk preferences significantly impact debt behaviour in university students. Other variables that are significantly associated with financial behaviour are income, decision-maker status, age, degree enrolled for and geographical location. Providing financial literacy education to students with low financial literacy improves their confidence, risk preferences and time preference choices.

The study is organized as follows. The next section focuses on methodology and the definition of variables. This is followed by results and findings, leading to discussion and conclusion in the final section.

3.2 Material and Method

The study uses financial literacy questions adapted from the National Financial Capability Study (NFCS) and Jump Start and Knowledge Assessment Survey Questions (Mandell, 2008; LaBorde et al., 2013; Lusardi and Mitchell, 2011).The questionnaire included questions on personal information, financial literacy perceptions, financial behaviour and financial knowledge responses. To elicit risk preferences and time preferences, the respondents participated in 8 Multiple Price List (MPL) tasks (Andersen et al., 2008). The subjects played a total of four risk preferences and four time preferences tasks, which were standardized and modified by the Research Unit in Behavioural Economics and Neuro-economics (RUBEN) at the University of Cape Town in South Africa to suit the South African context.

The set of financial literacy responses focused on personal finance (money management), debt, savings and investment, retirement and insurance. After carefully analyzing responses that reflect actual financial behaviour of university students, we decided to base our study on personal finance, saving and investment, and debt responses only. Our financial behaviour and financial literacy perception variables were predicted using factor analysis. All the variables had an internal reliability Cronbach Alpha above (0.7) (the results can be provided on request). We also constructed three indices; namely, a risk preference index, time preference index and financial perception index. We then constructed a confidence variable that shows whether a respondent is overconfident, neutral or less confident. Our analysis also includes personal characteristics of the university students. All subjects that scored a mark above average were categorized as belonging to the high-financial-literacy group, while those that scored a mark below average were classified as belonging to the low-financial-literacy group.

The study uses a model specification by Bergner (2011), which specifies financial behaviour (FB) as a function specified as follows:

$$FB = f(knowledge; psychological\ factors; perceptions; personal\ characteristics)$$

The study uses a *t-test* analysis and Ordinary Least Squares analysis to explore variables that are significantly associated with financial behaviour of university students. Knowledge is represented by the financial literacy test score, while confidence, risk preferences and time preferences stand for psychological factors. We also included a set of personal characteristics in our regression models.

3.2.1 Sample

We collected data from a total convenient sample of 191 University students (females=53%) at the University of the Free State in South Africa at the beginning of the second semester on 27 July 2016. All students who participated in the study were enrolled in the Faculty of Economic and Management Sciences pursuing some Bachelor of Commerce degree. The students were also enrolled for a financial literacy module known as 'Personal Finance'. The students majored in economics, investment, law, administration, accounting, entrepreneurship, marketing, business management or human resources. Program majors that had a few respondents were grouped together and represented as 'Other degree' in our analysis. University students were invited by way of email via a university internet platform known as Blackboard to participate in the study that included completing a questionnaire, a financial literacy test and multiple price list time preference and risk preferences experiments. Email was sent to over 400 students; 221 turned up and 191 students' responses were used in the study. Participation in the study was voluntary; students completed the consent form and received R50 for participating in the MPL risk preference and time preference experiments. Ten percent of students were randomly selected and paid prizes in line with their choices in the experiments.

The high cost of running an experiment and the easy accessibility of university students were the major reasons we settled for a convenient sample. Convenience sampling is a non-probability sampling method suitable for a target population meeting certain criteria, easily accessible, geographical proximity, available at a given time and willing to participate in the study (Etikan, 2016). For a population of 100, assuming a margin of error of 3%, alpha of 1% and t=2.58 a sample of 68 observations can be used for continuous data regression while for a

margin of error of 5% and a t=2.58, a sample 87 observation can be used for categorical data (Kotrlik & Higgins, 2001). Our sample falls within the required threshold.

3.3 Defining variables

3.3.1 Financial Behaviour

We asked a set of financial literacy behaviour questions with a seven-point Likert Scale response, where '1' represents 'never' and '7' 'always' on the following financial behaviour outcomes: debt, saving and investment, and personal finance. Saving and investment questions were as follows:

    i.   How often have you considered saving and investing your money?

    ii.   To what extent are your current savings and investments satisfying your personal needs?

    iii.   How often are you frustrated when you fail to have the opportunity to save and invest?

    iv.   How often do you dream about investing and saving money one day?

    v.   How likely are you prepared to start saving and investing if the opportunity arises?

    vi.   How often have you looked for information on savings and investment?

The set of financial behaviour questions were asked on all financial behaviour themes under study. The variable financial behaviour is split into three; namely, financial behaviour, personal finance and debt behaviour. In order to construct the variable financial behaviour, we predicted a variable using factor analysis from financial behaviour responses, saving and investment, personal finance and debt financial behaviour. In a similar way, we constructed the variable personal finance from saving and investment and personal finance responses using factor analysis. The variable debt behaviour was predicted using factor analysis from debt financial behaviour responses.

3.3.2 Financial literacy perceptions

Students responded to a set of financial literacy perception statements with a seven-point Likert Scale, where '1' represents 'strongly disagree' and '7' 'strongly agree' on the following themes: debt, saving and investment, and personal finance:

    i.   I know what makes me a good or bad credit risk.

    ii.   I understand what affects the credit terms I am offered by different lending institutions.

    iii.   I am comfortable with my ability to make decisions about savings instruments based on their fixed and compounded interest rates.

    iv.   I understand the general relationship between risk and reward in investing.

    v.   I feel confident in my understanding of the differences between bonds, stocks, U.S. Treasury bills and mutual funds.

    vi.   I feel comfortable with my understanding of the various financial terms that go along with buying a home someday.

    vii.   I understand what personal net worth means.

    viii.   I am confident in my ability to write a monthly budget.

3.3.3 Risk Preference Index (RPI)

The RPI is constructed from risk preference parameter choices elicited from four risk preference tasks over the university students' financial knowledge. We recorded the risk preference parameter on the initial switching point for an individual in the multiple price list experimental tasks (Appendix B). We calculated the average individual risk parameter for the four tasks and then divided it by the test score in the 30-question financial literacy test:

$$RPI = \frac{average\ risk\ preference\ parameter}{financial\ literacy\ test\ score}$$

The cumulative density graphical representations of the risk preferences index values show that subjects with low financial literacy are more risk-loving when compared to subjects with high financial literacy (Figure 3.1). There is a wider variation on RPI values calculated for low financial literacy subjects when compared to subjects with high financial literacy. The RPI values for low financial literacy university students are cumulatively bounded between *-8 <RPI< 1* whereas the RPI values for high financial literacy subject are between *-1<RPI< 1*. Negative values of RPI reveal a risk-loving attitude; figures around 0 reveal a risk-neutral attitude, and positive RPI values reveal a risk-aversion attitude. The kernel density representation shows that RPI values for those with high financial literacy are concentrated around 0, reflecting that the subjects are generally risk neutral.
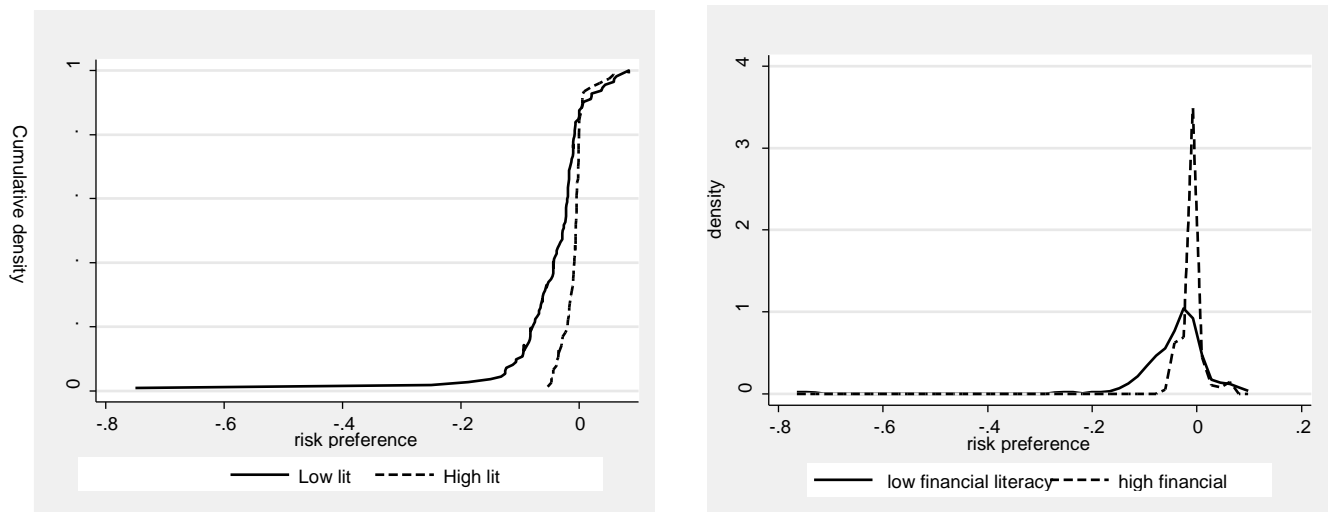
Figure 3.1: RPI Cumulative and kernel density

3.3.4 Time Preference Index (TPI)

The TPI is constructed from time preference discount rates choices elicited from (four) time preference tasks, given individual financial literacy knowledge measured by financial literacy test score. We recorded the discount rate on the initial switching point for an individual on lottery options in the multiple price list time preference tasks (Appendix B). We calculated the average individual time discount rate for the four tasks and then divided it by the test score in the 30-question financial literacy test:

$$TPI = \frac{average\ time\ preference\ discount\ rate}{financial\ literacy\ test\ score}$$

The cumulative density graphical representation for time preference index values show that high- financial-literacy subjects exhibited low calculated indices when compared with respondents with low financial literacy (Figure 3.2). The TPI values for high-financial-literacy university students' cumulative range are *0<TPI<0.2* while those for the low-financial-literacy university students' range are *0<TPI<0.9.* Low calculated TPI values show that high-financial-literacy subjects were more patient when compared to low-financial-literacy subjects. Higher financial literacy has been found to be associated with a higher level of patience (Van der Pol, 2011). Put differently, the graphical representation shows that low-financial-literacy subjects' TPI values are high - revealing that they were more impatient when compared to subjects with high financial literacy. People with low IQ were found to be impatient (Dohmen et al., 2010).
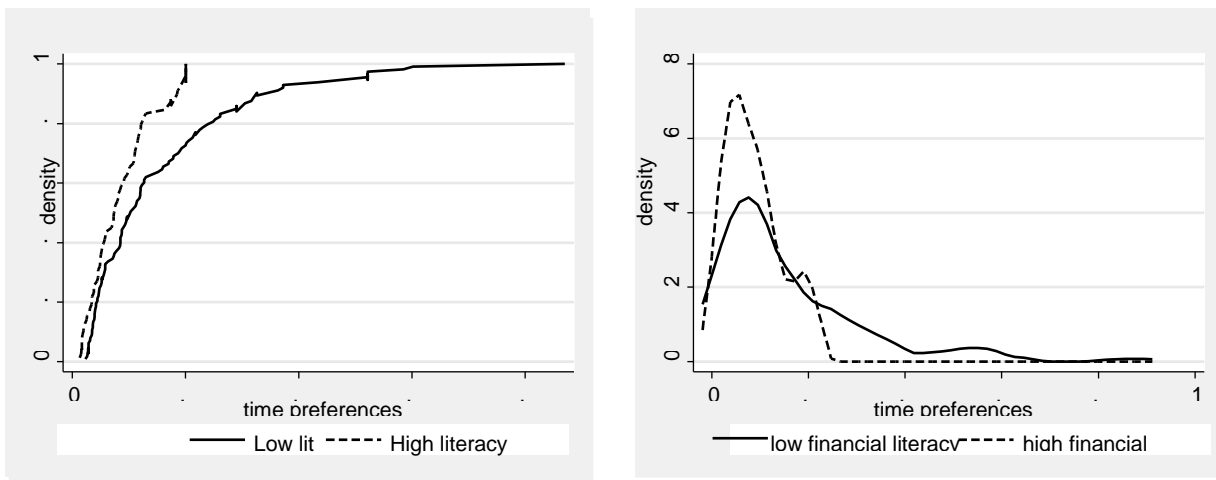
Figure 3.2: TPI cumulative density and kernel density

The TPI values for high-financial-literacy university students are clustered around *0<TPI<0.3* on the kernel density distribution, while those for low-financial-literacy subjects are widely spread in respect of 0<*TPI<0.7* (Figure 3.2).

3.3.5 Financial literacy perception index (FLPI)
We constructed FLPI values by predicting a perception variable using Factor Analysis, then divided the value by the financial literacy test score:
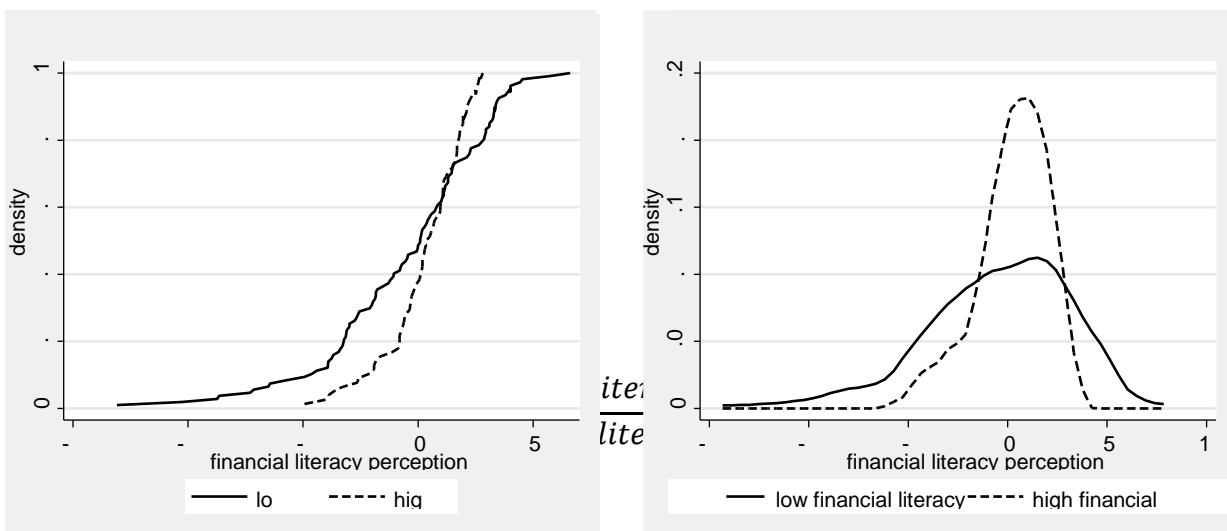
Figure 3.3: FLPI cumulative density and kernel density

Figures 3.3 show a clear distinction in the financial literacy perception index between high-financial-literacy and low-financial-literacy university students. The FLPI values for high financial literacy subjects are cumulatively clustered on a short range -5<FLPI<2 while values for low financial literacy are spread over a wide range -14<FLPI<6.

3.3.6 Confidence (C)

To measure confidence (C), we considered university students' financial literacy perceptions and actual financial knowledge, that is, test score in the financial literacy test:

$$C = financial\ perceptions - financial\ literacy\ test\ score$$

To measure financial literacy perceptions, we used Lusardi and Mitchell's (2011) statement with a seven-point Likert scale response, where '1' represents 'strongly disagree' and '7', 'strongly agree'. The subjects had to respond to the statement, *I am good at dealing with day-to-day financial matters, such as checking accounts, credit and debit cards, and tracking expenses.* Financial literacy perceptions were divided by 7 and financial literacy test scores by 30 to scale the variables to the same level. The two variables were scaled to 1.
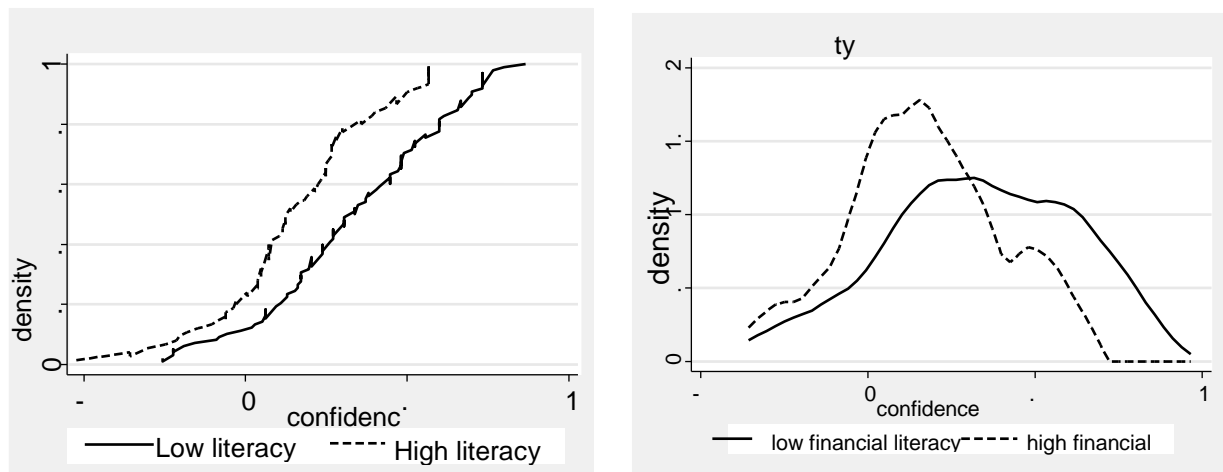
Figure 3.4: Confidence cumulative density and kernel density

The cumulative density representation of the variable confidence shows that subjects with low financial literacy were more overconfident than subjects with higher financial literacy (Figure 3.4). The range of confidence cumulative density values for low-financial-literacy students was (*-0.3<C<0.8),* while the range of confidence values for high-financial-literacy students was (*-0.6<C<0.5).* Although the graphical representations show that all subjects were generally overconfident, low-financial-literacy subjects exhibited higher levels of overconfidence, suggesting that the source of sub-optimal financial behaviour in lower-financial-literacy subjects is driven by the confidence gap. The findings that low financial literacy university students are risk loving, overconfident and impatient are confirmed in the *t-test* analysis below. A research by Barber and Odean (2001) concluded that overconfidence leads to investing in riskier stock positions.

3.4 Findings

3.4.1 Analysis using t-test by financial literacy level

We investigated whether there is significant difference in financial behaviour across financial literacy level using responses from savings and investment, personal finance (money management) and debt behaviour responses. The study formulated a dummy variable 'financial

literacy'. Our results show a significant difference at 5% level in personal finance behaviour by the level of financial literacy of the subjects. Our results furthermore show a weak significant difference in financial and debt behaviour of university students by their financial literacy level at 10%. These results confirm that financial behaviour differ if individuals have different levels of financial literacy, which strengthens the argument that high-financial-literacy individuals achieve better life outcomes (Lusardi & Mitchell, 2005). The variation in financial behaviour by financial literacy might explain why low financial literacy individuals achieve poor financial life outcomes. It also confirms what the theory of planned behaviour contends, that is, financial knowledge is related to financial behaviour (Ajzen, 2011). The variation in financial behaviour can be improved by availing financial literacy on those with low financial literacy. Turning to the variable confidence, our results show a significant difference at 1% level in confidence levels of subjects by their level of financial literacy. Being over- or under-confident can increase challenges in making financial decisions either by increasing cognitive biases and making short cuts (García, 2013). Confidence levels among university students help them make decisions. Our results show that confidence levels in financial decision making of university students play an important role.

Table 3.1: *t-test* analysis by financial literacy level

Variable	Low financial literacy	High financial literacy	t-statistics
Financial behaviour	-0.072593	0.1299613	t =-1.5189*
	(0.0897019)	(0.0986747)	
Personal finance	-0.107605	0.1728434	t =-2.1686**
	(0.0864954)	(0.0961405)	
Debt behaviour	0.1133886	-0.1338221	t =1.9779*
	(0.0877871)	(0.0889675)	
RPI	-0.0440142	-0.0083771	t=-4.3012***
	(0.0079607)	(0.0022964)	
Confidence	0.3338678	0.1530794	t=4.5746***
	(0.0278756)	(0.0280137)	
FLPI	-0.4917	0.3400647	t=-1.9398*
	(0.2686843)	(0.1949713)	
TPI	0.1575176	0.0861551	t=4.6040***
	(0.0141091)	(0.0064175)	
Decision making staus	2.135135	1.884615	t = 2.0594**
	(0.076241)	(0.0947872)	

Mean and standard errors in brackets represented in the table.
Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Being overconfident results in an individual failing to take note of market signals that may assist in making an optimal decision. Over confident individuals are more likely to invest in riskier financial stocks (Barber & Odean, 2001). Variation in confidence by financial literacy might help us to explain why more people with low financial literacy are more likely to participate in money pyramids and 'ponzi' schemes which are a common feature in South Africa. On the other hand, being less confident may result in someone making sub-optimal financial decisions. Our findings also confirm significant differences of subjects' RPI, TPI, FLPI and decision-making status by their level of financial literacy. This also shows that risk preferences, financial literacy perceptions and time preferences differ across levels of financial literacy. If this is true in the real world, then people with different levels of financial literacy

would achieve different financial life out comes. Financial literacy is significantly associated with perceptions and preferences for university students.

3.4.2 Analysis using t-test by gender

We investigated whether there is significant difference in financial behaviour across gender. Our results found no significant difference in financial behaviour, personal finance behaviour and debt behaviour by gender for university students.

Table 3.2: *t-test* analysis by gender

Variable	Male	female	t-statistics
Financial behaviour	-0.0020563	0.0333982	t = -0.2660
	(0.0942001)	(0.0943252)	
Personal finance	-0.0091703	0.0347411	t = -0.3376
	(0.0926042)	(0.0913592)	
Debt behaviour	0.0131522	0.0039518	t = 0.0728
	(0.0858334)	(0.092808)	
RPI	-0.03385	-0.0257013	t = -0.7896
	(0.009095)	(0.0048771)	
Confidence	0.2789632	0.235765	t = 1.0267
	(0.0306598)	(0.0288143)	
FLPI	0.1026325	-0.4037829	t = 1.1885
	(0.2967438)	(0.3057562)	
TPI	0.142711	0.1158657	t = 1.4518*
	(0.0149919)	(0.010825)	
Decision making	1.988764	2.07	t = -0.6745
	(0.0882447)	(0.0819645)	

Mean and standard errors in brackets represented in the table
Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

There is also no significant difference in confidence levels, decision status, RPI and FLPI - implying that for university students, gender is not a barrier to financial behaviour and decision making. We found a weak significant difference at 10% on time preferences index (TPI) by gender. These results are similar to that of Wagland and Taylor (2009), who found that gender is not significant for University of Western Sydney students' decision-making ability. Our *t-test* findings confirm that financial literacy plays a vital role in modeling financial behaviour of university students. Financial literacy is linked to confidence levels, preferences, decision-making status and financial literacy perceptions – which, in turn, is related to students' financial behaviour.

3.4.3 Determinants of financial behaviour of university students

In a bid to understand how financial literacy interact with psychological factors - such as risk preferences, time preference and confidence in influencing financial behaviour - we carried out a set of regression analyses split by gender and financial literacy. Only the financial literacy perceptions index (FLPI) significantly associated the financial behaviour of all subjects (Table 3.3). For male university students, the risk preference index (RPI), confidence and FLPI is significantly related to financial behaviour. Confidence and risk preferences were found to interact in accepting bets with average that steadily decline with increasing confidence (Goodie, 2005). It follows then that risk preferences, confidence levels and financial literacy perceptions are significantly associated with financial behaviour in male students. Turning to

female subjects, our results show that financial behaviour is significantly related to by confidence only.

Table 3.3: OLS Regression: Determinants of financial behaviour

	All	male	female	low literacy	high literacy
RPI	-1.09	-1.55[*]	2.18	-2.19[**]	12.2[**]
	(1.258)	(0.924)	(2.514)	(1.074)	(6.028)
TPI	-0.060	-0.21	0.35	-0.046	-2.94
	(0.455)	(0.491)	(0.987)	(0.500)	(1.885)
confidence	0.079	-0.77[**]	1.00[**]	0.75[*]	-0.16
	(0.278)	(0.320)	(0.385)	(0.402)	(0.420)
FLPI	0.055[**]	0.066[**]	0.037	0.011	0.10[*]
	(0.027)	(0.033)	(0.041)	(0.030)	(0.058)
_cons	-0.036	0.13	-0.15	-0.40[**]	0.44[**]
	(0.117)	(0.158)	(0.145)	(0.197)	(0.215)
N	153	70	83	81	72
R^2	0.049	0.141	0.126	0.116	0.108

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Revealing that confidence levels in female university students play a significant role in their financial behaviour. Overconfidence or less confidence my lead to suboptimal choices hence, financial literacy initiative should focus more on factual knowledge and skills to assist university students to have an appropriate dose of confidence (Asaad, 2015). Our regression model for subjects with low financial literacy show that RPI and confidence is significantly related to financial behaviour.

Table 3.4: OLS Regression: Determinants of personal finance behaviour

	All	male	female	low literacy	high literacy
RPI	-0.57	-0.86	1.78	-1.68	9.19
	(1.175)	(0.930)	(2.383)	(1.031)	(6.149)
TPI	-0.14	-0.26	0.18	-0.099	-2.07
	(0.445)	(0.433)	(0.959)	(0.492)	(1.860)
confidence	-0.014	-0.83[***]	0.82[**]	0.69[*]	-0.28
	(0.281)	(0.307)	(0.406)	(0.408)	(0.442)
FLPI	0.060[**]	0.076[**]	0.039	0.013	0.12[*]
	(0.027)	(0.031)	(0.042)	(0.030)	(0.061)
_cons	0.011	0.17	-0.099	-0.38[*]	0.40[*]
	(0.116)	(0.154)	(0.147)	(0.193)	(0.203)
N	157	72	85	84	73
R^2	0.046	0.135	0.101	0.093	0.103

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

RPI and FLPI significantly impact financial behaviour for subjects with high financial literacy. The regression analyses in Table 3.3 could not confirm a significant impact of time preferences

index (TPI) on financial behaviour. Stated differently, time preferences are not significantly related to financial behaviour of university students. We investigated factors that are associated with personal finance behaviour (Table 3.4). According to the results, FLPI is the only variable that significantly with personal financial behaviour in all subjects. Confidence and FLPI are significantly related to personal finance behaviour in male subjects. Female subjects' confidence levels is significantly associated with their personal finance behaviour. These results show that for subjects split across gender, the gap between their perceptions and financial knowledge better known as confidence plays a critical role in molding personal finance behaviour. Low-financial-literacy subjects' personal financial behaviour is weakly and significantly linked to the respondents' confidence levels. On the other hand, FLPI is weakly significantly related to personal finance behaviour in subjects with high financial literacy. In our regression analyses in Table 3.4, RPI and TPI are not related to personal finance behaviour in any classification of the subjects.

Table 3.5: OLS Regression: Determinants of debt financial behaviour

	All	male	female	low literacy	high literacy
RPI	-2.51***	-3.04***	-0.46	-2.41***	10.1
	(0.613)	(0.585)	(2.780)	(0.546)	(6.784)
TPI	0.18	-0.0026	0.60	0.027	-2.80
	(0.549)	(0.679)	(1.211)	(0.628)	(2.032)
confidence	0.33	0.22	0.48	0.32	0.26
	(0.282)	(0.360)	(0.448)	(0.419)	(0.448)
FLPI	-0.0020	-0.011	0.00063	0.0071	-0.036
	(0.023)	(0.032)	(0.035)	(0.028)	(0.052)
_cons	-0.17	-0.15	-0.18	-0.056	0.13
	(0.112)	(0.147)	(0.175)	(0.201)	(0.238)
N	159	72	87	86	73
R^2	0.054	0.125	0.028	0.070	0.043

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

In Table 3.5, all subjects, male respondents and low-financial-literacy subjects' debt financial behaviour are significantly associated with risk preference index (RPI). No other variable is confirmed to be influencing debt financial behaviour of the subjects. These results show that debt financial behaviour is significantly associated with risk preferences, given the university student's level of financial literacy. It shows that borrowing behaviour in the subjects under consideration is related to by risk preferences. Attitudes towards risk were found to be significantly related to debt held by households in the US (Brown, Garino, & Taylor, 2013). Our findings show that debt financial behaviour of university students is mostly driven by their risk preferences. Results from the OLS regression analysis show that financial behaviour of university students is mainly associated with by risk preferences, confidence and financial literacy perceptions. To understand financial behaviour of university students, we need to take note of their financial literacy perceptions, financial knowledge, confidence levels and risk preferences. Our results confirm assertions by the theory of planned behaviour by Ajzen (2011) which posits that financial literacy and financial behaviour may interact through unobserved feedback mechanisms.

Table 3.6: OLS Regression: Determinants of financial behaviour

	All	high_lit	low_lit	male_high_lit	male_low_lit	female_high_lit	female_low_lit
RPI	-1.91*	9.95	-2.22**	16.1	-2.95**	1.30	-0.057
	(1.132)	(6.808)	(1.021)	(12.926)	(1.050)	(16.095)	(2.659)
TPI	-0.089	-4.10	-0.13	-8.59	1.84	-1.09	-0.90
	(0.582)	(2.464)	(0.703)	(6.479)	(1.147)	(5.267)	(1.192)
confidence	0.12	-0.33	0.77*	-0.63	-0.87*	0.75	2.25***
	(0.283)	(0.446)	(0.453)	(1.158)	(0.445)	(0.770)	(0.620)
FLPI	0.026	0.087	-0.0095	0.16	0.050	0.083	-0.074
	(0.029)	(0.052)	(0.034)	(0.111)	(0.041)	(0.090)	(0.055)
age	-0.0075	0.013	-0.025	-0.066	-0.040	0.20*	-0.12**
	(0.022)	(0.035)	(0.033)	(0.102)	(0.060)	(0.097)	(0.052)
income	0.23**	0.14	0.24**	-0.057	0.45***	0.36	0.17
	(0.092)	(0.160)	(0.120)	(0.238)	(0.143)	(0.277)	(0.208)
African	0.17	0.27	0.44	1.02	0.34	-0.46	0.87
	(0.366)	(0.427)	(0.653)	(0.927)	(0.395)	(0.566)	(0.650)
Investment degree	0.34	0.0070	0.74**	-0.28	0.0078	-0.099	1.17*
	(0.222)	(0.383)	(0.299)	(0.524)	(0.386)	(0.710)	(0.594)
Other degree	0.29	0.20	-0.26	0.48	-0.42	-0.52	0
	(0.448)	(0.467)	(0.931)	(0.699)	(1.148)	(0.822)	(.)
Admin degree	0.010	-0.22	0.29	-0.033	0.74	0.13	0.016
	(0.220)	(0.317)	(0.304)	(0.742)	(0.462)	(0.449)	(0.631)
Management degree	-0.095	-0.68	0.52	-0.090	0.14	-0.85*	0.89*
	(0.275)	(0.448)	(0.321)	(0.638)	(0.472)	(0.492)	(0.521)
Family size	-0.0040	-0.034	0.037	-0.071	-0.042	-0.0045	-0.025
	(0.021)	(0.024)	(0.040)	(0.048)	(0.070)	(0.038)	(0.066)
single	-0.28	-0.32	-0.15	-1.93	0.52	0.83	-0.36
	(0.406)	(0.593)	(0.506)	(2.627)	(1.059)	(1.135)	(0.474)
urban	0.32*	0.046	0.36*	0.38	0.15	0.17	0.47
	(0.165)	(0.275)	(0.202)	(0.564)	(0.275)	(0.457)	(0.297)
Non decision maker	-0.27	-0.19	-0.31	-0.63	-0.57	-0.37	-0.23
	(0.178)	(0.216)	(0.285)	(0.394)	(0.333)	(0.266)	(0.533)
Join decision maker	-0.41**	-0.51*	-0.23	-0.56	-0.14	-0.69	0.030
	(0.166)	(0.264)	(0.241)	(0.589)	(0.294)	(0.427)	(0.376)
_cons	-1.47	-0.21	-2.44	4.45	-3.12	-6.62*	-0.42
	(1.151)	(1.708)	(1.650)	(5.625)	(2.507)	(3.426)	(2.006)
N	151	72	79	30	39	42	40
R^2	0.180	0.321	0.307	0.588	0.514	0.477	0.645

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3.7: OLS Regression: Determinants of personal finance behaviour

	All	high_lit	low_lit	male_high_lit	male_low_lit	female_high_lit	female_low_lit
RPI	-1.35	7.71	-1.82*	15.2	-1.94*	2.12	-1.09
	(1.045)	(6.734)	(0.962)	(13.682)	(0.957)	(15.730)	(2.457)
TPI	-0.14	-3.33	-0.100	-7.83	1.62	-0.28	-0.96
	(0.528)	(2.576)	(0.649)	(6.906)	(0.990)	(5.231)	(1.146)
confidence	0.042	-0.35	0.69	-0.61	-1.00**	0.81	2.14***
	(0.275)	(0.476)	(0.421)	(1.262)	(0.403)	(0.768)	(0.607)
FLPI	0.032	0.096*	-0.0077	0.15	0.064	0.089	-0.089
	(0.029)	(0.057)	(0.035)	(0.110)	(0.038)	(0.093)	(0.054)
age	-0.0079	0.0074	-0.025	-0.079	-0.021	0.18*	-0.10**
	(0.025)	(0.036)	(0.034)	(0.107)	(0.046)	(0.096)	(0.050)
income	0.23***	0.12	0.25**	-0.050	0.40***	0.35	0.18
	(0.086)	(0.146)	(0.114)	(0.230)	(0.127)	(0.266)	(0.212)
African	0.29	0.26	0.73	1.05	0.30	-0.47	1.16
	(0.360)	(0.425)	(0.586)	(0.928)	(0.350)	(0.556)	(0.722)
Investment degree	0.31	0.055	0.63**	-0.26	-0.033	-0.010	0.96
	(0.215)	(0.371)	(0.283)	(0.531)	(0.392)	(0.677)	(0.573)
Other degree	0.32	0.21	-0.38	0.60	-0.52	-0.67	0
	(0.449)	(0.446)	(0.986)	(0.690)	(1.202)	(0.749)	(.)
Admin degree	-0.066	-0.32	0.20	-0.055	0.70	-0.017	-0.058
	(0.214)	(0.325)	(0.285)	(0.779)	(0.427)	(0.469)	(0.610)
Management degree	-0.12	-0.66	0.43	-0.22	0.11	-0.71	0.66
	(0.273)	(0.445)	(0.326)	(0.670)	(0.411)	(0.464)	(0.474)
Family size	-0.0076	-0.040	0.033	-0.087	-0.036	0.00068	-0.031
	(0.021)	(0.025)	(0.041)	(0.052)	(0.064)	(0.035)	(0.071)
single	-0.060	-0.21	-0.014	-2.08	0.88	1.40	-0.30
	(0.454)	(0.581)	(0.537)	(2.734)	(0.675)	(1.080)	(0.607)
urban	0.36**	0.025	0.38*	0.35	0.19	0.41	0.51
	(0.165)	(0.282)	(0.200)	(0.590)	(0.227)	(0.432)	(0.300)
Non decision maker	-0.21	0.0080	-0.31	-0.55	-0.36	-0.15	-0.42
	(0.176)	(0.224)	(0.266)	(0.359)	(0.345)	(0.274)	(0.534)
Joint decision maker	-0.35**	-0.33	-0.29	-0.46	0.025	-0.51	-0.23
	(0.168)	(0.275)	(0.240)	(0.602)	(0.281)	(0.455)	(0.354)
_cons	-1.77	-0.12	-2.81*	4.86	-3.51**	-7.21**	-0.93
	(1.214)	(1.769)	(1.630)	(5.973)	(1.591)	(3.335)	(2.207)
N	155	73	82	30	41	43	41
R^2	0.177	0.287	0.300	0.623	0.499	0.425	0.633

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3.8: OLS Regression: Determinants of debt financial behaviour

	All	high_lit	low_lit	male_high_lit	male_low_lit	female_high_lit	female_low_lit
RPI	-2.54***	6.98	-1.79*	2.00	-3.89***	1.75	0.96
	(0.721)	(6.664)	(0.900)	(12.613)	(1.260)	(15.780)	(3.668)
TPI	0.024	-3.00	-0.19	-4.05	1.22	-2.99	-0.13
	(0.708)	(2.570)	(0.903)	(5.636)	(1.444)	(3.382)	(1.781)
confidence	0.29	-0.12	0.38	-0.016	0.46	-0.38	0.52
	(0.302)	(0.470)	(0.483)	(1.002)	(0.662)	(0.702)	(0.868)
FLPI	-0.018	-0.022	-0.0029	0.070	-0.036	-0.044	0.015
	(0.026)	(0.061)	(0.036)	(0.113)	(0.045)	(0.093)	(0.063)
age	0.0057	0.020	0.0055	0.024	-0.038	0.064	-0.052
	(0.023)	(0.032)	(0.034)	(0.083)	(0.053)	(0.058)	(0.087)
income	-0.020	0.040	-0.021	-0.087	0.33	0.017	-0.18
	(0.120)	(0.187)	(0.166)	(0.287)	(0.205)	(0.248)	(0.296)
African	-0.27	0.012	-0.75	-0.072	-0.016	-0.19	-1.12
	(0.301)	(0.259)	(0.609)	(0.498)	(0.498)	(0.237)	(0.910)
Investment degree	0.27	-0.11	0.54	0.065	0.16	-0.45	0.76
	(0.204)	(0.270)	(0.345)	(0.604)	(0.549)	(0.365)	(0.628)
Other degree	0.14	-0.099	0.83*	-0.22	0.68	0.023	0
	(0.306)	(0.335)	(0.468)	(0.523)	(0.682)	(0.508)	(.)
Admin degree	0.37*	0.29	0.49	0.17	0.19	0.25	0.52
	(0.211)	(0.239)	(0.367)	(0.382)	(0.518)	(0.349)	(0.722)
Management degree	0.19	-0.23	0.60	0.49	0.32	-0.78**	0.74
	(0.233)	(0.281)	(0.380)	(0.780)	(0.555)	(0.346)	(0.544)
Family size	0.016	0.0070	0.033	0.044	-0.024	-0.024	0.067
	(0.018)	(0.018)	(0.047)	(0.048)	(0.082)	(0.025)	(0.120)
single	-0.40	-0.62	-0.25	0.023	-0.69	-1.54	-0.29
	(0.546)	(0.833)	(0.611)	(2.299)	(0.876)	(1.082)	(0.854)
Urban	-0.035	-0.0024	0.058	0.19	0.038	-0.60	-0.074
	(0.159)	(0.267)	(0.217)	(0.453)	(0.344)	(0.382)	(0.366)
Non decision maker	-0.35*	-0.67**	-0.17	-0.29	-0.67	-0.87***	0.053
	(0.196)	(0.257)	(0.354)	(0.558)	(0.483)	(0.303)	(0.723)
Joint decision maker	-0.24	-0.70***	0.24	-0.61	-0.41	-0.83**	0.69
	(0.185)	(0.239)	(0.310)	(0.516)	(0.338)	(0.366)	(0.630)
_cons	0.39	0.41	0.23	0.052	-0.88	1.70	2.58
	(1.144)	(1.480)	(1.728)	(5.076)	(2.599)	(2.427)	(3.322)
N	155	73	82	30	40	43	42
R^2	0.114	0.303	0.176	0.370	0.337	0.594	0.282

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

We further controlled for personal characteristics in a quest to investigate factors that are linked to the financial behaviour of university students (Table 3.6). Income, RPI, living in an urban area, and being a joint decision maker significantly associated with financial behaviour of all respondents. Being a joint decision maker is the only variable that is significantly associated with financial behaviour of subjects with high financial literacy. For subjects with low financial literacy variables, RPI, confidence, income, being enrolled in investment degree and residing in an urban center are significantly linked to financial behaviour. Financial behaviour for male subjects with low financial literacy is significantly impacted by the variables RPI, confidence and income. Age and being enrolled for a Bachelor of Commerce Management Degree are weakly and significantly associated with financial behaviour in female university students with high financial literacy. In respect of female university students with low financial literacy, our results show that confidence and age significantly impact subjects' financial behaviour.

Switching to factors that determine personal finance behaviour after controlling for personal characteristics of university students, our findings show that income, residing in an urban center and being a joint financial decision maker are significantly linked to personal finance behaviour of all university students (Table 3.7). The financial literacy perception index is weakly significantly related to personal finance behaviour of students with higher financial literacy. On the other hand, RPI, income, being enrolled in a Bachelor of Commerce Investment Degree and residing in an urban center is significantly related to personal finance behaviour of university students with low financial literacy. Confidence, income and RPI significantly impact personal finance behaviour of male university students with low financial literacy. Age is the only variable that is significantly associated with personal finance behaviour of female subjects with high financial literacy at 10% level. Personal finance behaviour in female university students with low financial literacy is significantly associated by the variables, confidence and age.

Table 3.8 explores determinants of debt financial behaviour of university students after controlling for personal characteristics. RPI, being enrolled in a Bachelor of Commerce Administration Degree, and being a non-financial decision maker is significantly related to debt financial behaviour of all university students. High-financial-literacy university students' debt financial behaviour are significantly determined by being a non-financial decision maker and being a joint financial decision maker - showing that decision-making status is important in molding financial behaviour. Individuals who participated in stock market investments were found to be financially literate, showing that involvement in financial decision making increases financial knowledge (Van Rooij, Lusardi, & Alessie, 2011). RPI and being enrolled in other degrees are the only variables that is significantly linked to debt financial behaviour in university students with low financial literacy. Only the variable RPI is significantly associated with debt financial behaviour of male university students with low financial literacy. For female university students with high financial literacy, being a non-financial decision maker, being a joint decision maker and being enrolled in a Bachelor of Commerce Management Degree is significantly related with debt financial behaviour of the subjects.

Our results show that RPI, confidence, FLPI, age, income, geographical location and financial decision-making status are significantly associated with financial behaviour of categorized university students. Our findings confirm determinants of behaviour portrayed by the theory of planned behaviour (Ajzen, 2011). The theory of planned behaviour postulates that behaviour is related to knowledge, perceptions, attitudes and norms. Behavioural aspects are prevalent

when an individual maximize utility. Psychological factors that are significantly associated with financial behaviour of university students are risk preferences and confidence. Being overconfident or less confident leads one to make suboptimal choices (Kramer, 2016; Allgood & Walstad, 2016). Factual financial knowledge should be imparted to university students to give them the appropriate confidence to ensure beneficial financial behaviour. There is evidence that conform to our findings, risk attitudes is significantly associated with debt behaviour in US households (Brown et al., 2013). Participation in financial decisions is related with financial behaviour. Our regression analyses could not confirm a significant relationship of time preference index with financial behaviour showing that time preferences do not play a significantly role on financial behaviour of university students.

3.5 Conclusion

This study uses data collected by a financial literacy questionnaire which included a financial literacy test and multiple price list risk preferences and time preferences experiments on 191 students at University of the Free State in South Africa. The Students were enrolled in undergraduate commercial degrees in the Faculty of Economic and Management Sciences. The analysis is split across financial literacy level and gender. Our results from a *t-test* analysis show that financial behaviour, risk preferences, confidence and time preferences of university students significantly differ by their financial literacy level. Low-financial-literacy university students are more risk loving, more overconfident and more impatient than high-financial literacy university students. Our study found out that financial behaviour of categorised university students is associated by confidence, risk preferences and financial literacy perceptions.

Our results go a long way to explain why low financial literacy is generally associated with poor financial life outcomes. Being overconfident or less confident might result in someone overlooking market signals that are important in making some beneficial financial decisions. This leads to 'cognitive biases' and making short cuts in making financial decisions. This behaviour is synonymous with actions that propagate financial crises across the world. In addition, a risk-loving attitude can potentially lead someone to invest in assets that have low probability of a positive return. This behaviour is quite prevalent in South Africa. More and more people have been robbed of their hard earned income by investing in 'Ponzi schemes' and money pyramids. In a case reported in the news in 2018, South African citizens are believed to have lost a billion rands in a bitcoin 'Ponzi' scheme and money pyramids. Some of these losses can be attributed to low financial literacy as our results show that low financial literacy students are risk loving, impatient and overconfident. These traits result in individuals ignoring crucial market information in making decision. Even if the market interest rate of return on investment is low, individuals who participate in 'Ponzi schemes' invest their incomes in unbelievably high interest investment scams probably due to overconfidence. These could be signs of low financial literacy, overconfidence and risk loving attitudes. Inability to wait for a higher future return shown by being impatient amongst low financial literacy university students lead individuals to settle for lower return financial choices.

Our findings also show that financial literacy perceptions significantly differ by level of financial literacy. If perceptions differ across groups of people, for example, university students with different levels of financial literacy, then optimization of financial behaviour is bound to be different. Our *t-test* results also show that university students' financial decision status differ significantly across the level of financial literacy. This reflects that active or inactive participation in financial decision matters is associated with level of financial literacy. Our

analysis could not confirm significant difference in risk preference index, confidence, decision-making status and financial literacy perception index by gender of university students. Showing that gender for university students played no or little role in influencing financial behaviour, risk preferences and financial literacy perceptions. In a nutshell, financial behaviour of university students with similar levels of financial literacy does not differ by gender.

A set of ordinary least squares regression models show that risk preference index, confidence and financial literacy perception index are significantly associated with financial behaviour of categorised university students. Confirming the theory of planned behaviour theory which argues that behaviour is influenced by knowledge, perceptions, attitudes and norms. Our regression analyses could not confirm a significant impact of time preference index on financial behaviour. Our results also show that the risk preference index is significantly linked to debt financial behaviour, but is not significantly related with personal finance behaviour. Revealing that debt financial behaviour of university students is significantly determined by risk preferences. Other variables that are significantly associated with financial behaviour of university students in our study are age, income, geographical location and financial decision-making status.

Our results partially confirm assertions by traditional financial economics and behavioural financial economics literature. We confirmed that university students use information available to them to make decisions; however, they do not have unlimited cognitive capacity to store and process it, shown by differences across financial literacy level. Our findings are contrary to the rational expectation economic behaviour theory assertions, which posits that individuals use all information available to them and have unlimited cognitive capacity to store and process it (García, 2013). Differences in cognitive abilities, psychological factors and confidence levels play a significant role in determining financial behaviour of university students, a confirmation of claims by financial behavioural economics. While mandatory availing of financial literacy in public institutions is a welcome move, lifelong participation in the financial activities can go a long way in molding financial behaviour. There is greater need to provide factual financial literacy to deliver right dose of confidence in financial decision making by university students. Empowerment programs that allow one to build own income and help one to fully participate in financial decision making could go a long way in improving financial behaviour. Understanding financial behaviour of individuals requires one to take cognizance of their preferences, perceptions, financial literacy knowledge and psychological factors.

This study has its own set of limitations. University students enrolled in Bachelor of Commerce degrees' financial behaviour are not a good representation of South African population financial behaviour and financial literacy levels. A study on a South African representative population can shade light on determinants of financial behaviour of South African population. Nevertheless, using university students provides an initiating stage to investigate financial behaviour of South African population. The instruments used to gather data in this study can also be used to collect data on a South African population.

3.6 References

Agnew, J. R., & Szykman, L. R. 2005. Asset Allocation and Information Overload: The Influence of Information Display, Asset Choice, and Investor Experience. *Journal of Behavioral Finance*, 6(2), 57–70. https://doi.org/10.1207/s15427579jpfm0602_2

Ajzen, I. 2011. The theory of planned behaviour: Reactions and reflections. *Psychology & Health*, 26(9), 1113–1127. https://doi.org/10.1080/08870446.2011.613995

Allgood, S., & Walstad, W. 2016. The Effects of Perceived and Actual Financial Literacy on Financial Behaviors. *Economic Inquiry*, 54(1), 675–697. Retrieved from http://0-search.ebscohost.com.wagtail.ufs.ac.za/login.aspx?direct=true&db=edswss&AN=00036 5756100038&site=eds-live&scope=cite

Allgood, S., & Walstad, W. B. 2016. The effects of perceived and actual financial literacy on financial behaviors. *Economic Inquiry*, 54(1), 675–697. https://doi.org/10.1111/ecin.12255

Andersen, S., Harrison, G. W., Lau, M. I., & Rutström, E. E. 2008. Eliciting risk and time preferences. *Econometrica*, 76(3), 583–618. Retrieved from http://onlinelibrary.wiley.com/doi/10.1111/j.1468-0262.2008.00848.x/abstract

Asaad, C. T. 2015. Financial literacy and financial behavior: Assessing knowledge and confidence. *Financial Services Review*, 24(2), 101–117. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=eoh&AN=EP103068434&site= ehost-live

Atkinson, A., McKay, S., Collard, S., & Kempson, E. 2007. Levels of Financial Capability in the UK. *Public Money and Management*, 27(1), 29–36.

Baker, H. K., & Nofsinger, J. R. 2002. Psychological Biases of Investors. *Financial Services Review*, 11(2), 97–116.

Barber, B. M., & Odean, T. 2001. Boys will be Boys: Gender, Overconfidence, and Common Stock Investment. *The Quarterly Journal of Economics*, 116(1), 261–292. https://doi.org/10.1162/003355301556400

Bergner, R. M. 2011. What is behavior? And so what? *New Ideas in Psychology*, 29(2), 147–155. https://doi.org/10.1016/j.newideapsych.2010.08.001

Bernanke, B. S. 2006. Financial literacy. *Testimony before the Committee of Banking, Housing and Urban Affairs of the United States Senate. May, 23*. Retrieved from http://www.federalreserve.gov/newsevents/testimony/bernanke20060523a.htm

Brown, S., Garino, G., & Taylor, K. 2013. Household debt and attitudes towards risk. *Review of Income and Wealth*, 59(2), 283–304. https://doi.org/10.1111/j.1475-4991.2012.00506.x

Camerer, C., & Lovallo, D. 1999. Overconfidence and Excess Entry: An Experimental Approach. *American Economic Review*, 89(1), 306–318. https://doi.org/10.1257/aer.89.1.306

Capuano, A., & Ramsay, I. 2011. What causes suboptimal financial behaviour? An exploration of financial literacy, social influences and behavioural economics. *An Exploration of Financial Literacy, Social Influences and Behavioural Economics (March 23, 2011). U of Melbourne Legal Studies Research Paper*, (540). Retrieved from

http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1793502

De Meza, D., Irlenbusch, B., & Reyniers, D. 2008. *Financial capability: A behavioural economics perspective*. Financial Services Authority London. Retrieved from http://www.fca.org.uk/static/fca/documents/research/fsa-crpr69.pdf

Delavande, A., Rohwedder, S., & Willis, R. J. 2008. Preparation for Retirement, Financial Literacy and Cognitive Resources. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.1337655

Dohmen, T., Falk, A., Huffman, D., & Sunde, U. 2010. Are Risk Aversion and Impatience Related to Cognitive Ability? *American Economic Review*, *100*(3), 1238–1260. https://doi.org/10.1257/aer.100.3.1238

Etikan, I. 2016. Comparison of Convenience Sampling and Purposive Sampling. *American Journal of Theoretical and Applied Statistics*, *5*(1), 1. https://doi.org/10.11648/j.ajtas.20160501.11

Fehr-Duda, H., De Gennaro, M., & Schubert, R. 2006. Gender, financial risk, and probability weights. *Theory and Decision*, *60*(2–3), 283–313. https://doi.org/10.1007/s11238-005-4590-0

García, M. J. R. 2013. Financial education and behavioral finance: New insights into the role of information in financial decisions. *Journal of Economic Surveys*, *27*(2), 297–315. https://doi.org/10.1111/j.1467-6419.2011.00705.x

Goodie, A. . 2005. The role of perceived control and overconfidence in pathological gambling. *Journal of Gambling Studies, Springer*, *21*(4), 481–502. Retrieved from https://link.springer.com/article/10.1007/s10899-005-5559-1

Holt, C. A., & Laury, S. K. 2002. Risk aversion and incentive effects. *American Economic Review*, *92*(5), 1644–1655.

Hung, A., Parker, A. M., & Yoong, J. 2009. Defining and Measuring Financial Literacy. *RAND Working Paper Series*. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1498674

Joseph, K., & Culwick, C. 2015. *Quality of Life Survey 2015. Gauteng city-region observatory quality of life survey 2015,* Johannesburg. Retrieved from http://www.gcro.ac.za/media/redactor_files/GCRO_QoL_2015_Press_pack_low_res.pdf

Koch, A., & Nafziger, J. 2015. Behavioral economics of education. *Journal of Economic Behavior & Organization*, *115*, 3–17. https://doi.org/10.1016/J.JEBO.2014.09.005

Koropp, C., Kellermanns, F. W., Grichnik, D., & Stanley, L. 2014. Financial Decision Making in Family Firms An Adaptation of the Theory of Planned Behavior. *Family Business Review*, 0894486514522483.

Kotrlik, J., & Higgins, C. 2001. Organizational research: Determining appropriate sample size in survey research appropriate sample size in survey research. *Information Technology, Learning, and Performance Journal*, *19*(1), 43. https://doi.org/10.1109/LPT.2009.2020494

Kramer, M. M. 2016. Financial literacy, confidence and financial advice seeking. *Journal of Economic Behavior & Organization*, *131*, 198–217. https://doi.org/10.1016/J.JEBO.2016.08.016

Kuhnen, C. M., & Knutson, B. 2011. The influence of affect on beliefs, preferences, and financial decisions. *Journal of Financial and Quantitative Analysis*, *46*(3), 605–626. https://doi.org/10.1017/S0022109011000123

LaBorde, P. M., & Mottner, S. W. 2013. Personal Financial Literacy: Perceptions of Knowledge, Actual Knowledge and Behavior of College Students. *Journal of Financial Education*, *39*(3/4), 1–30. Retrieved from http://www.jstor.org/stable/23608645

Lusardi, A., & Mitchell, O. 2011. Financial literacy and retirement planning in the United States. *Journal of Pension Economics and Finance*, *10*(04), 509–525. https://doi.org/10.1017/S147474721100045X

Lusardi, A., & Mitchell, O. S. 2005. Financial literacy and planning: Implications for retirement wellbeing. *Michigan Retirement Research Center Research Paper No. WP*, *108*. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=881847

Lusardi, A., & Mitchell, O. S. 2008. Planning and Financial Literacy: How Do Women Fare? *American Economic Review*, *98*(2), 413–417. https://doi.org/10.1257/aer.98.2.413

Mandell, L. 2008. Financial Education in High School. In *Overcoming the saving slump: how to increase the effectiveness of inancial education and saving programs* (pp. 257–279). Retrieved from http://books.google.co.za/books?hl=en&lr=&id=1M3RUvoG6l4C&oi=fnd&pg=PA257&dq=Financial+literacy,+Boyce,+Danes+(2004)+&ots=v4D1OObhXV&sig=G-2wRq_GrPZba9ZA44yagKMp7oY

Meier, S., & Sprenger, C. D. 2013. Discounting financial literacy: Time preferences and participation in financial education programs. *Journal of Economic Behavior & Organization*, *95*, 159–174.

Németh, K. H.-D. B. 2014. An Empirical Study of Financial Literacy versus Risk Tolerance Among Higher Education Students. *Public Finance Quarterly*, *4*, 445. Retrieved from http://www.asz.hu/public-finance-quarterly-articles/2014/an-empirical-study-of-financial-literacy-versus-risk-tolerance-among-higher-education-students/a-huzdik-beres-nemeth-2014-4.pdf

Parker, A. M., & Stone, E. R. 2014. Identifying the Effects of Unjustified Confidence versus Overconfidence: Lessons Learned from Two Analytic Methods. *Journal of Behavioral Decision Making*, *27*(2), 134–145. https://doi.org/10.1002/bdm.1787

Sargent, T. 1986. *Rational Expectations and Inflation*. *Journal of Economic Literature* (Vol. 24). Princeton University Press.

Struwig, J., Roberts, B., & Gordon, S. 2013. Financial Literacy in South Africa 2013 Report. *Results of A*, 132. Retrieved from http://www.hsrc.ac.za/en/research-outputs/ktree-doc/13821

Thaler, R. H., & Sunstein, C. R. 2008. *Nudge: Improving decisions about health, wealth, and happiness.* Yale University Press. Retrieved from http://books.google.co.za/books?hl=en&lr=&id=dSJQn8egXvUC&oi=fnd&pg=PA17&dq=Thaler+and+Sunstein,+2008&ots=0dHORKLoWm&sig=5tM8mQT32Hl8bdZVpXqT1j7GX4c

Van der Pol, M. 2011. Health, education and time preference. *Health Economics*, *20*(8), 917–929. https://doi.org/http://dx.doi.org/10.1002/hec.1655

Van Rooij, M., Lusardi, A., & Alessie, R. 2011. Financial literacy and stock market participation. *Journal of Financial Economics*, *101*(2), 449–472. Retrieved from https://www.sciencedirect.com/science/article/pii/S0304405X11000717

Wagland, S. P., & Taylor, S. 2009. When it comes to financial literacy, is gender really an issue? *Australasian Accounting, Business and Finance Journal*, *3*(1), 3. Retrieved from http://ro.uow.edu.au/aabfj/vol3/iss1/3/

3.7 Appendix B

3.7.1 Measurement of time preferences and risk preferences

Table 3.9: Time preference payment matrix table

	Lottery A	Lottery B	
row	Payment in one week	Payment in one month and one week	Discount rate
1	R250	R250+ 10% interest=R252.09	0.0084
2	R250	R250 +20% interest=R254.20	0.017
3	R250	R250+30% interest=R256.33	0.025
4	R250	R250+40% interest=R258.47	0.034
5	R250	R250+50% interest=R260.63	0.043
6	R250	R250+60% interest=R262.81	0.051
7	R250	R250+70% interest=R265.00	0.06
8	R250	R250+80% interest=R267.22	0.069
9	R250	R250+90% interest=R269.45	0.078
10	R250	R250+100% interest=R271.70	0.087

Table 3.10:Typical risk preference payoff and risk parameter

	Lottery A				Lottery B				
row	prob	Rand	prob	Rand	prob	Rand	prob	Rand	CRRA
1	0.1	60	0.9	50	0.1	100	0.9	25	-2.5
2	0.2	60	0.8	50	0.2	100	0.8	25	-1.33
3	0.3	60	0.7	50	0.3	100	0.7	25	-0.72
4	0.4	60	0.6	50	0.4	100	0.6	25	-0.32
5	0.5	60	0.5	50	0.5	100	0.5	25	-0.005
6	0.6	60	0.4	50	0.6	100	0.4	25	0.275
7	0.7	60	0.3	50	0.7	100	0.3	25	0.545
8	0.8	60	0.2	50	0.8	100	0.2	25	0.825
9	0.9	60	0.1	50	0.9	100	0.1	25	1.17
10	1	60	0	50	1	100	0	25	2.5

CHAPTER 4:

Incentivized Time Preferences, Level of Education in a Household and Financial Literacy: Laboratory Evidence

Abstract

This study investigates the impact of financial literacy, level of education in a household and gender differences on time preferences of students at a university in South Africa. The study relies on a convenient sample of (N=85, female=48%) pursuing a financial literacy course. The study uses a questionnaire, a financial literacy test and a simple binary choice experimental game that elicited individual time discount rate to gather data. Ten percent of the participants were paid (in South African rands) for their time preference choices by way of quota random sampling. Female university students' individual time discount rate was found to be on average higher than that of their male counterparts, indicating that female university students are generally impatient, especially those with low levels of financial literacy. Our results (using a Negative Binomial Regression analysis and Ordinary Least Squares regression analysis) show that time preference of university students is significantly associated with highest level of education in the household. The OLS regression model shows that financial literacy, measured using financial literacy test, is significantly related with time preferences for all subjects. The study concluded that patience levels among male university students increase as financial literacy increases. Gender, income, age and family size is significantly related to time preferences of university students. Highest level of education in a household, financial literacy and gender differences have a bearing on individual time preferences.

Keywords: Time preferences, financial literacy, education, individual discount rate, gender, impatient, Experiment

4.1 Introduction

Time preferences can reveal one's levels of patience and self-control, attributes which are critical in making financial investments and choices. The pleasure of consuming goods immediately as opposed to the discomfort of future consumption is mainly influenced by the circumstances in which decision-makers find themselves(DellaVigna, 2009; Frederick, Loewenstein, & O'donoghue, 2002; Loewenstein, Read, & Baumeister, 2003; Rae & Mixter, 1905).Research evidence suggests that individuals' time preferences are highly correlated with financial literacy-information acquisition, job search for a long period, earning of higher wages, preparation to take up contingency measures to improve future welfare and generally better financial outcomes(DellaVigna, 2009; Meier & Sprenger, 2013). Time preferences have been used to explain economic concepts such as credit card take up, life cycle savings, retirement savings, procrastination, homework and deadlines as well as perseverance by individuals (DellaVigna, 2009). Aspects of time preferences such as self-control and patience determine whether individuals make choices immediately, in the near future, or in the distant future. On the other hand, financial literacy, according to Huston (2010), relates to measuring how well an individual can understand as well as use personal finance-related information. This implies that for one to be financially literate, one should be able to use financial knowledge to improve one's welfare. This statement is further backed by Gallery, Newton and Palm (2011) and Schagen and Lines (1996) who consider financial literacy to be the ability to make informed judgments and take effective decisions regarding the use and management of money.

Both definitions of financial literacy suggest a variation in time preferences among people with different levels of financial literacy. The differences in welfare outcomes of people across financial levels could be explained by variations in time preferences. In reality, choices made at a given moment to accrue benefits in the present or future, are aimed at maximizing one's utility; therefore, one's financial knowledge might be an important factor. In addition, time preferences are sometimes strongly associated with an individual's cognitive ability (Frederick, 2005). Cognitive ability plays an important role in helping individuals achieve beneficial outcomes (Banks, o'Dea, & Oldfield, 2010).Further, presenting incentives in the form of actual money payment on the choices made by individuals can be seen as the setting up of a practical life situation conducive to displaying true time preference behaviour. This study investigates the impact of financial literacy and highest level of education in a household on time preferences of university students at a university in South Africa. The discrete and non-negative value nature of time discount rates allows the study to use theNegative Binomial regression method to analyse data(Hilmer & Hilmer , 2014). We also constructed a variable Time Preference index (TPI) and regressed a set of Ordinary Least Squares models in our investigation(Németh, 2014). A total convenient sample of 85 university students took part in a financial literacy test and a time preference experimental game that was included in a questionnaire. The simple binary choice time preference experimental game used tokens which were allocated over time and summed into a time budget (TB), making the design an intertemporal choice framework(Andreoni, Kuhn, & Sprenger, 2015; Angerer, Lergetporer, Glätzle-Rützler, & Sutter, 2015). Students that scored a mark above the average in the financial literacy test were categorized as the high financial literacy group, whereas those that scored a mark below average represented the low financial literacy group. Ten percent of the participants were randomly selected and paid the actual amounts of their choices using quota random sampling and according to the instructions in the time preference game. The quota random sampling incentivized system allowed all participants a fair and equal chance of being selected for payment.

The study also explored whether the state of world where university students survive in, is associated with their time preferences. The state of the individual's world may include gender orientation and family status among others. In a society which participates in intertemporal choice decision making, university students are an important component mainly because of their level of financial literacy, therefore, it is critical to understand the determinants of their time preferences. In addition, students are the most logical next entrants into the job market where saving and investment decisions are equally vital. The possibility of time preferences being related to financial literacy and highest level of education in a household is significant in two ways. First, the impact of financial literacy on individual time preferences may sum up into market outcomes which might help authorities to design policies that improve welfare of citizens. Secondly, the impact of highest level of education in a household on university students' time preferences can explain the intergenerational education spill over. Further, understanding gender differences in time preference choices might assist in designing interventions necessary to reduce disparities. A number of studies have explored the level of financial literacy across gender, economic status, social status and area of specialization(Batty, Collins, & Odders-White, 2015;Lusardi, Mitchell, & Curto, 2010; Shambare & Rugimbana, 2012; Oanea & Dornean, 2012; Mandell, 2008). However, very little information is available on the interaction between financial literacy level, gender differences and time discount rate as a measure of time preferences. The fact that financial literacy attainment yields better welfare outcomes cannot be doubted(Becchetti, Caiazza, & Coviello, 2013; Tang & Peter, 2015; Sayinzoga, Bulte, & Lensink, 2016). What is not clear, however, is how financial literacy affects one's level of patience or impatience, which is measured by one's individual time discount rate. The level of patience (or impatience) allows individuals to gainfully use financial literacy acquired to improve current and future welfare(Carlin & Robinson, 2012).

This study shares some similarity to researches by Frederick (2005), Benjamin, Brown and Shapiro (2013) and Parker and Fischhoff (2005). Fredrick tested time preferences of subjects using a cognitive reflection test (CRT) and concluded that there are time preferences variations across gender. Benjamin et al (2013) concluded that Chilean high school students with a high maths score were more patient while Parker and Fischoff (2005) found out that vocabulary proficient scholars were more likely to be patient. Our results are mixed; female university students were more likely to be impatient especially those with lower levels of financial literacy while on the other hand, increase in financial literacy levels among male students also increased patience. There is evidence that show that the highest level of education in a household is associated with time preference of university students. The OLS regression model shows that financial literacy is significantly related to time preferences of all participants and male participants in particular. Our study can also be compared with studies by Meier and Sprenger (2013) as well as Sabri et al. (2010). The next section presents a review of literature, followed by a discussion of the methodology, data analysis and presentation of results. The final section provides the conclusion of the study.

4.2 Literature Review

Financial behaviour is known to be determined by financial knowledge, perceptions, norms, and attitudes(Kennedy, 2013). Important financial attitudes that help economic agents to maximise on their financial behaviour are time preferences, which is a process of making intertemporal choices. The quest to understand what drives time preferences has been a subject of debate to researchers(Capuano & Ramsay, 2011; Hoch & Loewenstein, 1991; Loewenstein & Thaler, 1989;Frederick, Loewenstein, & O'donoghue, 2002). Although individual time discount rate is used to measure time preferences, a number of factors are known to influence

time preferences; namely, habit formation, affection, anticipatory utility and visceral influences(Frederick et al., 2002). Neoclassical economics holds that exhibiting an optimal behaviour is an aspect of rational choice (Mas-Colell, Whinston, & Green, 1995). Predictable, yet irrational behaviour exhibited by consumers is mainly driven by knowledge and psychological processes that create mental "shortcuts" as well as biases (Smith & Barboza, 2014). Beside neoclassical suggestions, human beings have exhibited time-inconsistent behaviour, which is an aspect of irrationality (Hoch &Loewenstein, 1991; Loewenstein & Thaler, 1989; Imrohoroglu, Imrohoroglu, & Joines, 2003). Students' social upbringing, cognitive ability, circumstances and the surrounding environment can play an important role in determining their time preferences(Frederick, 2005). Preferences in general influence supply and demand of goods, a fact that has incentivized researchers to gain greater insight into how preferences are formulated(Ariely, Loewenstein, & Prelec, 2003). In addition, poorly enforced property rights increase impatience which is an aspect of time preferences (Epper, Fehr-Duda, & Bruhin, 2009).Measuring time preferences has generally presented challenges to researchers and no single method is absolved of errors in measuring discount rates(Loewenstein et al., 2003). Although research contends that intertemporal time preferences exhibit hyperbolic discount rates, that is, discount rates tend to be lower as time frame for rewards gets longer(Epper, Fehr-Duda & Bruhin, 2009),a number of researchers have tended to use laboratory experiments to explain time preferences in real life situations(Ariely & Wertenbroch, 2002; Ausubel, 1999).Their findings reveal that individuals make time preference choices that maximize their utility and resemble real life behaviour.

There has also been a concerted effort to test whether laboratory experiment findings explain real behaviour of subjects in the practical world. The general consensus is that the measured time preferences lack the scope to explain actual human behaviour(Chabris, Laibson, Morris, Schuldt, & Taubinsky, 2008). However, a number of researchers concluded that there is a close relationship between experimental research findings and true human time preference choices(Benzion, Rapoport, & Yagil, 1989; Charness, Gneezy, & Imas, 2013; Meier & Sprenger, 2013). A research project in the district of Georgia in the US in 2008 concluded that drop-outs and referrals were positively correlated with impatient behaviour (Castillo, Ferraro, Jordan, & Petrie, 2011). The findings are, however, inconclusive in that the research project could not identify precisely what drives individual and group time preferences. On the other hand, financial literacy has been hailed for improving welfare of individuals and society. A study on elementary school students by Batty et al. (2015)found that financial education impacted attitudes. The findings indicate that one's level of financial literacy influences how one makes intertemporal choices and that financial knowledge influences time preferences. In addition to their findings, students that were exposed to financial literacy were able to save and were financially savvy. Another aspect that has been found to be important in moulding intertemporal choices is family background. In a study by (Sabri, MacDonald, Hira, & Masud, 2010) carried out in Malaysia, students that received financial literacy from their parents exhibited better financial outcomes and were more likely to save money. This suggests that knowledge within a household plays a pivotal role in shaping time preferences.

Time preferences represent an aspect of intertemporal choice and researchers have investigated how it is impacted by financial literacy level as well as gender orientation. In short, time preferences reveal one's choices over time while financial literacy has more to do with financial knowledge and the ability to apply financial knowledge(Güth, 2004;Huston, 2010). The direction of causality between financial literacy and time preferences seems difficult to tell, however, evidence suggests that interaction of the two influences life outcomes(Benjamin, Brown & Shapiro, 2013). Meir and Sprenger (2013) conducted an incentivized multiple price

list experiment on individuals participating in a volunteer income tax assistance (VITA) credit counselling programme and concluded that participants in the VITA program had a higher discount rate. Research evidence suggests that there are variations in time preferences across gender. For example, a research study investigating time preferences of high school students carried by Castillo et al. (2011) concluded that boys compared to girls had a higher discount rate - suggesting impatience amongst boys. Gender differences are mainly driven by variation in preferences (Croson & Gneezy, 2009). An increased number of literature on risk preferences found out that women are more risk averse compared to men (Charness & Gneezy, 2012; Eckel & Grossman, 2008; Powell & Ansic, 1997). Aside observing differences in risk preferences across gender, there is also evidence of variation in time preferences by gender and race (Norum, 2008; Adan & Natale, 2002). Married women were concluded to be investing less in common stock than married men (Bajtelsmit, 1999). However, there are some studies that could not conclude variation in time preferences across gender(Kim, Dueker, Hasher, & Goldstein, 2002). In a research study comparing risk and time preferences among students in the USA, no differences were found across gender (Bernheim, Garrett, & Maki, 2001). Evidence from previous work on time preferences and education remain inconclusive.

Financial literacy is a form of education on financial concepts and requires cognitive prowess to master. Research has concluded a correlation between education and time preferences (Van der Pol, 2011;Lawrance, 1991; Fuchs, 1980). Van der Pol (2011) and Lawrance (1991) observed that time preferences tend to decrease as the level of education increases. Their studies were confined to health and poverty but did not focus on financial literacy. Financial literacy level may or may not vary across university students in general. There is evidence of variation of financial literacy level by gender, degree being pursued, family background among others (Cull & Whitton, 2011; Lusardi, Mitchell & Curto, 2010;Chen & Volpe, 1998). Chen and Volpe (1998) found out that female students were less financially literate compared to their male counterparts. In a 2010 study in Romania, it was concluded that male university students had a higher level of financial literacy compared to females (Oanea & Dornean, 2012). If there is a correlation between time preferences and financial literacy then, this could partially explain variation in life outcomes. On the other hand, there are studies that conclude absence of differences in financial literacy especially for university students (Wagland & Taylor, 2009). Little research has been carried out to investigate the impact of financial literacy level on time preferences. More so, it is not clear whether there is reverse causality between financial literacy and time preferences. There is need to understand factors that influence time preferences of individuals given the fact that they play an important role in determining life outcomes. More needs to be explored with regard to time preferences and gender differences.

4.3 Methodology

The study used a modified stylized standard model version by Rabin (2002) given below, to explain how individuals make choices over time.

$$\max_{x_i^t \in X_i} -\sum_{t=0}^{\infty} \delta^t \sum_{s_t \in S_t} p(S_t) U(x_i^t / S_t) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where, individual university student *i* at time *t* maximizes expected utility subject to probability distribution *p(s)* of the states of the world $s \in S$"(DellaVigna, 2009; Rabin, 2002). The utility function *U(x/s)* is defined over pay-off of the experimental game x_i^t of subject (*i*) over one's state of the world (*s*) and future utility is discounted with a discount factor δ for naiveté assumed to be time consistent.*S,* the state of the university student's world explained by financial literacy level, highest level of education in a household, financial literacy perceptions, student characteristics and the demographic information. In the study, the minimum discount rate is set at 0 and the maximum discount rate is set at 5. The discount factor δ is calculated from the choices made by the subjects given as ($columnA/columnB$),where column A is the

present time pay-off received after 2 weeks and column B is delayed consumption paid after 6 weeks(Meier & Sprenger, 2013).

To deal with present time bias, the initial payment is paid in the future period(Alan & Ertac, 2015) such that:

$$b_1 + \beta\delta b_2 \geq 0 \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \text{(2)}$$

Where b_1 is pay-off in 2 weeks and b_2 is pay-off in 6 weeks. β represents unobservable self-control or patience problems and δ is the future utility discount rate. We adopted a simplified model used by Epper et al.(2009) and (Frederick, 2005), since our data could not capture risk parameters, we did not include the risk value. We formulated aNegative Binomial regression model as follows:

$\delta(time\ discount\ rate) = f$(Financial literacy score, financial literacy perceptions, age, highest level of education in a household, number of family members in a household, income).

Our dependent variables time discount rate is discrete, the variance and mean are significantly different from each other which made a Negative Binomial regression model suitable for analysing our data instead of a Poisson regression model (Hilmer & Hilmer, 2014). We tested the Likelihood-ratio test of alpha for the Negative Binomial regression model and the Poisson regression model as a way of determining the appropriate model to use for our data analysis. Our results show a likelihood-ratio test of Alpha = 0: chibar2 (01) =135.99 Pro>=chibar2=0.000, confirming over dispersion which allowed us to use the Negative Binomial regression model in our analysis. In addition, university students' preference choices were non-negative ranging between 0 and 5. Financial literacy is measured using the mark scored in the financial literacy test written before students are taught financial literacy concepts. This is the variable that measures the financial literacy or knowledge level of the university students. A number of studies have used financial literacy test to measure financial knowledge (LaBorde, Mottner, & Whalley, 2013; Mandell, 2008; Sayinzoga et al., 2016). Financial knowledge, perceptions and norms play a vital role in shaping financial attitudes and behaviour (Ajzen, 2011). To assess financial literacy perceptions, we asked the following three questions adopted from Lusardi et al., (2010)

 i. On a scale from 1 to 7, where 1 means very low and 7 means very high, how would you assess your overall financial knowledge?
 ii. Please give your answer on a scale of 1 to 7, where 1 = "Strongly Disagree," 7 = "Strongly Agree,"
 a) I am good at dealing with day-to-day financial matters, such as checking accounts, credit and debit cards, and tracking expenses
 b) I am pretty good at math

A single variable of perceptions was predicted using factor analysis. Self-reported age, highest level of education in the family, family size and individual income are some of the variables that were used. The highest level of education in the family was used as a proxy for family status, because number of education years has been found to be positively correlated with higher levels of income(Argent, Finn, Leibbrandt, & Woolard, 2009). A question in our questionnaire asked respondents to indicate the highest level of education in their households excluding themselves. The age of a respondents is normally associated with experience, as one gets older, bank of knowledge grows until retirement (Lusardi & Mitchell, 2005). Income is measured using self-reported cash and cash equivalence that university students were holding during the time of the study. The respondents also indicated the numbers of family members in their households. Family size, income and age are some of the variables that have been concluded to be influential in shaping time preferences in some studies(Andersen, Harrison, Lau, & Rutström, 2006;Meier & Sprenger, 2013). We further constructed variable time

preference index (TPI) and ran an Ordinary least squares regression model on same variables indicated above. TPI represents time preferences choice over financial literacy.

$$TPI = \frac{individual\ time\ discount\ rate}{financial\ literacy\ test\ score} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \quad (3)$$

Variable TPI is a continuous variable which made it possible for us to analyse our data using an ordinary least squares regression model.

4.3.1 Time Preferences: Eliciting Individual Discount Rates
A simple binary choice time preference game was used to collect students' individual discount rates. In the time preference game, the subjects were asked to allocate five tokens between two periods; that is, after 2 weeks or after 6 weeks- resembling an investment or savings venture. The instruction for the experiment is as follows (Giné, Goldberg, Silverman, & Yang, 2011; Angerer et al., 2015):

"You are allocated 5 tokens. If you place the token in column A you will be paid R20 per token paid after 2 weeks. If you place the token in column B you will be paid R25 per token paid after 6 weeks. To receive payment for your choices you should pick a winning ticket from a raffle".

The choice for the price paid for each token is based on the interest levied on creditors by local loan sharks (credit providers) '*Mashonisas*', who charge an interest between 15% to 50% per month. To deal with the present time bias in the subject's choices a front end delay payment was used (Andersen, Harrison, Lau, & Rutström, 2008). Choices for column A were paid after 2 weeks (which resembled a present time pay-off or Smaller Sooner), whereas choices for column B were paid after 6 weeks(a future period pay-off or larger later) (Andreoni & Sprenger, 2012).To select the winners, the researcher used quota random sampling. Coupons equal to the number of participants were placed in a hat. Ten percent of the coupons were stamped and whoever picked the stamped coupon was paid the amount according to his/her choice in line with instructions provided in the experimental task above. The use of coupons placed in a hat provided all the university students who participated in the game with an equal chance to win according to their choices in the task. Selection of ten percent of university students who participated in the experimental task was informed by previous studies. In a Danish study focusing on eliciting risk and time preferences of adult population, only ten percent of the participants were selected and paid for their choices(Andersen et al., 2008). The names of the winners were listed and their contact details collected for administration purposes. The information collected was aggregated for analysis and no information traceable to an individual was used. Payment to the winners was made through e-wallet, a banking platform offered by FNB bank in South Africa. The researcher paid the university students on the days promised according to instructions of the game/task.

4.3.2 Procedure and Data
 A total of 85 students (female=48%) studying a financial literacy module (known as Personal Finance module) at the University of the Free State in South Africa Qwaqwa Campus were conveniently sampled to participate in the study. The high cost of running an experiment and the easy accessibility of university students were the major reasons we settled for a convenient sample. Convenience sampling is a non-probability sampling method suitable for a target population meeting certain criteria, easily accessible, geographical proximity, available at a given time and willing to participate in the study (Etikan, 2016).Students pursuing a Bachelor of commerce degree in the faculty of Economic and Management Sciences were invited to participate in the study on the 28th July 2016 through their emails. The email was send via the university e-learning platform known as blackboard a week before the study was carried out. The target group was 86 undergraduate university students enrolled in a personal finance

module. 85 students turned up and the participation rate was 99%. For a population of 100, assuming a margin of error of 3%, alpha of 1% and t=2.58 a sample of 68 observations can be used for continuous data regression while for a margin of error of 5%, probability of 50% and a t=2.58, a sample 87 observation can be used for categorical data (Kotrlik & Higgins, 2001). Sample size observations in our study fell within the required threshold. Participation in the study was voluntary. The study used a questionnaire which included demographic information, financial literacy perceptions, time preferences (a binary choice experimental task) and a financial literacy test. The test was administered before the students studied the financial literacy module.

4.4 Results and Findings

4.4.1 Descriptive statistics

Self-reported evidence from the questionnaire revealed that 49% of the university students belonged to a household with matric as the highest level of education. These were followed by 32% of the university students that indicated that they belonged to a household with a degree as the highest level of education. About 56% of the university students were from households with at least a matric or less. This is a clear indication that the majority of the university students belonged to families with low levels of education. Students answered a total of 20 financial literacy questions which constituted a financial literacy test. The questions were adopted from jumpstart and National Financial Capability Survey (Lusardi & Mitchell, 2011;Mandell & Klein, 2009). The average financial literacy score for the group was very low at 43%. The highest and lowest mark scored in the financial literacy test were 65% and 15% respectively. A t-test analysis showed no significant difference between male and female university students' level of financial literacy although the average financial literacy level of females was slightly higher. Male participants scored an average of 43% while female participants scored an average of 44%. This confirmed similar findings in Australia where low financial literacy levels amongst university students was identified(Beal & Delpachitra, 2003). This shows that the university students under consideration had low levels financial literacy. This is also similar to earlier findings by (Wagland & Taylor, 2009) who compared performance of university students that received equal treatment across gender and found no difference in performance. In the case under consideration, university students were generally of a similar level of education, under-graduate students pursuing Bachelor of Commerce Degree.

Our results showed a variation in individual time discount rates across gender. In relative terms, female subjects reported higher time discount rates compared to their male counterparts. A t-test analysis on individual discount rates across gender showed a significant difference in the time preferences of female and male students at 5% level of significance (results can be provided on request).   In addition, university students with higher financial literacy levels exhibited a higher average time discount rate when compared to those with low levels of financial literacy. On average, female university students reported a higher average individual income and cash equivalence of R798.15 compared to R699.48 for their male counterparts. The average family size for the whole group, males and females, was around five family members. On the other hand, the maximum age recorded for female university students was 40 years compared to 29 years for males. The average ages for male and female university students were 22 and 23 years respectively.

4.4.2 Histograms for elicited time discount rates

Plotted histograms show variations in time discount rates - especially across gender and financial literacy level. Figure 4.1A. Male subjects were more willing to accept delayed

consumption compared to female subjects. There are lower densities for male subjects for highest discount rates as well as higher densities for lowest discount rates for male subjects in general when compared to female subjects. The discrete and non-negative nature of elicited time discount rates allowed us to make use of the Negative Binomial regression model.
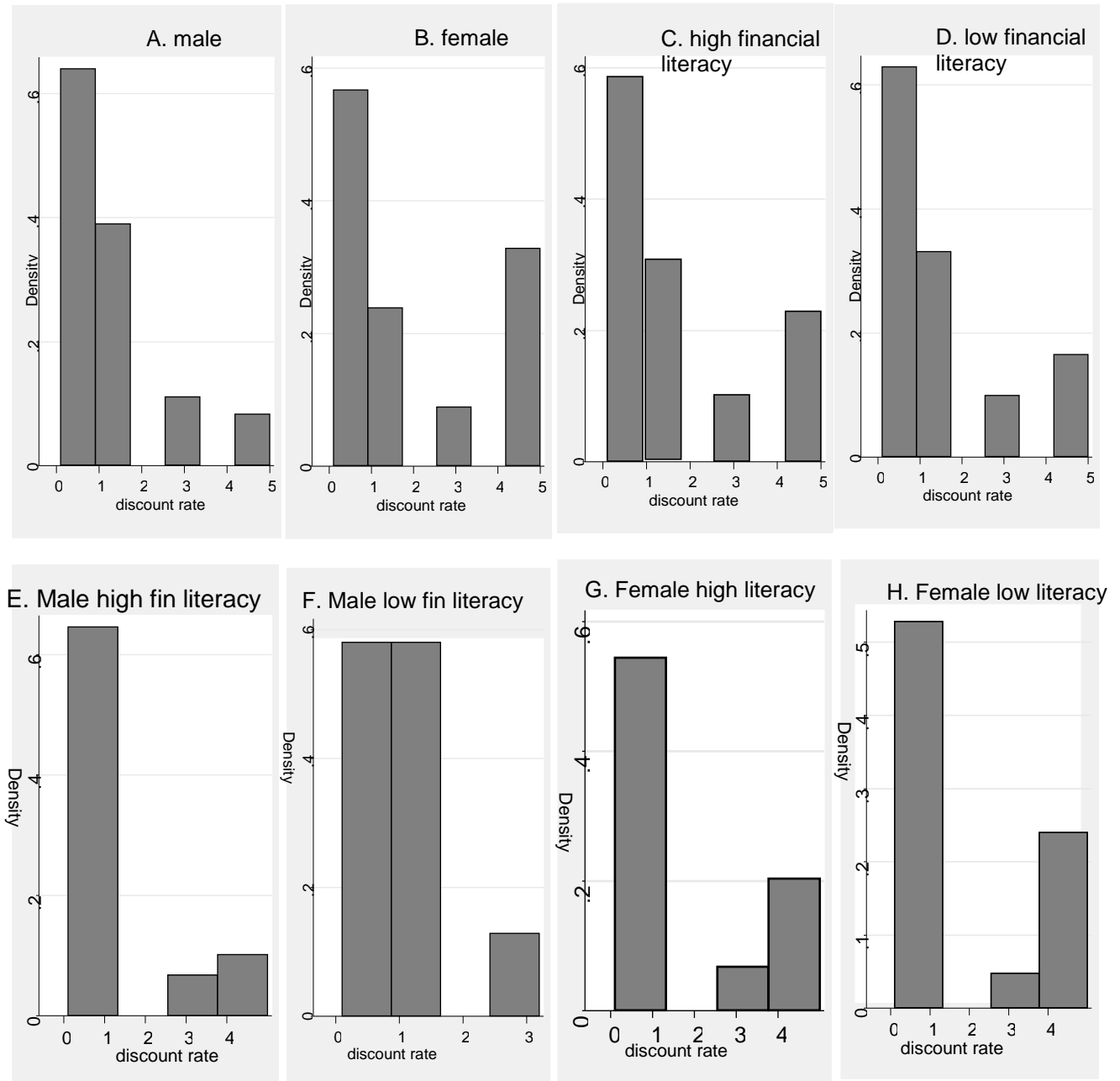
Figure 4.1: Elicited discount rates

4.4.3 Time Budget

A graphical representation of simple binary choices made by subjects and the equivalent pay-off were presented in a time budget (TB) shown in Figure 4.2. All university students chose optimal choices that maximised their utility subject to the total return they could earn from their choices. In this instance, all university students allocated all the five tokens into two columns. During quota random sampling, most of the subjects were eager to pick the winning

coupon, an aspect which revealed their need to maximize their utility. Several researchers have used the Convex Time Budget (CTB) point due to its ease of understanding by subjects, making it an appropriate tool to elicit time preferences (Alan & Ertac, 2015; Andreoni et al., 2015). The CTB is known to be a better measure of intertemporal choice when compared to the double multiple price list (DMPL) used by Andersen et al. (2008). The corner solution provided by the TB has a predictive power of individual impatience or patience. It also forecasts the demand theory as well as the equality of an individual in allocating income over periods (Andreoni et al., 2015). A marginal rate of substitution of 1.25 shows the opportunity cost of allocating of monetary rewards over the present and future period. It also shows the return the subjects could earn in the event that they were patient enough to receive the pay-off after 6 weeks.
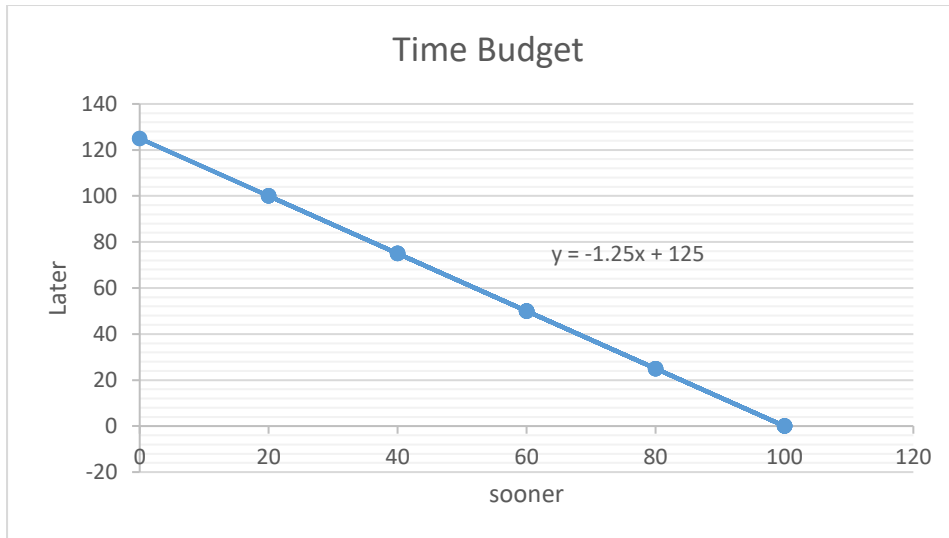
Figure 4.2: Time Budget

The return for a subject who is patient enough to receive all pay-off after 6 weeks compounded per annum is approximately 217%. This means that subjects who collected all their pay-off in 2weeks' time had a very high discount rate of the present pay-off. The maximum pay-off a participant could get in two weeks was 100 rands (7.7 USD) if all tokens were allocated in Column A, while those that collected all their pay-off after 6 weeks collected a maximum of 125 rands (9.7 USD) if all the tokens were allocated in Column B. The prevailing exchange rate during the time of the study was 1USD: 12.99 rands.

4.5 Regression Analysis

4.5.1 Time preferences and financial literacy level

Calculated marginal effects in Table 4.1 show that female university students had a higher individual discount rate compared to their male counterparts. Given that one is female, there is an 0.83% chance of a higher discount rate compared to male subjects at 5% level of significance. The first regression confirms that there is a significant variation in individual time discount rates across gender suggesting that female university students were generally impatient. A higher individual time discount rate for female university students compared to their male counterparts might be due gender disparities and girl child challenges regarding financial needs. These findings are contrary to a conclusion reached by Castillo et al., (2011) who found that boys were more impatient than girls in a 2008 study on time preference of high school students in the US. Other variables that are significantly related with time discount rates of all university students under consideration were the highest level of education in the household – matric, diploma or certificate and degree. There is a 2.74%, 7.50% and 3.47%

chance of a high time discount rate for a respondent from a household with highest level of education of matric, diploma or certificate and degree respectively.

This reveals that the highest level of education in a household is significantly associated with respondents' level of patience, which shows an intergenerational education spill over. This confirms findings by (Smith & Barboza, 2014), who concluded that financial behaviour can be linked to by the parent/guardian's level of education. We split the subjects by their level of financial literacy. An investigation into the university students with high level of financial literacy showed that the time discount rate of university students from households with the highest level of education of a matric, diploma or certificate and degree had a 2.96%, 8.4% and 2.31% chance of being significantly higher respectively. There was no significant difference between time discount rates of female and male university students with high levels of financial literacy across gender, showing that if both males and females have high levels of financial literacy, their time preferences would not differ significantly. Turning to the regression analysis which focused on university students with low levels of financial literacy, if one is female, there is a 0.96% chance that one's discount rate will be higher at 5% level of significance. Female subjects with low levels of financial literacy were found to be impatient.

Table 4.1: Negative Binomial Regression marginal effects: Time discount rate

	All	all_literate	all_low_lit	high_lit_female	low_lit_female	high_lit_male	low_lit_male
female	0.83**	0.50	0.96**				
	(0.335)	(0.48)	(0.420)				
age	-0.04	0.000	-0.065*	-0.048	-0.16***	0.041	0.022
	(0.045)	(0.097)	(0.038)	(0.140)	(0.047)	(0.083)	(0.095)
family_size	0.095	0.094	0.077	0.088	0.066	0.20**	0.07
	(0.068)	(0.118)	(0.060)	(0.187)	(0.152)	(0.092)	(0.048)
matric	2.74***	2.96***	1.97***	7.02***	3.19	0.11	1.32
	(0.75)	(1.115)	(0.316)	(2.510)	(2.061)	(0.641)	(0.868)
Dip/cert	7.50*	8.40*	1.48**	18.99	2.71	5.79**	2.71
	(4.0)	(5.076)	(0.583)	(1.780)	(5.256)	(2.768)	(3.066)
degree	3.47***	2.31*	2.39***	5.38*	9.61	1.23*	1.72
	(1.102)	(1.180)	(0.417)	(2.81)	(6.440)	(0.643)	(1.881)
lincome	0.096	0.15	0.18	0.1867	0.58**	0.58***	0.09
	(0.156)	(0.210)	(0.187)	(0.324)	(0.223)	(0.186)	(0.191)
perceptions	0.35	0.030	0.30	-0.30	0.94	-0.57	0.18
	(0.224)	(0.440)	(0.439)	(0.845)	(0.609)	(0.351)	(0.109)
ltest	0.35	-0.557	-0.557	0.150	0.48	-4.40***	-1.33***
	(0.556)	(1.858)	(0.726)	(2.757)	(1.600)	(1.517)	(0.500)
N	85	48	37	24	17	24	20

Standard errors in parentheses *p< 0.10, **p< 0.05, ***p< 0.01

If a respondent was from a household with the highest level of household education of matric, diploma/certificate and degree there was a 1.97%, 1.48% and 2.39% chance of an increase in time discount rate respectively. Findings suggest that highest level of education in a household is significantly related to time preferences of university students in the low financial literacy cohort. Further, there was a 0.07% significant chance of a decrease in time discount rate if one had low financial literacy as age increased at 10% level. In a study that looked at time preferences and participation in financial education programs in US, Meier and Sprenger (2013) found that as age increased individual discount rate of participants' decrease. This means that older and low financial literacy university students are more likely to be patient or willing to accept a larger later. This behaviour can be attributed to life experience (Frederick, 2005).

The highest level of education in a household was the only variable that was concluded to be influencing discount rates of female university students with a higher level of financial literacy. The individual time discount rates had a significant chance to increase if the university students were from households with the highest level of education as matric and degree. The discount rates of female university students with low levels of financial literacy had a 0.16% significant chance to decrease at 1% level as age increased. This shows that older female university students were more patient, revealing that as one grows older, even if one has low levels of financial literacy, one would have an understanding of the value of money and would be willing to wait to receive a larger later prize. Discount rates of female university students with lower level of financial literacy had a 0.58% significant chance of increasing at 1 % level as income increased. The finding also confirmed conclusions by Meier and Sprenger (2013) that increase in gross income tends to increase discount rates of subjects.   Higher income makes university students in this group impatient. This indicates that female university students with higher income in this cohort were not willing to wait up to six weeks to receive future income (larger later reward), rather, they preferred present consumption.

Table 4.2: Negative Binomial Regression marginal effects: Time discount rate

	All	male	female	Male1	female1	all_female	all_male	all1
Ltest_score	0.11	0.04	0.12	-0.07	0.12	0.41	-0.15	0.14
	(0.593)	(0.580)	(1.124)	(0.539)	(0.560)	(1.064)	(0.498)	(0.616)
matric				1.29**	2.45***	5.64***	1.45**	3.07***
				(0.625)	(0.195)	(1.419)	(0.723)	(0.784)
Dip/cert				4.96*	1.57***	7.959**	7.19	7.12**
				(2.751)	(0.191)	(3.819)	(4.755)	(3.357)
degree				1.71**	2.28***	7.559***	2.42***	3.87***
				(0.725)	(0.267)	(2.656)	(1.21)	(1.142)
age						-0.08	-0.02	-0.02
						(0.064)	(0.074)	(0.050)
family_size						0.09	0.13**	0.09
						(0.132)	(0.067)	(0.081)
lincome						0.02	0.26	0.11
						(0.249)	(0.180)	(0.166)
perceptions						0.35	0.08	0.22
						(0.515)	(0.171)	(0.243)
N	85	44	41	44	41	41	44	85

Standard errors in parentheses *$p< 0.10$, **$p< 0.05$, ***$p< 0.01$

In cases where the highest level of education in a household was a diploma or certificate, there was a 5.79% significant chance that time preferences would be higher for male respondents with high level of financial literacy. A 1% increase in financial literacy test score leads to a 4.4% significant decrease in time preferences of male university students with higher levels of financial literacy. A higher test score is associated with a lower individual time discount rate for male university students. The findings are similar to what was concluded by Van der Pol (2011) where high levels of financial literacy were associated with lower discount rate for individuals. Further, a 1% increase in income level is associated with a 0.58% increase in time discount rate which suggests that university students with high income from this group are generally impatient. In addition, increase in household size for male university students with higher level of financial literacy is associated with a 0.2% significant increase in time preferences. Meier and Sprenger (2013) also concluded that there was a weak significant

impact between number of dependents and time preferences. Large family sizes might have an effect of constraining household resources leading subjects to be impatient. Turning on to male subjects with low financial literacy, a 1% increase in financial literacy test score leads to a 1.33% decrease in one's time preferences. In a study on health and preferences Fuchs (1980) also concluded that an increase in knowledge levels is significantly associated with low discount rates. Our findings show that when subjects are split across gender and level of financial literacy, the highest level of education in a household is only significantly related with time preferences of subjects with higher levels of financial literacy. The findings submit that for male students, time preferences are significantly linked to their financial literacy. This conclusion could not be confirmed from all female university students. This might imply that financial literacy knowledge is significantly associated with time preferences of male university students in this study.

4.5.2 Time preferences and financial literacy

We ran a Negative Binomial regression model on time discount rate against financial literacy score for all participants across gender to investigate if there were gender differences in the sample of subjects under consideration. We also controlled for highest level of education in a household, age, family size, income and financial literacy perceptions. The regression analysis on time preference and financial literacy knowledge could not confirm the impact of financial literacy on time discount rates (Table 4.2). What is evident in all the regression analyses is the significance of highest level of education in a household in influencing time preferences, which shows an intergenerational education spill over. In all cases investigated in Table 4.2., the highest level of education in a household of matric, diploma/certificate and degree are significantly related to time preferences. The highest level of education in a household tend to increase the chance of a higher time discount rate for participants, showing that the highest level of education in a household increased chances of being impatient on subjects. In a Malaysian study, Sabri et al. (2010) found that discussing family finances with parents increased financial literacy on children. Findings confirm that the respondent's state of the world critically impacts on how they make choices over time. A regression analysis for all males also concluded that time preferences are significantly related to family size. A 1% increase in family size significantly increased time discount rate by 0.13% chance at 5% level. This finding also confirms that the state of the world where one lives is important in determining one's intertemporal choices.

4.5.3 Time preferences index

In order to carry out a robust investigation on variables that are significantly related to time preferences and financial literacy jointly, we constructed a time preference index (TPI) by dividing individual time discount rate by the financial literacy test score. The variable represented the individual's intertemporal choice over their financial knowledge. The TPI is a continuous dependent variable which permitted us to run a set of Ordinary Least Square regressions (Table 4.3). In our first regression analyses, all the university students were included. If one were female, there was a 0.11% chance that their time discount rate would be significantly higher at 5% level of significance. This was a confirmation that gender differences are significantly related to time preference choices given an individual's financial literacy level. A study on young Australians confirmed a significant variation of patience levels across gender (Booth & Katic, 2013). The highest level of education in a household is significantly associated with TPI variable. Individuals who indicated that they belonged to a household with the highest level of education as matric, certificate/diploma and degree significantly increased the TPI variable by 0.16%, 0.21% and 0.18% chance respectively, showing that intergenerational education is significantly linked to intertemporal choices. Further, a 1% increase in a test score

led to 0.55% decrease in the TPI variable, showing that financial literacy is significantly related to time preferences.

According to our results, increase in financial literacy increased patience amongst university students, a trait which is important for an individual to earn a higher return from time preference choices. In the high financial literacy group, the highest level of education in a household which is significantly associated with the TPI variable were matric and Diploma/certificate. At higher levels of financial literacy, gender difference is not significantly related with TPI variable confirming findings from Table 4.1. These findings show that if both female and male university students attained higher levels of financial literacy, the TPI variable will not be significantly different. A regression analysis of all university students with low financial literacy indicated that gender differences is weakly significantly related to TPI variable at 10%. At low levels of financial literacy, gender differences were prevalent. If one were a female with low levels of financial literacy, there was a 0.17% chance that the TPI variable would be higher. Another variable that is significantly associated with TPI variable at low levels of financial literacy was the highest level of education in a household of degree. Only highest level of education in household of matric is significantly linked to TPI variable for female university students with higher levels of financial literacy. If one were a female with higher level of financial literacy, there would be a 0.31% significant chance that the TPI variable would be higher if they belonged to a household with highest level of education of matric. For female subjects with lower levels of financial literacy, as age increased TPI variable significantly decreased by 0.041% at 5% level, a finding which confirmed the impact of age on financial experience indicated by Frederick (2005). Highest level of education in a household of diploma/certificate is significantly related to TPI variable with a 0.31% significant chance of increasing TPI for male university students with higher levels of financial literacy. An increase in financial literacy increased patience levels among male university students categorised by financial literacy level.

Table 4.3: OLS Regression: Time preference index marginal effect

	All	all_literate	all_low_lit	highlit_female	lowlit_female	high_lit_male	low_lit_male
female	0.11**	0.047	0.17*				
	(0.054)	(0.060)	(0.101)				
test	-0.55**	-0.38	-1.08	-0.26	-1.03	-0.81*	-1.73*
	(0.262)	(0.375)	(0.843)	(0.597)	(1.714)	(0.461)	(0.810)
age	-0.0063	0.0013	-0.014	-0.0023	-0.041**	-0.0019	-0.0013
	(0.007)	(0.011)	(0.011)	(0.017)	(0.014)	(0.013)	(0.022)
Family size	0.017	0.0086	0.026	0.0095	0.036	0.017	0.013
	(0.013)	(0.013)	(0.020)	(0.027)	(0.048)	(0.016)	(0.017)
matric	0.16***	0.15**	0.14	0.31**	0.074	0.021	-0.0082
	(0.053)	(0.058)	(0.108)	(0.134)	(0.249)	(0.053)	(0.221)
diploma	0.21**	0.23**	0.099	0.15	-0.14	0.31**	-0.0098
	(0.086)	(0.113)	(0.122)	(0.172)	(0.452)	(0.124)	(0.223)
degree	0.18***	0.088	0.26*	0.15	0.42	0.077	-0.052
	(0.058)	(0.053)	(0.144)	(0.113)	(0.323)	(0.051)	(0.260)
income	0.0097	0.013	0.022	0.016	0.16*	0.054	-0.013
	(0.022)	(0.031)	(0.045)	(0.048)	(0.084)	(0.045)	(0.058)
perceptions	0.063*	0.0074	0.075	-0.026	0.22	-0.053	0.028
	(0.036)	(0.057)	(0.056)	(0.122)	(0.136)	(0.060)	(0.043)
N	85	48	37	24	17	24	20
R^2	0.192	0.153	0.312	0.199	0.456	0.446	0.472

Standard errors in parentheses *$p< 0.10$, **$p< 0.05$, ***$p< 0.01$

Financial literacy is weakly significantly related to TPI for male subjects with high and low level of financial literacy. When university students were split into males and females with lower or higher levels of financial literacy, only the highest level of education in a household is significantly associated with TPI variable for university students with higher levels of financial literacy, a finding also highlighted in table 4.1, showing that the highest level of education in a household significantly impacts time preferences of university students with high financial literacy levels. The findings are in line with findings by Sabri et al. (2010), who indicated in a Malaysian study that students who received financial literacy from their parents were found to be financially literate. The study concluded that the highest level of household education causes university students to be impatient, since their time discount rates are more likely to increase. The ordinary least squares regression analysis shows that increase in financial literacy generally makes university students patient. Other variables that were concluded to be significantly related to time preferences were income, age and family size.

4.6 Conclusion

This study used a questionnaire that included a simple binary experimental game of tokens (to elicit time preferences of subjects) and a financial literacy test. Time discount rates of categorised university students with higher or lower financial literacy levels were significantly related to the household's highest level of education and gender differences. When subjects were split according to gender and literacy levels, the highest level of education in a household is only associated with subjects with higher levels of financial literacy. These findings reveal that highest level of education in a household is significantly related with time preference choices of individuals, showing the effect of education externality across generations. Elicited time discount rates from the experimental game also show that female university students' time discount rates were more likely to be higher than those of their male counterparts - reflecting that females under consideration were more impatient especially if they belong to a low financial literacy level group. Our findings reveal that gender differences impact time preferences, especially after factoring financial literacy level. This may be explained by the different financial challenges faced by the girl child. Providing financial literacy to university students can play an important role in reducing time preference differences across gender. The study shows that financial literacy significantly impacts time preferences of male subjects with low and high levels of financial literacy. As financial literacy increases, male university students are more likely to be patient. Being patient is a trait associated with waiting longer to earn a larger later reward with a high return. Increasing financial literacy to male university students will help to improve their welfare.

A robust check using the OLS model on time preference index (TPI) variable confirmed that the highest level of education in a household is significantly associated with time preferences of subjects, especially students with higher level of financial literacy, showing that education has a generational spill over effect. Providing education to the current generation will impact the welfare of future generations. The OLS regression model for the whole group also showed that financial literacy is significantly linked to university students' time preferences. Increasing financial literacy amongst university students induces them to be patient. Our study shows that provision of financial literacy to university students will improve their welfare by impacting their time preferences. Other variables concluded to be significantly related to university students' time preferences were age, income and family size. It is critical to understand how time preferences of individuals are formulated as they are associated with perseverance and patience which are vital for future welfare and investment choices. The findings are however

not exhaustive; a deeper investigation into how household levels of education is linked to time preferences is required. The list of independent variables can be stretched to include more characteristics. More so, factors that tend to increase time discount rates for female university students need further exploration. It will be important to understand how university students react to high and low time preference incentives at varying time stretches. Further research may investigate whether time preferences change as the level of income changes.

4.7 References

Adan, A. & Natale, V. 2002. Gender differences in morningness-eveningness preference. *Chronobiology International*, 19(4), 709–720. https://doi.org/10.1081/CBI-120005390

Ajzen, I. 2011. The theory of planned behaviour: Reactions and reflections. *Psychology & Health*, 26(9), 1113–1127. https://doi.org/10.1080/08870446.2011.613995

Alan, S. & Ertac, S. 2015. Patience, self-control and the demand for commitment: Evidence from a large-scale field experiment. *Journal of Economic Behavior & Organization*, 115, 111–122.

Andersen, S., Harrison, G. W., Lau, M. I. & Rutström, E. E. 2006. Elicitation using multiple price list formats. *Experimental Economics*, 9(4), 383–405.

Andersen, S., Harrison, G. W., Lau, M. I. & Rutström, E. E. 2008. Eliciting risk and time preferences. *Econometrica*, 76(3), 583–618. Retrieved from http://onlinelibrary.wiley.com/doi/10.1111/j.1468-0262.2008.00848.x/abstract

Andreoni, J., Kuhn, M. A. & Sprenger, C. 2015. Measuring time preferences: A comparison of experimental methods. *Journal of Economic Behavior & Organization*, 116, 451–464. https://doi.org/10.1016/j.jebo.2015.05.018

Andreoni, J. & Sprenger, C. 2012. Estimating Time Prefernces from Convex Budgets. *American Economic Review*, 102(7), 3333–3356. https://doi.org/10.1257/aer.102.7.3333

Angerer, S., Lergetporer, P., Glätzle-Rützler, D. & Sutter, M. 2015. How to measure time preferences in children: a comparison of two methods. *Journal of the Economic Science Association*, 1(2), 158–169. https://doi.org/10.1007/s40881-015-0016-0

Argent, J., Finn, A., Leibbrandt, M. & Woolard, I. 2009. Poverty: Analysis of the NIDS Wave 1 dataset. *National Income Dynamics Study, NiDS Discussion Paper*, (12).

Ariely, D., Loewenstein, G. & Prelec, D. 2003. Coherent arbitrariness: Stable demand curves without stable preferences. *The Quarterly Journal of Economics*, 118(1), 73–106. Retrieved from http://qje.oxfordjournals.org/content/118/1/73.short

Ariely, D. & Wertenbroch, K. 2002. Procrastination, Deadlines, and Performance: Self-Control by Precommitment. *Psychological Science*, 13(3), 219–224. Retrieved from http://pss.sagepub.com/content/13/3/219.short4

Ausubel, L. M. 1999. Adverse Selection in the Credit Card Market, (C), 1–52. Retrieved from http://weber.ucsd.edu/~aronatas/conference/adverse.pdf

Bajtelsmit, V. 1999. Gender differences in defined contribution pension decisions. *Financial Services Review*, 8(1), 1–10. https://doi.org/10.1016/S1057-0810(99)00030-X

Banks, J., o'Dea, C. & Oldfield, Z. 2010. Cognitive Function, Numeracy and Retirement Saving Trajectories. *The Economic Journal*, 120(548), F381–F410. Retrieved from http://onlinelibrary.wiley.com/doi/10.1111/j.1468-0297.2010.02395.x/pdf

Batty, M., Collins, J. & Odders-White, E. 2015. Experimental Evidence on the Effects of Financial Education on Elementary School Students' Knowledge, Behavior, and Attitudes. *Journal of Consumer Affairs*, 49(1), 69–96. Retrieved from http://onlinelibrary.wiley.com/doi/10.1111/joca.12058/full

Beal, D. J. & Delpachitra, S. B. 2003. Financial Literacy Among Australian University Students. Centre for Australian Financial Institutions (CAFI) at the University of Southern Queensland, 1–15. https://doi.org/10.1111/j.1759-3441.2003.tb00337.x

Becchetti, L., Caiazza, S. & Coviello, D. 2013. Financial education and investment attitudes in high schools: evidence from a randomized experiment. *Applied Financial Economics*, 23(10), 817–836.

Benjamin, D. J., Brown, S. A. & Shapiro, J. M. 2013. WHO is "behavioral"? Cognitive ability and anomalous preferences. *Journal of the European Economic Association*, 11(6),

1231–1255. https://doi.org/10.1111/jeea.12055

Benzion, U., Rapoport, A. & Yagil, J. 1989. Discount rates inferred from decisions: An experimental study. *Management Science*, 35(3), 270–284. Retrieved from http://pubsonline.informs.org/doi/abs/10.1287/mnsc.35.3.270

Bernheim, B. D., Garrett, D. M. & Maki, D. M. 2001. Education and saving:: The long-term effects of high school financial curriculum mandates. *Journal of Public Economics*, 80(3), 435–465. Retrieved from http://www.sciencedirect.com/science/article/pii/S0047272700001201

Booth, A. L. & Katic, P. 2013. Cognitive Skills, Gender and Risk Preferences. *Economic Record*, 88(284), 19–30. https://doi.org/10.1111/1475-4932.12014

Capuano, A. & Ramsay, I. 2011. What causes suboptimal financial behaviour? An exploration of financial literacy, social influences and behavioural economics. An Exploration of Financial Literacy, Social Influences and Behavioural Economics (March 23, 2011). U of Melbourne Legal Studies Research Paper, (540). Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1793502

Carlin, B.I. & Robinson, D.T. 2012. What Does Financial Literacy Training Teach Us? *Journal of Economic Education*. 43(3):235–247. DOI: 10.1080/00220485.2012.686385.

Castillo, M., Ferraro, P. J., Jordan, J. L. & Petrie, R. 2011. The today and tomorrow of kids: Time preferences and educational outcomes of children. *Journal of Public Economics*, 95(11), 1377–1385. Retrieved from http://www.sciencedirect.com/science/article/pii/S0047272711001381

Chabris, C. F., Laibson, D., Morris, C. L., Schuldt, J. P. & Taubinsky, D. 2008. Individual laboratory-measured discount rates predict field behavior. *Journal of Risk and Uncertainty*, 37(2–3), 237–269. Retrieved from http://link.springer.com/article/10.1007/s11166-008-9053-x

Charness, G. & Gneezy, U. 2012. Strong Evidence for Gender Differences in Risk Taking. *Journal of Economic Behavior and Organization*, 83(1), 50–58. https://doi.org/10.1016/j.jebo.2011.06.007

Charness, G., Gneezy, U. & Imas, A. 2013. Experimental methods: Eliciting risk preferences. *Journal of Economic Behavior & Organization*, 87, 43–51. Retrieved from http://www.sciencedirect.com/science/article/pii/S016726811200282X

Chen, H. & Volpe, R. P. 1998. An analysis of personal financial literacy among college students. *Financial Services Review*, 7(2), 107–128. Retrieved from http://www.sciencedirect.com/science/article/pii/S1057081099800067

Croson, R. & Gneezy, U. 2009. Gender Differences in Preferences. *Journal of Economic Literature*, 47(2), 448–474. https://doi.org/10.1257/jel.47.2.448

Cull, M. & Whitton, D. 2011. University Students' Financial Literacy Levels: Obstacles and Aids. *Economic and Labour Relations Review*, 22(1), 99–114. https://doi.org/http://search.informit.com.au/browseJournalTitle;res=IELBUS;issn=10 35-3046

DellaVigna, S. 2009. Psychology and Economics: Evidence from the Field. *Journal of Economic Literature*, 47(2), 315–372. Retrieved from http://www.ingentaconnect.com/content/aea/jel/2009/00000047/00000002/art00001

Eckel, C. C. & Grossman, P. J. 2008. Men, Women and Risk Aversion: Experimental Evidence. Handbook of experimental economics results, McGraw-Hill, New York. https://doi.org/10.1016/S1574-0722(07)00113-8

Epper, T., Fehr-Duda, H. & Bruhin, A. 2009. Uncertainty Breeds Decreasing Impatience : The Role of Risk Preferences in Time Discounting Uncertainty Breeds Decreasing Impatience : The Role of Risk Preferences in Time Discounting. *University of Zurich*

Working Paper, 412(412). https://doi.org/10.2139/ssrn.1416007

Etikan, I. 2016. Comparison of Convenience Sampling and Purposive Sampling. *American Journal of Theoretical and Applied Statistics*, 5(1), 1. https://doi.org/10.11648/j.ajtas.20160501.11

Frederick, S. 2005. Cognitive Reflection and Decision Making. *Journal of Economic Perspectives*, 19(4), 25–42. https://doi.org/10.1257/089533005775196732

Frederick, S., Loewenstein, G. & Donoghue, T. O. 2007. Time Discounting and Time Preference : A Critical Review. *Journal of Economic Literature*, 40(2), 351–401. Retrieved from http://www.jstor.org/stable/2698382

Frederick, S., Loewenstein, G. & O'donoghue, T. 2002. Time Discounting and Time Preference: A Critical Review. *Journal of Economic Literature*, 40(2), 351–401. https://doi.org/10.1257/jel.40.2.351

Fuchs, V. 1980. Time Preference and Health: An Exploratory Study. https://doi.org/10.3386/w0539

Gallery, N., Newton, C. & Palm, C. 2011. Framework for assessing financial literacy and superannuation investment choice decisions. *Australasian Accounting, Business and Finance Journal*, 5(2), 3–22. Retrieved from http://search.proquest.com/openview/8e76d19fc343a195363e67d46d82d982/1?pq-origsite=gscholar&cbl=38872

Giné, X., Goldberg, J., Silverman, D. & Yang, D. 2011. Revising Commitments: Time Preference and Time Inconsistency in the Field. Working Paper. Retrieved from http://cega.berkeley.edu/assets/cega_events/17/Revising_Commitments-_Time_Preference_and_Time_Inconsistency_in_the_Field.pdf

Güth, W. 2004. Time and Decision: Economic and Psychological Perspectives on Intertemporal Choice. *The Journal of Socio-Economics*, 33(4), 519–521. https://doi.org/10.1016/j.socec.2004.04.003

Hilmer, C. E. & Hilmer, M. J. 2014. Practical econometrics. data collection, analysis and application.McGrall-Hill, New York. https://doi.org/9780071318518

Hoch, S. J. & Loewenstein, G. F. 1991. Time-inconsistent preferences and consumer self-control. *Journal of Consumer Research*, 4, 492–507. Retrieved from http://www.jstor.org/stable/2626842

Huston, S. J. 2010. Measuring financial literacy. *Journal of Consumer Affairs*, 44(2), 296–316. Retrieved from http://onlinelibrary.wiley.com/doi/10.1111/j.1745-6606.2010.01170.x/full

Imrohoroglu, A., Imrohoroglu, S. & Joines, D. H. 2003. Time-Inconsistent Preferences and Social Security. *The Quarterly Journal of Economics*, 118(2), 745–784. https://doi.org/10.1162/003355303321675509

Kennedy, B. P. 2013. The theory of planned behavior and financial literacy: A predictive model for credit card debt? *ProQuest Dissertations and Theses*, 84. https://doi.org/Paper 480

Kim, S., Dueker, G. L., Hasher, L. & Goldstein, D. 2002. Children's time of day preference: Age, gender and ethnic differences. *Personality and Individual Differences*, 33(7), 1083–1090. https://doi.org/10.1016/S0191-8869(01)00214-8

Kotrlik, J. & Higgins, C. 2001. Organizational research: Determining appropriate sample size in survey research appropriate sample size in survey research. *Information Technology, Learning, and Performance Journal*, 19(1), 43. https://doi.org/10.1109/LPT.2009.2020494

LaBorde, P. M. & Mottner, S. W. 2013. Personal Financial Literacy: Perceptions of Knowledge, Actual Knowledge and Behavior of College Students. *Journal of Financial Education*, 39(3/4), 1–30. Retrieved from http://www.jstor.org/stable/23608645

Lawrance, E. 1991. Poverty and the rate of time preference: evidence from panel data. *Journal*

of Political Economy. Retrieved from http://www.journals.uchicago.edu/doi/abs/10.1086/261740

Loewenstein, G., Read, D. & Baumeister, R. F. 2003. Time and Decision: Economic and Psychological Perspectives of Intertemporal Choice. Russell Sage Foundation, New York.

Loewenstein, G. & Thaler, R. H. 1989. Anomalies: intertemporal choice. *The Journal of Economic Perspectives*, 3(4), 181–193. Retrieved from http://www.jstor.org/stable/1942918

Lusardi, A. & Mitchell, O. S. 2005. Financial literacy and planning: Implications for retirement wellbeing. Michigan Retirement Research Center Research Paper No. WP, 108. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=881847

Lusardi, A. & Mitchell, O. S. 2011. Financial literacy around the world: an overview. *Journal of Pension Economics and Finance*, 10(4), 497–508. Retrieved from http://journals.cambridge.org/abstract_S1474747211000448

Lusardi, A., Mitchell, O. S. & Curto, V. 2010. Financial literacy among the young. *Journal of Consumer Affairs*, 44(2), 358–380. Retrieved from http://onlinelibrary.wiley.com/doi/10.1111/j.1745-6606.2010.01173.x/full

Mandell, L. 2008. Financial education in high school. Overcoming the Saving Slump: How to Increase the Effectiveness of Financial Education and Saving Programs, 257–279. Retrieved from http://books.google.co.za/books?hl=en&lr=&id=1M3RUvoG6l4C&oi=fnd&pg=PA257&dq=Financial+literacy,+Boyce,+Danes+(2004)+&ots=v4D1OObhXV&sig=G-2wRq_GrPZba9ZA44yagKMp7oY

Mandell, L. & Klein, L. S. 2009. The Impact of Financial Literacy Education on Subsequent Financial Behavior. *Journal of Financial Counseling & Planning*, 20(1), 15–24. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=43915999&site=ehost-live

Mas-Colell, A., Whinston, M. D., & Green, J. R. 1995. The principal–agent problem,". *Microeconomic Theory*, 447–510. Oxford University Press, Oxford.

Meier, S. & Sprenger, C. D. 2013. Discounting financial literacy: Time preferences and participation in financial education programs. *Journal of Economic Behavior & Organization*, 95, 159–174. Retrieved from http://www.sciencedirect.com/science/article/pii/S0167268112000625

Mitchell, O. S. 2009. Financial Literacy Among the Young. *Journal of Consumer Affairs*, 44(2), 358–380. Retrieved from http://onlinelibrary.wiley.com/doi/10.1111/j.1745-6606.2010.01173.x/full

Németh, K. H. D. B. 2014. An Empirical Study of Financial Literacy versus Risk Tolerance Among Higher Education Students. *Public Finance Quarterly*, 4, 445. Retrieved from http://www.asz.hu/public-finance-quarterly-articles/2014/an-empirical-study-of-financial-literacy-versus-risk-tolerance-among-higher-education-students/a-huzdik-beres-nemeth-2014-4.pdf

Norum, P. 2008. The role of time preference and credit card usage in compulsive buying behaviour. *International Journal of Consumer Studies*, 32(3), 269–275. Retrieved from http://onlinelibrary.wiley.com/doi/10.1111/j.1470-6431.2008.00678.x/full

Oanea, D. C. & Dornean, A. 2012. Defining and Measuring Financial Literacy. New Evidence from Romanian' Students of the Master in Finance. *Annals of the Alexandru Ioan Cuza University - Economics*, 59(2), 113–129. https://doi.org/10.2478/v10316-012-0036-3

Parker, A. M. & Fischhoff, B. 2005. Decision-making competence: External validation through an individual-differences approach. *Journal of Behavioral Decision Making*, 18(1), 1–

27. https://doi.org/10.1002/bdm.481

Powell, M. & Ansic, D. 1997. Gender differences in risk behaviour in financial decision making, an experiment analysis. *Journal of Economic Psychology,* 18(6), 605-628. https://doi.org/10.1016/S0167-4870(97)00026-3

Rabin, M. 2002. A perspective on psychology and economics. *European Economic Review*, 46(4), 657–685. Retrieved from http://www.sciencedirect.com/science/article/pii/S0014292101002070

Rae, J. & Mixter, C. W. 1905. The sociological theory of capital. Macmillan Company.

Sabri, M. F., MacDonald, M., Hira, T. K. & Masud, J. 2010. Childhood Consumer Experience and the Financial Literacy of College Students in Malaysia. *Family & Consumer Sciences Research Journal*, 38(4), 455–467. https://doi.org/10.1111/j.1552-3934.2010.00038.x

Sayinzoga, A., Bulte, E. H. & Lensink, R. 2016. Financial Literacy and Financial Behaviour: Experimental Evidence from Rural Rwanda. *Economic Journal*, 126(594), 1571–1599. https://doi.org/10.1111/ecoj.12217

Schagen, S. & Lines, A. 1996. Financial literacy in adult life: a report to the Natwest Group Charitable Trust. NFER. Retrieved from https://www.nfer.ac.uk/publications/91091/91091.pdf

Shambare, R. & Rugimbana, R. 2012. Financial Literacy Among the Educated : An Exploratory Study of Selected University Students in South Africa By. *Feature Article*, 4425(4), 581–590. https://doi.org/10.1002/tie

Smith, C. & Barboza, G. 2014. The Role of Trans-Generational Financial Knowledge and Self-Reported Financial Literacy on Borrowing Practices and Debt Accumulation of College Students. *Journal of Personal Finance*, 13(2), 28. Retrieved from http://search.proquest.com/openview/5c7378f8f8e46cd7d823ba9e979975aa/1?pq-origsite=gscholar

Tang, N. & Peter, P. C. 2015. Financial knowledge acquisition among the young: The role of financial education, financial experience, and parents' financial experience. *Financial Services Review*, 24(2), 119. Retrieved from http://search.proquest.com/openview/ba4d2750e5e4c38a618e0fa26ece9a1a/1?pq-origsite=gscholar

Van der Pol, M. 2011. Health, education and time preference. *Health Economics*, 20(8), 917–929. https://doi.org/http://dx.doi.org/10.1002/hec.1655

Wagland, S. P. & Taylor, S. 2009. When it comes to financial literacy, is gender really an issue? *Australasian Accounting, Business and Finance Journal*, 3(1), 3. Retrieved from http://ro.uow.edu.au/aabfj/vol3/iss1/3/

CHAPTER 5:

Paper presented at the Australian Conference for economists (ACE 2018)-10-13 July 2018

Multiple price list incentivized time preferences and financial literacy of university students[3]

Abstract

This paper investigates the impact of financial literacy on individual time preferences. Existing research shows that people with higher levels of financial literacy are less likely to make mistakes and achieve better life outcomes. What is not clear is whether variation in life outcomes are driven by time preferences given that financial literacy is weakly associated with cognitive abilities. This paper uses data collected by way of Multiple Price List time preference and risk preference experiment, questionnaire and financial literacy test on 192 (female=53%) university students enrolled in the Faculty of Economic and Management Sciences at a university in South Africa. Study findings show that individuals with high financial literacy exhibited higher cumulative density individual discount rate and are more decisive in their choices reflected by a lower percentage of multiple switching on binary lottery choices. Ordered probit regression models capturing a latent variable time preference show that financial literacy impacts on individual discount rates for categorised university student groups by task(s) completed. Increase in risk preference parameter significantly increases impatience on university students in all instances explored. Impatient choices increase with low levels of financial literacy for the whole group and male university students while impatience increases with high financial literacy for female university students. Using a probit regression analysis, the research concludes a reverse causality between time preferences and financial literacy in the whole group and female subjects. Financial literacy has an impact on university students' time preferences.

Key words: Time preferences, financial literacy, impatience, risk preferences, university students

5.1 Introduction

Time preferences are unobservable characteristics that influence individuals to allocate choices over time while financial literacy is thought to be the output of human capital-production function requiring raw cognitive abilities that include numeracy, knowledge as well as capability to make financial decisions (Delavande et al., 2008). Making time preference choices is a function of information that an individual is holding. In personal finance individuals with higher levels of financial literacy are known to achieve better life outcomes (Van Rooij et al., 2011; Bernanke, 2006; Meier and Sprenger, 2013). Better life outcomes are an indication that financial literacy, which is information that an individual might be endowed with, plays a role in influencing one's time preferences. The financial decision involves making intertemporal choices. Evidence of knowledge influencing choices over time cannot be doubted. What needs further investigation is how individuals with high or low levels of financial literacy make their time preferences choices.

This study investigates the impact of financial literacy on time preference choices of university students. It also seeks to examine whether there is reverse causality between time preferences and financial literacy. Further, the study explores whether there are differences in the way individuals make time preference choices given different levels of financial literacy and gender orientation. A total of 192 (female=53%) university students took part in eight standardized incentivized Multiple Price List (MPL) time preference and risk preference experimental games at the University of the Free State in South Africa. The MPL games, (where individuals were asked to make a choice to receive payment sooner or later and to choose between safe and risk lotteries), questionnaire collecting individual financial information and financial literacy test were used to collect data. Ten per cent of the participants were selected using quota random sampling and paid the actual amount for their choices on one of the randomly selected games they played.

Exploring the impact of financial literacy on time preferences is an important initiative in studying determinants of life outcomes of individuals. First, administering a financial literacy test provides a selection process to determine the financial literacy level and assists in evaluating if there is a need to provide financial literacy to university students. Financial literacy level is touted as a critical component in reducing financial decision mistakes (Lusardi and Mitchell, 2005; Clark et al., 2006). Given an increase in financial challenges in the global world and South Africa in particular, understanding financial behaviour that propagates predatory lending, enormous levels of consumer debt, poor saving rates, proliferation of pyramid 'ponzi' schemes and financial fraud, high product cost and penalty fees, information asymmetry in pricing of goods and limited knowledge of how to get compensation for losses is important (Roberts et al., 2014). The quest to understand the impact of financial knowledge on choices over time could play an essential role in highlighting how life outcomes differ even for people with fairly similar life opportunities. Second, the use of MPL experimental games in eliciting individual time preferences resembles an investment-savings venture that can essentially test if cognitive ability plays a role in making financial decisions. The relationship between cognitive abilities and inter-temporal preferences have implications on optimal policy design (Banks et al., 2010). Thirdly, all subjects financially gained, a participation fee of 50 rands was paid for taking part in the experiment.

Existing studies point towards the fact that financial literacy is lacking amongst even the educated citizens and university students are not an exception (Bernanke, 2006; Braunstein and

Welch, 2002; Van Rooij et al., 2011). Low levels of financial literacy are associated with poor life outcomes and reduced welfare achievements (Lusardi and Mitchell, 2007). Studies reported low levels of financial literacy in South Africa, even among university students (Roberts et al., 2014; Shambare and Rugimbana, 2012; Struwig et al., 2012). Further, financial illiteracy is also rampant across, gender, tribes, region, race, demographic level, and other social strata (National Consumer Financial Education Strategy, 2013). A couple of organisations have carried out financial literacy surveys in South Africa namely Fintrust and Human Science Research Council (HSRC) and have also confirmed low levels of financial literacy even among students (Roberts et al., 2014). The National Treasury of South Africa is in the process of championing imparting of financial literacy in order to increase the financial capability and financial well-being of all South Africans (National Consumer Financial Education Strategy, 2013). The big question is, is financial literacy associated with choices over time?

There is evidence of a correlation between financial information and time preference decisions (Meier and Sprenger, 2013; Gathergood John, 2012). Meier and Sprenger (2013) found that individuals who were prepared to acquire financial literacy were patient. A 1979 longitudinal survey on youth focusing on credit card debt puzzle found that borrowers had a high discount rate (impatient) and low financial literacy (Gorbachev and Luengo-Prado, 2016). There is also contrasting evidence that elicited time preference parameters may not precisely represent real individual behaviour (Chabris et al., 2008). No evidence of the impact of knowledge on time preference was found in a study that explored whether learning the basic fundamentals of cash flow capitalization affect intertemporal choice (Lahav et al., 2015). On the other hand, there are a number of studies that have used experimental methods to measure time preferences in a bid to link the parameters to real-life outcomes and tend to accept that actual behaviour in individuals can be explained by the elicited measures (Harrison et al., 2004; Castillo et al., 2011; Sayinzoga et al., 2014). Further evidence also shows that cognitive ability plays a pivotal role in making financial decisions. Literature suggests that there is a small distinction between broad financial literacy and narrow measures of cognitive ability, such as numeracy (Banks et al., 2010). However, what is not clearly spelt is whether financial literacy increases or decreases patience levels in individuals faced with decisions on choice over time.

Classical economics suggests that time preferences are independent of the delay of the reward and the size of the reward (Kirby and Maraković, 1995). Classical economics theorists also believe in exponential discounting where the discount rate for rewards is constant over time. A violation of the classical theory assumptions occurs if there are dynamic inconsistencies in preference choices between two prizes separated in time, better explained by impulsivity (David Laibson, 1997). The habit of giving present time special treatment when faced with rewards over time has been found to be inherent in people and animals. Research evidence has concluded evidence of hyperbolic discounting on rewards over time (Andersen et al., 2008; Kirby and Maraković, 1995). People show a high level of impulsivity when faced with rewards in a short time horizon and tend to be patient as the time frame of the rewards gets longer. A study on a broad sample of US population's time preferences found evidence of hyperbolic and exponential discounting playing a role in the variation of retirement savings (Shah et al., 2015)

This study concluded that financial literacy has an impact on time preferences especially on female subjects and male subjects with higher financial literacy. A reverse causality on the impact of time preferences on financial literacy was also concluded. Individuals with lower

financial literacy show a higher level of indifference over lotteries which is reflected by a higher multiple switching percentage on MPL experimental game lotteries, revealing that people with low financial literacy struggle to make financial decisions and are indecisive, most probably due to low cognitive ability. This study can be compared with findings by Meier and Sprenger (2013), they concluded that individual who chose to acquire personal finance information is generally patient when matched with individuals who did not choose to. Further, a study on self-control, financial literacy and consumer indebtedness concluded that there is an association between financial illiteracy and lack of self-control (Gathergood, 2012). High school students who excelled in mathematics in Chile were found to be risk averse and patient (Benjamin et al, 2013).

The study is organized as follows; the next section focuses on methodology, followed by an analysis of descriptive statistics. The paper focuses on regression analyses in the section that follows, discussed the results and provide concluding remarks in the final section.

5.2 Methodology

5.2.1 Design of the study
This research is based on a laboratory study measuring time and risk preferences of students by their financial literacy level. Subjects who scored a mark above average in the financial literacy test are categorized as possessing high financial literacy while all subjects that scored a mark below average are classified as having lower financial literacy.

5.2.2 Laboratory study procedure
A total of 192 university students participated in the study. The laboratory study was conducted in the following steps. A recruitment advert for students enrolled in a Personal Finance module in the Faculty of Economic and Management Sciences was posted on Blackboard (university online learning platform) a week before students commenced Personal Finance lectures which ran between July and December 2016. The advertisement voluntarily invited students to participate in risk preference and time preference games that included a questionnaire (used to collect personal information) and a financial literacy test used to measure financial literacy. The advert also indicated that all participants were going to be paid R50 participation fee and they also stood a chance to win money in line with the choices made in the games played. The study was carried out on the 27th of July 2016 at the University of Free State Bloemfontein Campus. The financial literacy test assessed students' literacy levels or knowledge before they pursued the Personal Finance module. A thirty question financial literacy test is drawn from National Financial Capability Study (NFCS), Jump start, Knowledge Assessment Survey Questions and dollar sense was used to measure the level of financial literacy (LaBorde et al., 2013; Lusardi and Mitchell, 2011; Mandell, 2008). The financial literacy test provided financial literacy levels of the subjects. The subjects were made aware of the purpose of the study.

We enlisted the services of two research assistants who assisted in distributing the document that included experimental games, personal financial information questionnaire and the financial literacy test to individual students. Students were instructed to sit one sit away from each other in the venue. The research assistants then distribute the experiment document to the participants. To incentivize participants to exhibit their true financial literacy level prize money of R200 rands was paid to the person who scored the highest mark in the financial literacy test. The announcement for the prize money was made before students started completing the tasks.

The subjects were asked to fill in a consent form which had a voluntary participation clause. The researcher then read the instruction on how the time preference games were played and the participants were given time to play one demo game followed by four actual games. This was followed by the reading of the instruction on how to play risk preference games and the subjects were given time to play four games plus one demo game. The games had written instructions and for clarity, the researcher read the instructions. After completing the tasks, subjects then completed a personal financial information questionnaire followed by completing a multiple choice financial literacy test.

When students finished answering the financial literacy test, one of the research assistants asked the subjects to pick a ticket from a hat that gave them a chance to win from the choices that they made in the time preference and risk preference games. A total of 200 tickets were put in the hat of which 20 were winning tickets, which gave all participants a 10% chance to be paid for their choices. Placing tickets in the hat sets the design of a quota random sampling. The experiment was carried out in a single session that took two hours thirty minutes

5.2.3 Measuring time discount rates

In the study, the subjects were asked to make four time preference and four risk preference choices on Multiple Price Lists (MPL)(Andersen et al., 2008). Each MPL game had ten decision rows with two choice options A or B (see, Table 5.1). Subjects had an option of choosing small sooner (SS) choice or larger later (LL) choice and all in all one subjects completed (four) time preference tasks/games.

Table 5.1: Time preference payment matrix table

	Lottery A	Lottery B	
row	Payment in one week	Payment in one month and one week	Discount rate
1	R250	R250+ 10% interest=R252.09	0.0084
2	R250	R250 +20% interest=R254.20	0.017
3	R250	R250+30% interest=R256.33	0.025
4	R250	R250+40% interest=R258.47	0.034
5	R250	R250+50% interest=R260.63	0.043
6	R250	R250+60% interest=R262.81	0.051
7	R250	R250+70% interest=R265.00	0.06
8	R250	R250+80% interest=R267.22	0.069
9	R250	R250+90% interest=R269.45	0.078
10	R250	R250+100% interest=R271.70	0.087

The design of the MPL tables row 1 were as follows (Table 5.1), subjects were asked to make a choice to receive R250 in one week (t=0) or R254.20 in one month and one week(τ =1), task 2, subjects were asked in row 1 to make a choice to receive R250 in one week (t=0) or R256.33 in three months and one week (τ =3), task 3, subjects were asked in row 1 to make a choice to receive R250 in one week (t=0) or R262.82 in six months and one week (τ =6) and task 4, subjects were asked in row 1, to make a choice to receive R250 in one week (t=0) or R276.29 in one year and one week (τ =12). The interest paid for the future period (larger later) ranged from 10% in row 1 up to 100% in row 10. In short the, individual discount rate is given as IDR$_{(t}$ $_{,\tau)}$. Where (t) represents time preference choice paid in a week and τ is future time delivery time preference choice paid after 1 month, 3monts, 6monts and 12 months. Our study used standardized MPL games used by Andersen et al (2008) which were modified to suit South

African currency and context by the Research Unit in Behavioural Economics and Neuro-economics (RUBEN) at the University of Cape Town in South Africa. All time preferences winners were paid after a week to deal with present time bias (Harrison et al., 2004; Alan and Ertac, 2015). The study assumed a risk neutral discounting model in order to calculate the individual discount rate of subjects from the MPL time preferences games (Andersen et al., 2008).

$$M_t = (1/(1+\delta)^\tau)M_{t+\tau} \qquad (5.2)$$

Where M_t is the monetary reward outcome at time t, present time consumption that provides a smaller sooner, $M_{t+\tau}$ is monetary reward outcome at time $t+\tau$ that yields a larger later future period consumption and , is the individual discount rate. The research calculated δ using the values given in the MPL tables. Discount rate for all the four MPL time preference games are the same and are given in Table 5.1. The values M_t and $M_{t+\tau}$ were recorded at a point where the subject first switches from option A to Option B on the MPL game. The subjects were assumed to be indifferent at the point where they switched from lottery A to B, therefore equating the two lotteries indicated that the subject is indifferent between the two lotteries (Andersen et al., 2008). The discount rate at the initial switching point was recorded and represented the individual discount rate for the subject on a particular task completed.

5.2.4 Measuring risk aversion

The study uses risk parameters mid-points calculated by Holt and Laury (2002) (Andersen et al, 2008). Individual subjects are faced with a choice of two lotteries A or B. The MPL risk preference games were made up of choice on two lotteries where one is safe and another is a risk with varying rewards.

Table 5.2: Typical risk preference payoff and risk parameter

| row | Lottery A | | | | Lottery B | | | | |
	prob	Rand	prob	Rand	prob	Rand	prob	Rand	CRRA
1	0.1	60	0.9	50	0.1	100	0.9	25	-2.5
2	0.2	60	0.8	50	0.2	100	0.8	25	-1.33
3	0.3	60	0.7	50	0.3	100	0.7	25	-0.72
4	0.4	60	0.6	50	0.4	100	0.6	25	-0.32
5	0.5	60	0.5	50	0.5	100	0.5	25	-0.005
6	0.6	60	0.4	50	0.6	100	0.4	25	0.275
7	0.7	60	0.3	50	0.7	100	0.3	25	0.545
8	0.8	60	0.2	50	0.8	100	0.2	25	0.825
9	0.9	60	0.1	50	0.9	100	0.1	25	1.17
10	1	60	0	50	1	100	0	25	2.5

The subjects have an option of either choosing one row for either lottery A or lottery B. Choosing lottery B in row 1 shows a high degree of risk-loving attitude while choosing lottery A in row 10 is a reflection of the high degree of risk aversion attitude. We recorded the CRRA of the subject on the row when subject initially switches from lottery A to lottery B. The study recorded unique risk parameter where the subject initially switched from lottery A to B and the value recorded was the measure of the level of individual risk aversion.

The four risk aversion tasks have four different prizes as follows; task/game 1(A1: 60 rands, 50 rands; B1: 100 rands, 25 rands), task/game 2 (A1:70 rands, 45 rands; B1: 110 rands, 10

rands), task/game 3 (A1: 200 rands, 120 rands; B1: 300 rands, 50 rands), task/game 4 (A1: 250 rands, 150 rands; B1: 400 rands, 10 rands). At the time of the experiment, the exchange rate was at 1USD: 12. 99 rands and the prizes range between USD 1.54 (20 rands) to USD30.80 (400 rands). The subjects completed all four tasks and 10% of the university students were selected and paid for one of the four games they played that was randomly chosen (Andersen et al., 2008). The selection process was by quota random sampling where an equal number of tickets of the same number as participants were put in a hat and 10% were winning tickets. A participant who picked a winning ticket they were asked to toss a 10 sided die. If the number is between 1 and 4 inclusive they were paid for a time preference task. On the other hand, after picking a winning ticket, subjects tossed a 10 sided die until a number between 5 and 8 inclusive appears where a 5 represents the choice of risk preference task 1 and 8 is choice of risk preference task 4. The subjects were then asked to toss a 10 sided die so that they could select one row from the task or game chosen. Subjects were paid the actual amount of money depicted in the row chosen. The participation fee and the risk preference game winners were paid on the day which experiments were carried out and all the other payments were paid using *e-wallet* in line with instructions in the tasks. *E-wallet* is an online banking system used by a financial institution in South Africa. With the *e-wallet* online banking money is paid through a mobile phone number and the receiver does not incur a cost to withdraw the money from the bank. All subjects were asked to provide phone numbers on the forms filled to facilitate payment, which made it possible to send the prizes that were won through mobile phones.

5.2.5 Model specification

The study uses a t-test, ordered probit, probit and ordinary least regression analysis to explore the data. The study uses *t-test* analysis to investigate whether there is a variation in time preference and risk preference choices of university students with different levels of financial literacy. The study formulated a dummy variable for financial literacy where '1' represented students with high financial literacy and '0' represented students with low financial literacy for the *t-test* analysis. To investigate the effect of multiple switching on time preference task lotteries and impatience choices on financial literacy, the study specified an Ordinary Least Squares model as follows;

$$FL = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots \beta_k x_k \qquad (5.6)$$

Where *FL* stands for financial literacy score and *x* represents multiple switching on lotteries in time preference tasks and a number of individual impatient choices in the time preference tasks. The study investigated whether there is a relationship between multiple switching on time preference lotteries and financial literacy. The research further assessed the relationship between impatient choices an individual made and their financial literacy. Students might acquire financial literacy from formal learning and environmental observations. Financial literacy is knowledge which is critical in making decisions (Courtney 2001). Financial literacy can also play an important role in influencing time preference choices (Van Rooij, Lusardi, and Alessie 2011). The study explored the impact of financial literacy on time preferences by specifying an ordered probit regression model, as follows:

$$y_{ij}^* = x_{ij}\boldsymbol{\beta} + a_{ij} \qquad (5.2)$$

Where a_{ij}, j= 0; 1; 2 are unobservable affecting time preferences. x_{ij} stands for individual *i*'s financial literacy, age, expenditure/income, race, degree student is enrolled in, geographical

location, financial decision status and risk preference parameter. y_i takes the value of (j=0; 1; 2) (Wooldridge, 2010). The specific ordered regression model is given as:

$$p(y_i = \frac{j}{x_i}) = \exp(x_{ij}\boldsymbol{\beta})/[\sum_{h=0}^{J} \boldsymbol{exp}\,(x_{ih}\,\boldsymbol{\beta})] \qquad (5.3)$$

Where j=0, 1, 2, representing; patient '0', neutral '1' and impatient '2'. The dependent variable *y* represents individual discount rate categories (0; 1; 2). The study initially ran a parsimonious model with individual discount rate categories and financial literacy test score. The aim is to investigate whether financial literacy impact time preferences of university students. To analyse reverse causality on time preferences and financial literacy the study estimated a probit regression model specified as follows (Wooldridge, 2010):

$$p(y = 1/x) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots \beta_k x_k \qquad (5.4)$$

Where,

$$y = \begin{cases} 1, & high\ financial\ literacy \\ 0, & low\ financial\ literacy \end{cases} \qquad (5.5)$$

The dependent variable *y* represents financial literacy level and variable *x* stands for individual time discount rate categories, age, marital status, family size, degree a student is enrolled in, geographical location, financial decision status and income.

5.2.6 Sample

A convenient sample of 192 (female=53%) university students participated in the risk and time preferences experiments. The research targeted 250 students, 221 students turned up and 192 responses were usable. The participation rate in the study stood at 76%. For a population of 300, assuming a margin of error of 3%, alpha of 1% and t=2.58 a sample of 123 observations can be used for continuous data regression while for a margin of error of 5%, probability of 50% and a t=2.58, a sample 180 observation can be used for categorical data (Kotrlik and Higgins, 2001). The sample size in our study falls within the required threshold. The ordinary least squares analysis is based on all the time preferences choices made by the subjects which amounted to 7640 observations. All the participants were enrolled for some undergraduate degree in the faculty of Economic and Management Sciences ranging from economics, investment, law, Administration, Accounting, entrepreneurship, marketing, business management and human resources.

5.3 Results

5.3.1 Time preference choice in percentages

The study created a discrete variable for time preferences where respondents who switched from lottery A to B between rows 1-3 were categorized as a patient, those that switched between 4-6 were classified as 'Neutral' and those who switched between row 7-10 were characterized as 'impatient' (Harrison et al., 2004). Cross-tabulations show that 42% of the subjects with low financial literacy fall under patient attitude while 33% falls under neutral attitude. On the other hand, 46% of students with high financial literacy fall under categories neutral attitude and 29% were impatient (Table 5.3). Other cross-tabulations by time preference choices that were considered in Table 5.3 are gender, race, degree pursued, whether a subject is a decision maker, geographical location and marital status.

Table 5.3: Time preference choice in percentages

variable		Time preferences			N
		Patient	neutral	impatient	
financial literacy	low	42%	33%	25%	114
	high	24%	46%	29%	78
gender	male	36%	38%	27%	90
	female	34%	39%	26%	102
race	white	0%	50%	50%	4
	African	34%	39%	27%	177
	Asian	50%	50%	0%	2
	Coloured	57%	29%	14%	7
degree	economics	42%	40%	18%	40
	investment	25%	32%	43%	66
	other	20%	50%	30%	10
	B.Admin	39%	43%	18%	46
	Management	41%	41%	18%	29
Decision maker	main	34%	33%	33%	61
	non	26%	53%	21%	61
	joint	40%	33%	27%	67
Geo location	Rural	33%	37%	30%	57
	Urban	34%	40%	26%	132
Marital status	Other	25%	13%	62%	8
	Single	34%	40%	26%	181

5.3.2 Multiple switching between lottery A or B

Table 5.4: Percentage of multiple switching subjects in the time preference tasks.

Task	subjects	Average multiple Switching %	Low fin literacy Multiple switching	High fin Literacy Multiple switching
Composite Average for all games played	All	34%	40%	26%
	male	34%	37%	27%
	female	34%	42%	25%
Task/Game 1- Table A	All	34%	39%	27%
	male	36%	40%	29%
	female	33%	39%	26%
Task/Game 2- Table B	All	31%	38%	20%
	male	30%	34%	23%
	female	32%	43%	18%
Task/Game 3- Table C	All	36%	40%	31%
	male	33%	35%	29%
	female	39%	44%	32%
Task/Game 4- Table D	All	35%	42%	26%
	male	36%	40%	29%
	female	35%	44%	23%

MPL method of measuring time and risk preferences has its own challenges and advantages (Frederick, 2005; Harrison et al., 2005). Measuring individual discount rate is only possible if the subject exhibit a unique switching point on the binary choices under consideration. Looking at all the four time preferences tasks completed, 34% exhibited multiple switching across the binary choices. Comparing the subjects across financial literacy level, subjects with low

financial literacy had an average of 40% multiple switching between lotteries, whereas subjects with high levels of financial literacy had an average of 26% multiple switching. This shows that use of MPL method of eliciting time and risk preferences is more suitable for people with higher cognitive ability. A higher percentage of multiple switching on lottery A or B by lower financial literacy subjects shows that the university students with low levels of financial literacy are more likely to face indecision in making preference choices hence they are indifferent between lotteries. Our study identifies the first switch across binary choices as a unique switching point (Meier and Sprenger, 2013). Multiple switching has been identified as a major problem in using MPL games especially the risk preferences games (Jacobson and Petrie, 2009).

5.3.3 Financial literacy and decision making on time preference lotteries

The research examined time preferences choices of all students in relation to their financial literacy. Our results show that multiple switching between lottery A and B 'switchIDR' increases as the financial literacy score in the test decreases, showing that students with low levels of financial literacy are more likely to suffer from indecision when they make time preferences choices. We recorded the total number of impatient choices that individual university students made. The study shows that impatience increases when the financial literacy test score decreases, revealing that for that whole group of university students with low financial literacy are more likely to be impatient. The results confirm earlier research findings where people with low IQs were found to be impatient (Dohmen et al., 2010). The research further split the analyses by gender. The results show that multiple switching between lotteries A or B on time preference choices increases as female university students financial test score decreases. Female university students with lower levels of financial literacy are more likely to engage in multiple switching across lotteries, reflecting a high level of indecisiveness in making time preference choices.

Table 5.5: OLS Regression: Financial literacy, impatience and indifference

	All	female	male
switchIDR	-1.67***	-2.10***	-1.21***
	(0.113)	(0.150)	(0.169)
impatient	-0.038**	0.093***	-0.18***
	(0.017)	(0.025)	(0.022)
_cons	12.8***	12.7***	12.8***
	(0.124)	(0.184)	(0.165)
N	7671	4040	3631
R^2	0.025	0.047	0.024

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Turning on to the recorded impatient choices made by female university students, impatient choices increases as the financial literacy test score increases. As financial literacy increases, female students are more likely to be impatient. Impatience in female students could explain the financial difficulties faced by the girl child in their day to day life. The research findings in Chapter 4 also confirm that female student are generally impatient. Our results contradict findings by Van der Pol (2011), who concluded that high education levels are associated with patient attitude. Results from male university students show that multiple switching on time preferences lotteries increases as financial literacy declines. Again confirming that indifference or indecision on time preferences choices is more prevalent in university students with low

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financial literacy. In addition, impatience in male students are more likely to increase as financial literacy decreases. This reveals that male university students with high financial literacy were more likely to make patient choices, showing that high financial literacy in male students is associated with a patient attitude. The research results show that university students with low levels of financial literacy were more likely to make mistakes in making their time preference choices. The findings confirm assertions by Lusardi and Mitchell (2007), who pointed out that individuals with low financial literacy make more financial mistakes compared to individuals with high financial literacy. The results also confirm findings by Benjamin et al (2013), they found that Chilean high school students who performed well in mathematics were patient.

5.3.4 Quasi-hyperbolic discounting

We plotted the average individual discount rates of subjects and since each MPL task had a specific time horizon the study sets IDR $_{(0,1)}$ as time period 1 and IDR $_{(0,12)}$ as time period 4. The analysis was split between gender and financial literacy level (Figure 5.1). The study results show evidence of quasi-hyperbolic discounting for higher financial literacy subjects (the aggregated group, males and females represented separately) as well as female respondents (both with lower and higher financial literacy). In the above cases, subjects are more likely to choose smaller sooner reward over larger later reward as the delay occurs sooner rather than later in time (Rubinstein, 2003). This shows that all university students except male university students with low financial literacy exhibited some aspect of Quasi-hyperbolic discounting.

The paper findings show that higher financially literate subjects are more impulsive when faced with smaller sooner and larger later rewards offered in a short time horizon (Laibson, 1997).Male university students with low financial literacy exhibited quasi-hypobolic discounting features. What is clear is that all subjects were less impulsive for rewards offered in the distant future, that is they chose to wait as rewards happen further in future and generally they exhibited a low average discount rate for time horizon IDR (0,12), that is period 4 (Kirby and Maraković, 1995) (evidence exhibited in Fig.5.1A to Fig. 5.1H).

5.3.5 Discount rate cumulative density

The paper presented the variable mean individual discount rate (IDR_mean) by summing individual discount rates of all subjects in the four tasks completed by the subjects and divided the aggregated value by four. The research analyzed the individual mean discount rate 'IDR_mean' by gender and financial literacy level. Figure 5.2A shows that higher financial literate subjects exhibited a higher individual discount rate when compared to the low financial literacy group. Meier and Sprenger (2013) in their study found out that people who participated in a tax counselling session exhibited a higher individual discount factor. Our results are similar to their findings although the subjects under consideration are different. A comparison of male subjects with higher financial literacy to female subjects with lower financial literacy as well as female subjects with higher financial literacy to female respondents with lower financial literacy confirms that higher financial literacy subjects exhibited higher individual discount rates (Figure 5.2C, 5.2D and 5.2F). Figure 5.2C & 5.2E also show that subjects with higher financial literacy have higher discount rates at lower levels of the cumulative density but switches at the top of the curve.
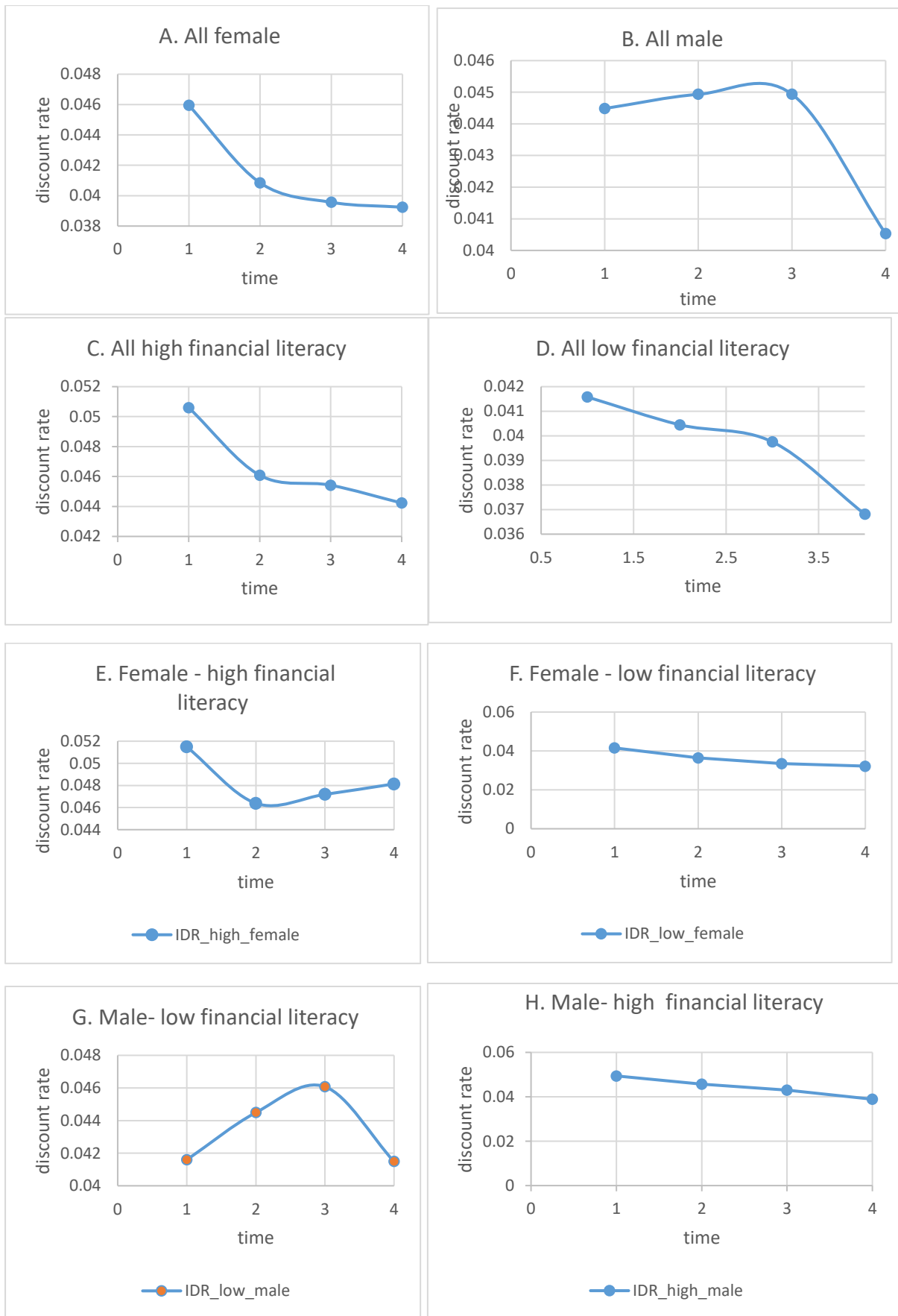
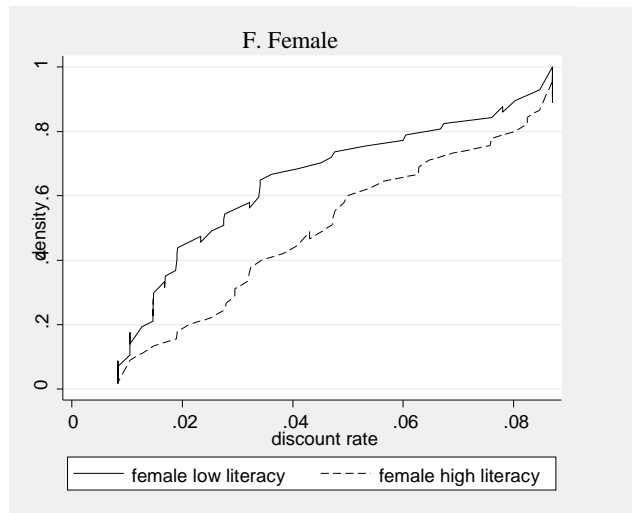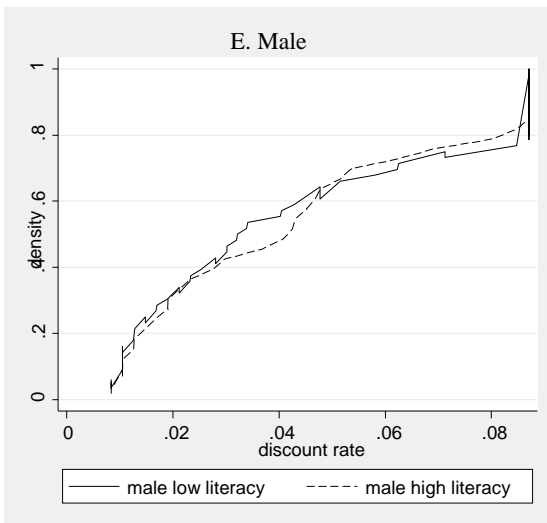Figure 5.1: Quasi-hyperbolic discounting

A. Financial literacy level

B. Gender

C. Gender

D. Gender

E. Male

F. Female
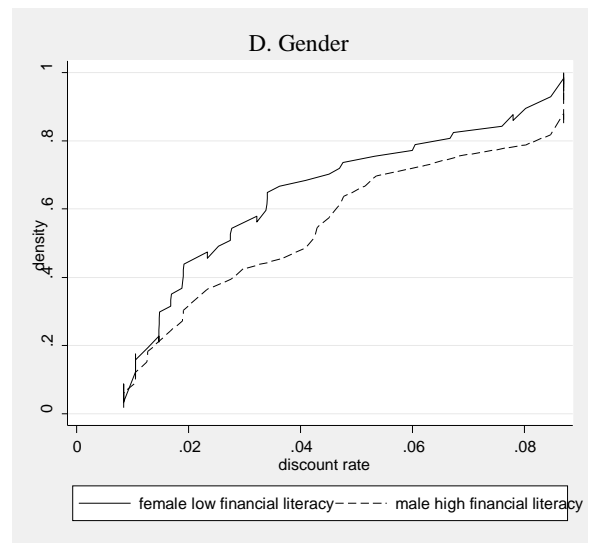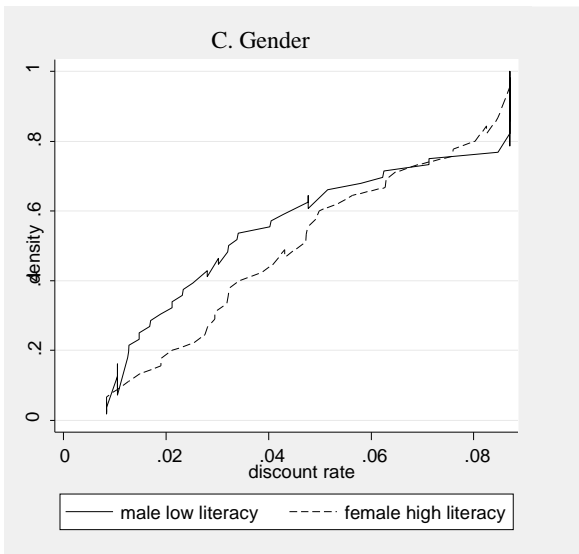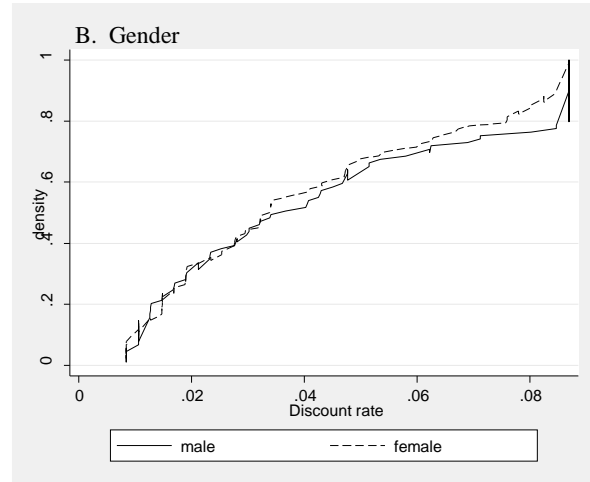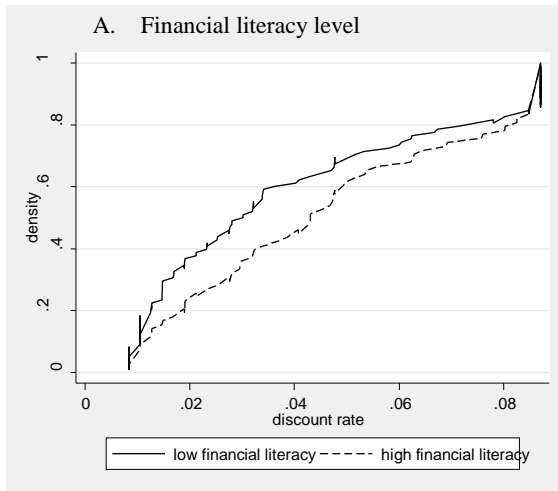
Figure 5.2: Cumulative densities for individual time discount rates

This reveals that higher financial literacy subjects are impatient when stakes are low than when stakes are high. In general, the graphical representations show that subjects with high levels of financial literacy are more likely to prefer smaller sooner when the return on the reward is lower and more likely to prefer a larger later as the return from the rewards increases. The paper coded all ten choices made by an individual on the time preference tasks completed '1' if the university student chooses lottery A and '0' if one chooses lottery 'B'. A total of 40 choices are made by an individual in the 4 tasks completed and a maximum of 7640 choices was recorded for the whole group. The study plotted the choices in graphs split across gender and financial literacy (Appendix C).

Our findings show that at lower stake prizes, high financial literacy subjects are more likely to prefer a smaller sooner options when returns on the rewards are low and chose larger later when the return on rewards increases, a confirmation of our earlier findings using cumulative density graphical representation (Figure 5.2).The way subjects with high financial literacy made their choices can be viewed as that when the returns from rewards increases such that market investment options around give a lower return to the larger later offered in the task played, then high financial literacy subjects become more likely to be patient (more likely to choose lottery B). This reveals that for higher returns that may be above market investment options, high financial literacy university students are more likely to choose a larger later. The reverse is true for the low financial literacy university students, at lower prize stakes the university students with low financial literacy are generally more patient (they chose lottery B) but as stakes increase, the subjects become generally more impatient when compared to high financial literacy university students (Appendix C). This contrasts the behaviour of higher financial literacy university students. Choices for the higher literacy group allow them to earn higher returns from the rewards as the stakes increase. If this behaviour is synonymous with general financial behaviour of economic agents, this could explain why high financial literacy level economic agents achieve better financial life outcomes (Lusardi and Mitchell, 2005)

5.3.6 Risk aversion and financial literacy

Arranging the task played according to the sizes of the prizes, the study calculated the average risk aversion parameters of subjects per game for all four games and plotted the values (Figure 5.3). The research splits subjects according to their level of financial literacy and gender. Graphical representations show that subjects with low financial literacy are more risk loving. A comparison of female subjects by the level of financial literacy shows that those with low financial literacy are more risk loving. There is a wide gap in the risk aversion levels of female respondents by financial literacy level. Our comparison of average risk parameter for male subjects by the level of financial literacy shows that in general subjects with low financial literacy are more risk-loving for all the games except game 2. The paper compared male and female subjects who belong to the group of high financial literacy and findings show that male respondents in the category are more risk loving. Turning to all subjects with low financial literacy, we observed that female respondents are more risk-loving when compared to their male counterparts. The research further compared male subjects with higher financial literacy against female respondents with low financial literacy and conclude that female respondent with low financial literacy are more risk loving. Finally, the study compared females with higher financial literacy with a male counterpart with low financial literacy and concluded that male subjects with low financial literacy are more risk loving.

Figure 5.3: Average risk parameter for four risk preference games played

In general, respondents with lower financial literacy are found to be more risk loving, explained the other way round our findings show that high financial literacy university students are more risk averse, a conclusion reached at by Huck and Weizsacker (1999) in an experimental study on cognitive ability and risk aversion. These finding can have a huge bearing on the behaviour of low financial literacy people. The results support the argument which suggests that engaging in risk-loving behaviour by low financial literacy individuals is the major cause of global financial crises across the world (Bernanke, 2006). Another similar behaviour observed regarding low financial literacy subjects explaining risk-loving behaviour is borrowing money from '*mashonisas*' loan sharks at very high-interest rates which are a common practice in South Africa (Roberts et al., 2014). The observed behaviour shows that low financial literacy subjects are more likely to choose a lottery that is riskier. In addition, our findings show that subjects that participated in the tasks are generally risked loving.

The study coded all choices on lottery A made by individual subject as number '1' and all choices made by particular subject on lottery B as number '0' and plotted the choices made by subjects on rows 1 to 10 for the four risk preference tasks (Appendix C). All graphical representations showing subjects categorised according to their financial literacy and gender reveal that financially literate respondents are more risk averse and are more likely to choose a lottery with a less risk outcome than respondents with low financial literacy. The graphical exhibits show that financially literate subjects trace the predicted safe choices of the binary lotteries more precisely than their counterparts with low financial literacy. The study findings cannot rule out aspects of cognitive ability in the way university students made choices on the risk preferences lotteries.

5.3.7 Time preference t-test analysis

Table 5.6: t-test analysis

Variable	Total	High literacy	Low literacy	t-statistic
Number of individuals	192	79	113	
IDR_mean	0.0424815	0.0465859	0.0396483	t = -1.689**
	(0.0280472)	(0.0272818)	(0.0283364)	
$IDR_{(0,1)}$	0.0452649	0.0506026	0.0415805	t = -1.852**
	(0.0333106)	(0.0324528)	(0.0335374)	
$IDR_{(0,3)}$	0.0427518	0.0460897	0.0404478	t = -1.2226
	(0.0313902)	(0.0310173)	(0.0315758)	
$IDR_{(0,6)}$	0.0420681	0.0454205	0.039754	t = -1.2013
	(0.0320794)	(0.0320239)	(0.0320545)	
$IDR_{(0,12)}$	0.039841	0.0442308	0.036811	t = -1.5433*
	(0.0327781)	(0.0330246)	(0.0324063)	
Age	22.26702	22.15385	22.34513	t = 0.3995
	(3.245549)	(3.710557)	(2.896334)	
expenditure	1464.073	1565.872	1393.805	t = -0.9959
	(1173.692)	(1434.384)	(954.0537)	
Family size	5.392473	5.692308	5.175926	t = -1.0900
	(3.189806)	(4.246642)	(2.121667)	

Mean and standard deviations in brackets represented in the table. Standard errors in parentheses [*] $p < 0.10$, [**] $p < 0.05$, [***] $p < 0.01$

A *t-test* analysis shows a significant difference in mean individual discount rate (IDR_mean), time preferences in the shortest period IDR $_{(0,\,1)}$ and longest period IDR $_{(0,\,12)}$, that is, task 1 that had a time horizon of one month, task 4 with the time horizon of one year as well as the overall average IDR of all four MPL time preference tasks completed (Table 5.5). The findings show that financial literacy is significantly associated with aggregated time preference choices of university students. The results, therefore, reveal that financial literacy plays a pivotal role in influencing the time preferences of university students. Providing financial literacy to university student will impact how they make intertemporal choices.

5.3.8 Risk preferences t-test analysis

In order to investigate whether there are variations in the risk aversion levels of subjects by financial literacy level, the research carried out a *t-test* analysis (Table 5.6).

Table 5.7: Risk preferences *t-test* analysis

Variable	Total	High literacy	Low literacy	t-statistic
Number of individuals	189	77	112	
risk_mean	-0.7528459	-0.4551542	-0.9575089	t =-3.057***
	(1.134275)	(1.013642)	(1.171256)	
Game 1	-0.8104365	-0.4800974	-1.037545	t =-2.925***
	(1.313121)	(1.166495)	(1.364191)	
Game 2	-0.7729894	-0.5757143	-0.9086161	t =-1.658**
	(1.362905)	(1.177221)	(1.466841)	
Game 3	-0.7047619	-0.3524026	-0.9470089	t =-2.907***
	(1.408989)	(1.243615)	(1.469064)	
Game 4	-0.7455556	-0.4196753	-0.9695982	t =-2.730***
	(1.383977)	(1.150658)	(1.487696)	
Age	22.26702	22.15385	22.34513	t = 0.3995
	(3.245549)	(3.710557)	(2.896334)	
expenditure	1464.073	1565.872	1393.805	t = -0.9959
	(1173.692)	(1434.384)	(954.0537)	
Family size	5.392473	5.692308	5.175926	t = -1.0900
	(3.189806)	(4.246642)	(2.121667)	

Mean and standard deviations in brackets represented in the table. Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Our results overwhelmingly show that the risk aversion levels of university students significantly differ across the level of financial literacy for all the tasks played as well as the average risk preferences for all the tasks completed. The results show a significant difference in risk preferences choices made by subjects with different levels of financial literacy at 1% level in all tasks. Our findings show that financial literacy plays an important role especially when economic agents would like to manage risk. It shows that if subjects with different levels of financial literacy are facing risk lotteries they behave in a significantly different way. Providing financial literacy to university student could go a long way in helping them to manage future lifetime risk. The results also reveal that financial literacy is more important when making risk preference choices than when making time preference choices. Our *t-test* analysis also shows that age, personal expenditure, and family size does not significantly differ by financial literacy level.

5.4 Regression analysis

5.4.1 Time preferences and financial literacy

Table 5.8: Ordered Probit Regression: Time discount rate marginal effects and financial literacy

Dependent	All	male	female
IDR_mean			
Test	0.317^{*}	0.009	-0.219^{***}
	(0.162)	(0.090)	(0.078)
$IDR_{(0,1)}$			
Test	-0.131^{**}	-0.103	-0.154^{*}
	(0.066)	(0.098)	(0.089)
$IDR_{(0,3)}$			
Test	-0.109^{*}	-0.051	-0.168^{*}
	(0.064)	(0.091)	(0.089)
$IDR_{(0,6)}$			
Test	-0.095	0.051	-0.225^{**}
	(0.068)	(0.100)	(0.091)
$IDR_{(0,12)}$			
Test	-0.093	-0.058	-0.222^{**}
	(0.067)	(0.101)	(0.089)
N	192	90	102

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The study uses ordered probit analysis to investigate whether financial literacy is linked to time preferences. The research created an ordered discrete variable of time preferences where if subjects switch between rows 1-3 they are classified as 'patient', between 4-6 as 'neutral' and between 7 and 10 as, 'impatient'. To explore the impact of financial literacy on time preferences the study ran a set of parsimonious regression analysis with the independent variable 'financial literacy test' on all the time preference games played and the IDR_mean (the average individual discount rate for all four tasks played) as the dependent variable. Our results confirm that financial literacy is significantly associated with time preferences choices of IDR_mean, $IDR_{(0,1)}$ and $IDR_{(0,3)}$ of all the subjects (Table 5.7).

The study findings also confirm that time preferences for female university students are significantly related with financial literacy for all tasks played. Increase in financial literacy for female university students significantly reduced their time preferences, showing that an increase in financial literacy significantly increase patience levels amongst female university students. On the other hand, the research results show that time preference choices of male subjects were not significantly associated with financial literacy. The paper shows that provision of financial literacy to university students is significantly related to time preferences, especially of female subjects.

5.4.2 Time preferences, financial literacy and demographics

The research ran an ordered probit regression with the dependent variable IDR_mean the average individual discount rates for all four games played (Table 5.8). The study controlled for a number of variables that range from financial literacy test, age, monthly expenditure as a proxy of income, race made up of African and other races aggregated due to very low numbers of other ethnic groups that participated in the experiment, degree the participant was enrolled,

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family size, marital status (the majority of the subjects were single since they were undergraduate university students), geographical location, and mean risk parameter elicited from the MPL risk preference games (Andersen et al., 2008). The regressions analyses were split across levels of financial literacy as follows: determinants of time preferences for the whole group, determinants of time preferences on subjects with high as well as low financial literacy, determinants of time preferences on female and male subjects with high and low levels of financial literacy. The regressions analyses were also carried on all the four tasks completed. The research included the risk preference parameter since time preference choices are affected with uncertainty and risk tied to myopia on future rewards (Andersen et al., 2008; Shoji and Kanehiro, 2012). Further, including risk preference caters for short-run temptation whilst time preference reveals long-run optimization by subjects (Fudenberg and Levine, 2006; Frederick et al., 2002; Andersen et al., 2008).

An analysis on the determinants of time preferences for the mean discount rates for all the respondents reveal that time preferences are more likely to increase significantly as age increases showing that age increases impatience (Table 5.8). Another variable that was concluded to be significantly influencing time preferences was the mean risk parameter suggesting that myopia on the intertemporal choices could have driven the way subjects made their choices by making them impatient. Turning to the group of university students with high financial literacy, being enrolled for Business Administration degree and being single is more likely to reduce one's time preferences, showing increasing patience levels. The risk parameter also significantly increases impatience levels of the subjects with high financial literacy. An analysis on factors that are associated with time preferences of university students with low levels of financial literacy shows that age, being enrolled in the BComm investment degree and the risk parameter are more likely to increase respondents' time preferences showing that the variables on spotlight increase impatience levels of the subjects.

Moving on to male subjects with high levels of financial literacy, financial literacy level significantly reduces the subjects' time preferences making them more patient. These results confirm the conclusion reached by Pol (2011) who found out that higher levels of literacy are associated with increased patience levels. Other variables that were found to significantly increase patience in male subjects with high financial literacy were age, being enrolled for Business administration, being single, and being a non-decision maker. On the other hand, male respondents with a high level of financial literacy's time preferences were significantly higher if they belong to the African race, enrolled in the degree labelled as other, enrolled for a Bcomm Management degree, as family size increases and as their risk preferences increase. The study considered male subjects with low levels of financial literacy, their time preferences significantly increase due to age, belonging to the African race, enrolled in the Bcomm investment degree or degrees designated as "other' or being enrolled Bcomm Management as well as if their risk preferences increase. The low financial literacy male subjects' time preference decrease when they are joint decision makers. Being single is more likely to reduce the time preferences of female subjects with high financial literacy, whereas, an increase in their risk preferences made the subjects more impatient. The regression analysis of female university students with low literacy shows that age and risk parameter makes the respondents impatient.

Table 5.9: Ordered Probit Regression: Individual discount rate and demographics

Mean rate	All	high_lit	low_lit	male_high_lit	male_low_lit	female_high_lit	female_low_lit
ltest	-0.051	-0.48	-0.46	-18.5***	0.050	1.58	-0.89
	(0.234)	(0.957)	(0.419)	(6.561)	(0.575)	(1.465)	(0.614)
age	1.81**	-2.49	4.04***	-17.1*	6.23***	-2.78	3.96*
	(0.886)	(1.573)	(1.286)	(9.849)	(2.150)	(2.585)	(2.053)
lnm_expend	-0.074	-0.15	-0.011	1.50	-0.35	0.37	0.30
	(0.123)	(0.205)	(0.156)	(1.092)	(0.247)	(0.362)	(0.276)
African	0.10	0.46	0.25	16.3**	5.77***	1.04	-0.82
	(0.400)	(0.510)	(0.784)	(6.822)	(0.720)	(0.798)	(0.748)
Investment degree	0.32	0.036	0.73**	-1.63	1.97***	0.72	0.72
	(0.271)	(0.518)	(0.360)	(1.019)	(0.579)	(0.809)	(0.542)
Other degree	0.43	0.22	0.98	5.66**	2.11**	1.07	0
	(0.428)	(0.605)	(0.810)	(2.631)	(1.065)	(0.971)	(.)
Admin degree	-0.039	-1.11**	0.67	-4.76***	1.11	-1.00*	0.76
	(0.268)	(0.441)	(0.411)	(1.771)	(0.675)	(0.595)	(0.589)
Management degree	-0.032	-0.46	0.63	4.14***	2.17***	-0.98	-0.30
	(0.301)	(0.576)	(0.416)	(1.587)	(0.628)	(0.698)	(0.692)
Family size	-0.038	-0.023	-0.079	0.63***	0.063	-0.021	-0.20*
	(0.027)	(0.029)	(0.058)	(0.224)	(0.070)	(0.034)	(0.117)
single	-0.064	-7.37***	0.30	-11.4**	-1.40*	-3.40**	1.12
	(0.597)	(1.252)	(0.596)	(5.492)	(0.722)	(1.732)	(0.944)
_urban	-0.23	0.24	-0.32	0.40	-0.12	0.23	-0.47
	(0.211)	(0.373)	(0.273)	(0.830)	(0.346)	(0.438)	(0.408)
Non decision maker	0.059	-0.0071	0.0030	-4.75***	0.18	0.24	-0.60
	(0.237)	(0.368)	(0.360)	(1.577)	(0.643)	(0.439)	(0.571)
Joint decision maker	-0.055	0.49	-0.32	1.04	-1.34**	0.71	-0.19
	(0.225)	(0.391)	(0.301)	(0.939)	(0.589)	(0.578)	(0.559)
risk_mean	0.58***	1.28***	0.45***	5.89***	1.06***	1.12***	0.39***
	(0.116)	(0.223)	(0.119)	(1.674)	(0.294)	(0.407)	(0.139)
cut1							
_cons	3.81	-18.9***	11.1**	-93.3**	21.0***	-5.47	10.9*
	(3.184)	(6.598)	(4.369)	(39.643)	(7.204)	(9.018)	(6.611)
cut2							
_cons	5.04	-16.9**	12.2***	-87.2**	22.8***	-3.37	12.1*
	(3.180)	(6.560)	(4.383)	(37.984)	(7.295)	(8.973)	(6.646)
N	184	77	107	32	54	45	53
R²							

Standard errors in parentheses * p < 0.10, ** p < 0.05, *** p < 0.0

In all cases, our analysis shows that an increase in risk preferences is associated with an increase in impatience among university students, showing that an increase in risk increase impatience among university students. The study carried regression analyses on choices made by subjects in the first game/task where participants were provided with a choice to receive rewards in one week or one month and one week (IDR $_{(0,1)}$) (Table 5.8). Time preferences for all the subjects are significantly related to risk preferences only. Increase in risk preferences is associated with an increase in impatience. The paper considered factors that are associated with time preferences of subjects with higher financial literacy and found out that monthly expenditure, being enrolled for Business Administration degree and being single is more likely to significantly reduce time preferences of the subjects, showing that the variables make the participants more patient. Conversely, variables risk parameter and belonging to African race increases the time preferences of subjects showing that these variables are significantly associated with impatience of university students with high financial literacy. Age and risk preferences significantly increase time preferences of subjects with low levels of financial literacy, revealing that he variable induced an impatient attitude among subjects. The research considered variables that related to time preference choices of male subjects with higher financial literacy and found out that financial literacy, age, being enrolled for a Bcomm investment degree, being enrolled in a Business administration degree and being single is more likely to reduce time preferences of subjects, hence making participants more patient. More impatient time preferences choices by male respondents with higher financial literacy are significantly driven by their risk preference parameter and belonging to the African race.

Male subjects with lower levels of financial literacy are more likely to be significantly impatient when their risk preferences increase when their age increase and if they belong to the African race group. Financial literacy, risk preference parameter, belonging to an urban area, being enrolled in other degree and belonging to the African race is more likely to make female university students with high levels of financial literacy impatient. Findings on the relationship of financial literacy on male and female university students with high financial literacy on time preferences show that their financial literacy knowledge may have played an influential role in shaping their time preferences. Turning to female university students with low financial literacy, belonging to the African race group is more likely to increase patience while the increase in risk preferences parameter is more likely to increase impatience.

In the second MPL time preference task completed (Table 5.9), subjects made choices that allowed them to receive rewards in one week or after three months and one week IDR $_{(0,3)}$. An Ordered probit regression analysis for all subjects show that individual time preferences of subjects are more likely to significantly increase due to age and an increase in their risk preferences, showing the two variable make subjects impatient. Variable financial literacy level (ltest) and being single makes male university students with high financial literacy more patient while variables belonging to an urban centre and the risk preferences parameter induces male respondents with high financial literacy to be impatient. Variables age, being enrolled for a Bcomm investment degree, being enrolled for 'other' degree, being enrolled for Bcomm Management degree and the risk preference parameter are more likely to significantly increase impatient on male university students with lower financial literacy levels. Female university students with higher financial literacy levels are more likely to be impatient if they reside in the urban area and if their risk preferences increase.

Table 5.10: Ordered Probit Regression: Individual discount rate and demographics

IDR$_{(0,1)}$	All	high_lit	low_lit	male_high_lit	male_low_lit	female_high_lit	female_low_lit
ltest	-0.031	0.15	-0.50	-11.9***	-0.62	4.43***	-0.89
	(0.214)	(1.081)	(0.390)	(3.461)	(0.557)	(1.682)	(0.647)
age	0.051	-0.11	0.10*	-0.46*	0.25**	-0.33**	0.068
	(0.036)	(0.086)	(0.058)	(0.237)	(0.108)	(0.144)	(0.101)
lnm_expend	-0.11	-0.41*	-0.026	-0.099	-0.033	0.71	0.16
	(0.122)	(0.222)	(0.151)	(0.565)	(0.266)	(0.455)	(0.285)
_African	0.24	1.17**	0.0037	16.3***	4.49***	3.58***	-1.17*
	(0.409)	(0.564)	(0.662)	(3.366)	(0.854)	(1.131)	(0.702)
Investment degree	0.15	-0.44	0.47	-4.20***	0.71	0.79	0.41
	(0.245)	(0.482)	(0.340)	(1.566)	(0.588)	(0.860)	(0.605)
Other degree	0.46	0.94	-0.0083	2.77	-0.13	4.90***	0
	(0.469)	(0.747)	(0.860)	(1.853)	(0.998)	(1.720)	(.)
Admin degree	-0.079	-1.29***	0.48	-4.68***	0.12	-0.91	0.52
	(0.274)	(0.459)	(0.424)	(1.378)	(0.801)	(0.658)	(0.701)
Management degree	-0.11	0.0096	-0.035	1.15	0.73	0.82	-1.22
	(0.297)	(0.595)	(0.427)	(1.400)	(0.685)	(0.789)	(0.759)
Family size	-0.030	-0.029	-0.064	0.28**	-0.0022	0.036	-0.20
	(0.027)	(0.034)	(0.061)	(0.140)	(0.085)	(0.044)	(0.125)
single	0.11	-6.45***	0.25	-10.6**	0.62	-2.06	-0.48
	(0.415)	(2.005)	(0.455)	(4.964)	(0.622)	(2.217)	(0.578)
_urban	-0.0076	0.63	-0.19	1.83	-0.50	1.12*	0.056
	(0.221)	(0.442)	(0.287)	(1.287)	(0.402)	(0.606)	(0.435)
Non decision maker	-0.11	-0.63	0.10	-0.51	1.01	-1.10	-0.45
	(0.245)	(0.398)	(0.380)	(1.035)	(0.709)	(0.685)	(0.616)
Joint decision maker	-0.14	0.30	-0.23	1.29	-0.77	0.91	0.22
	(0.231)	(0.399)	(0.323)	(0.817)	(0.599)	(0.760)	(0.529)
risk_mean	0.49***	1.25***	0.34***	4.41***	0.89***	1.94***	0.33**
	(0.110)	(0.252)	(0.116)	(0.886)	(0.262)	(0.650)	(0.152)
cut1							
_cons	-0.12	-11.5**	0.84	-42.8***	8.76**	11.4	-2.18
	(1.422)	(5.046)	(2.125)	(13.412)	(3.647)	(7.677)	(3.415)
cut2							
_cons	0.48	-10.4**	1.33	-39.3***	9.27**	12.8*	-1.51
	(1.422)	(5.015)	(2.130)	(13.180)	(3.702)	(7.754)	(3.395)
N	184	77	107	32	54	45	53

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5.11: Ordered Probit Regression: Individual discount rate and demographics

IDR$_{(0,3)}$	All	high_lit	low_lit	male_high_lit	male_low_lit	female_high_lit	female_low_lit
ltest	-0.27	-1.66*	-0.60	-5.81***	-0.19	-0.36	-1.15**
	(0.235)	(0.987)	(0.433)	(2.159)	(0.591)	(1.434)	(0.575)
age	0.082**	-0.017	0.14***	-0.20	0.13	0.037	0.16*
	(0.037)	(0.073)	(0.052)	(0.230)	(0.082)	(0.117)	(0.085)
lnm_expend	-0.13	0.055	-0.16	-0.17	-0.35	0.50	0.084
	(0.128)	(0.197)	(0.168)	(0.405)	(0.231)	(0.376)	(0.252)
_African	0.29	0.17	0.56	1.15	5.16***	0.51	-0.14
	(0.366)	(0.629)	(0.454)	(0.998)	(0.649)	(0.994)	(0.478)
Investment degree	0.36	0.12	0.77**	-1.27	1.04*	0.60	0.91
	(0.246)	(0.435)	(0.350)	(0.915)	(0.544)	(0.773)	(0.578)
Other degree	0.84	0.34	1.78*	-1.54*	2.27*	1.56	0
	(0.521)	(0.715)	(1.057)	(0.891)	(1.174)	(1.165)	(.)
Admin degree	0.13	-0.33	0.65*	-2.54**	0.86	0.053	0.85
	(0.267)	(0.426)	(0.381)	(1.008)	(0.615)	(0.534)	(0.624)
Management degree	0.095	-0.63	0.88**	0.96	1.59**	-1.27	0.18
	(0.304)	(0.531)	(0.418)	(1.234)	(0.752)	(0.869)	(0.665)
Family size	-0.0055	0.039	-0.075	0.26***	-0.031	0.058	-0.046
	(0.027)	(0.026)	(0.065)	(0.080)	(0.081)	(0.036)	(0.123)
single	0.51	-5.29***	0.70	-10.1**	0.30	-2.24	0.96
	(0.512)	(1.905)	(0.569)	(5.097)	(0.720)	(1.416)	(0.890)
_urban	0.098	0.62*	-0.013	1.24	0.22	1.13*	-0.13
	(0.213)	(0.369)	(0.271)	(1.003)	(0.371)	(0.670)	(0.412)
Non decision maker	-0.29	-0.62	-0.24	-2.30**	-0.53	-0.28	-0.45
	(0.247)	(0.385)	(0.350)	(0.948)	(0.622)	(0.469)	(0.556)
Joint decision maker	-0.30	-0.31	-0.39	-0.33	-0.92*	0.30	-0.33
	(0.216)	(0.368)	(0.308)	(0.700)	(0.527)	(0.645)	(0.542)
risk_mean	0.51***	0.91***	0.41***	2.43***	0.58***	0.98***	0.39***
	(0.100)	(0.165)	(0.108)	(0.539)	(0.212)	(0.299)	(0.130)
cut1							
_cons	0.45	-10.4***	1.57	-33.3***	5.16*	2.13	2.00
	(1.556)	(4.001)	(2.028)	(11.396)	(2.781)	(5.654)	(3.046)
cut2							
_cons	1.37	-9.20**	2.46	-30.3***	6.03**	3.16	3.04
	(1.554)	(3.999)	(2.013)	(11.398)	(2.766)	(5.667)	(3.056)
N	184	77	107	32	54	45	53

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Financial literacy significantly increases patience levels of female university students with higher financial literacy while age and their risk preferences significantly increase their impatience. A striking observation on results from the second game/ task is that in all situations, financial literacy level variable generally increases patience among subjects, supporting the findings concluded by Fuchs (1980) which pointed out that increase in education level in individuals increases patience attitude.

Moving on to the third game/task analysis (Table 5.13 Appendix C), subjects were allowed to make binary time preferences choices with an option of receiving a prize in one week or in six months and one week IDR $_{(0, 6)}$. All subjects were more likely to be significantly impatient due to age and their risk preference parameter. On another hand, university students with high levels of financial literacy are more likely to be significantly patient as their monthly expenditure increases, if they are enrolled for Business administration degree and if they are single while they are more likely to be impatient as their risk preferences increase. Turning to subjects with low levels of financial literacy, age and risk preferences significantly increases impatience among university students. Male university students with high levels of financial literacy levels were found to be significantly more patient as their financial literacy increases, as their age increases, if they are single, if they are enrolled in 'other' degree, if they were enrolled in Business Administration degree as well as if they were non-decision makers while they are more likely to be significantly impatient as their risk preferences increase. Male university students with lower financial literacy levels were more likely to be impatient if they were older, belong to the African race, were enrolled in the Bcomm Investment or Management as well as if their risk preference parameter increases while being single is significantly related to patience in the subjects. Increase in risk preferences is significantly associated with impatience while being enrolled for Business Administration and Management is significantly more likely to increase patience levels among female university students with higher financial literacy. Being a non-decision maker, belonging to the African race and increase in financial literacy is significantly linked to patience among female university students with low financial literacy. Enrolment in a Business Administration and increase in risk preferences were associated with a significant increase in time preferences for female university students with low levels of financial literacy. In all cases except for female university students with high financial literacy, increase in financial literacy is associated with increasing patience in university students although the impact is not significant in some cases (Table 5.13, Appendix C).

The fourth and final time preference game/task that was played by subjects allowed them to make choices where rewards were paid after one week or after twelve months and one week IDR $_{(0,12)}$ (Table 5.14 Appendix C). As age and risk preferences increases, all subject were more likely to be significantly impatient. High financial literate university students were significantly patient as their monthly expenditure increases, if they were single and belonging to an urban area while they were likely to be significantly impatience as their risk preferences parameter increases. Moving on to low financially literacy university students, impatience significantly increases as one gets older and when their risk preference parameter increases whereas patience increases as family size increases. Switching on to male university students with higher financial literacy, impatience significantly increases if they were African as well as if their risk preference parameter increases whereas being enrolled for Business Administration degree and being a non-decision maker significantly increases patience.

Moving on to male university students with low financial literacy, being older, belonging to the African race, being a non-decision maker and increase in risk preferences were significantly associated with impatience. A bigger family size as well as belonging to the urban centre were more likely to significantly increase patience while being a non-decision maker and increase in risk preferences increases impatience amongst higher financial literacy female university students. Finally, increase in income and increase in risk preferences were more likely to be associated with impatience while a higher family size was significantly more likely to be related to patience among female university students with low financial literacy. Our findings show that as the time horizon for receiving rewards gets longer and stake increase so much, choices made by university students are not significantly driven by financial literacy.

5.4.3 Financial literacy and time preferences

Table 5.12: Probit Regression: Financial Literacy and IDR Marginal effects

Dependent	All	male	female
Test neutral_mean	-0.204**	-0.057	0.869***
	(0.084)	(0.121)	(0.309)
impatient mean	-0.171*	0.022	0.883***
	(0.094)	(0.132)	(0.339)
Test Neutral IDR$_{(0,1)}$	0.551**	0.723*	0.410
	(0.248)	(0.378)	(0.332)
Impatient IDR$_{(0,1)}$	0.391	0.279	0.480
	(0.209)	(0.309)	0.287
Test Neutral IDR$_{(0,3)}$	0.430*	0.612*	0.284
	(0.222)	(0.332)	(0.303)
Impatient IDR$_{(0,3)}$	0.334	0.135	0.568
	(0.225)	(0.338)	(0.311)
Test Neutral IDR$_{(0,6)}$	-0.151	-0.126	0.431
	(0.100)	(0.146	(0.345)
Impatient IDR$_{(0,6)}$	-0.101	0.074	0.684**
	(0.082)	(0.114)	0.293
Test Neutral IDR$_{(0,12)}$	0.325	0.090	0.518*
	(0.232)	(0.349)	(0.313)
Impatient IDR$_{(0,12)}$	0.264	-0.214	0.702**
	(0.218)	(0.323)	(0.307)
N	192	90	102

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

There is evidence that suggests that there is a reverse causality between financial literacy and time preferences in previous studies (Meier and Sprenger, 2013). In their study, high financial literacy is associated with people who persevere to gain financial literacy, showing that acquiring financial information is equated to investment in knowledge. The study investigated whether the assertion is true for university students under consideration, that is, if there is reverse causality between financial literacy and time preferences. The paper analysis is split into two stages. Initially, the paper used a parsimonious Probit regression model disaggregated across gender by task completed to explore the claim that financial literacy is related to time preferences. The choice of the Probit regression model is arrived at after considering the binary nature of the variable financial literacy.

Table 5.13: Probit Regression: Determinants of financial literacy

Literacy	All	male	female
Neutral	0.59**	0.33	0.86**
	(0.235)	(0.368)	(0.339)
Impatient	0.63**	-0.028	1.28***
	(0.269)	(0.431)	(0.369)
age	-0.0072	-0.0090	-0.021
	(0.035)	(0.047)	(0.076)
single	0.94*	0.83	0.68
	(0.515)	(0.707)	(0.752)
Family size	0.057*	0.084**	0.039
	(0.030)	(0.042)	(0.042)
Invest degree	-0.29	0.39	-0.80**
	(0.280)	(0.474)	(0.395)
Other degree	0.79	1.27**	0
	(0.500)	(0.643)	(.)
Admin degree	-0.059	0.12	-0.39
	(0.297)	(0.505)	(0.421)
Man degree	0.042	0.33	0.100
	(0.347)	(0.621)	(0.491)
urban	0.49**	0.34	0.60*
	(0.233)	(0.333)	(0.354)
Non_dm	-0.62**	-1.42***	0.11
	(0.268)	(0.433)	(0.415)
Joint_dm	-0.55**	-0.90**	-0.24
	(0.243)	(0.372)	(0.380)
ln_expend	0.081	0.045	0.025
	(0.119)	(0.163)	(0.203)
_cons	-2.12	-1.63	-1.48
	(1.389)	(1.917)	(2.556)
N	186	87	96

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

We coded '1' if a university student had high financial literacy and '0' otherwise. The research further investigated if financial literacy is impacted by the average of time preferences for all the four games/tasks played with selected variables controlled for in the model. Analysis on all the respondents shows that average or mean of individual time preferences is significantly linked to financial literacy (Table 5.11 first row). This shows that individual who had financial literacy were willing to persevere to gain financial literacy. Patient subjects were more likely to hold higher financial literacy. Findings from the first game and the second game show that individuals that show a neutral attitude are more likely to be holding higher financial literacy. Results from game one and game two show that male respondents who exhibited a neutral attitude were more likely to be having higher financial literacy. Turning on to female subjects, our regression analysis on average time preferences, game/task three and four show that being impatient or having a neutral attitude is associated with higher financial literacy in female subjects. Our results show that elements of perseverance drive subjects' level of financial literacy although our findings were not universal to all the games played.

Controlling for a number of variables, we ran a probit regression analysis where latent variable time preference is the average value of all four the MPL time preference games. Financial literacy for all subjects is more likely to increase if they have a neutral attitude, are impatient, are single, as the family size increases and if they reside in the urban areas. Conversely, subjects who are non-decision makers and joint decision makers are more likely to hold lower levels of financial literacy. Switching on to male subjects, bigger family size and being enrolled in other degree was associated with higher financial literacy. In contrast, if one is a non-decision maker or joint decision-maker they were more likely to hold lower levels of financial literacy. There is no evidence of the impact of time preferences on the financial literacy of male university students. Female subjects who showed neutral attitude, impatient attitude and reside in urban areas are more likely to be of high financial literacy. On the flip side, female subjects enrolled for a Bcomm investment degree were more likely to hold a lower level of financial literacy. Our results show that time preferences are associated with financial literacy level of university students under consideration. Another interesting outcome was that university students that were passive decision makers are more likely to hold lower financial literacy. The study confirmed reverse causality between financial literacy and time preferences (Meier and Sprenger, 2013).

5.5 Discussion and conclusion

University students completed four MPL time preference and four MPL risk preference experimental tasks in conjunction with a questionnaire and a financial literacy test. All students who scored a mark above average were classified as high financial literacy group whereas those with a score below average were categorized as low financial literacy. Our analysis is split across the level of financial literacy and gender. In general, subjects with high financial literacy exhibited a higher cumulative density individual discount rate when compared with those with low financial literacy. All our subjects except male university students with low financial literacy show aspects of quasi-hyperbolic discounting where impulsivity is high for smaller sooner and larger later rewards offered in a short time frame.

Parsimonious regressions analyses show that financial literacy increases patience among female respondents. Our findings show that financial literacy impact choices over time for the whole group of university students for time preference tasks one and two where the time

horizon is shorter. Our results also show that financial literacy affects time preferences for female university students in all games for the parsimonious model. Our findings reveal that if female gain higher levels of financial literacy they are more likely to persevere, wait longer to earn a higher reward. Our parsimonious models could not prove the impact of financial literacy on time preferences for all male university students in general. Turning on to the elaborate ordered probit regression model analyses with a set of variables controlled for. The study found out that financial literacy significantly impacts time preferences of university students with high financial literacy, male and female respondents with high financial literacy and female subjects with low financial literacy depending on the task under scrutiny. Financial literacy makes all subjects with high financial literacy, male with high financial literacy and female with low financial literacy significantly more patient for games with a shorter time horizon of up to six months, showing that financial literacy increases self-control (Gathergood and Weber, 2014).

Our results also show that financial literacy makes female subjects with high levels of financial literacy more impatient. No evidence of impact of financial literacy on time preferences of all university students are concluded for game number four (Table 5.14) where time horizon of receiving the rewards stretches to 12 months and one week, showing that for higher rewards with an option of being paid after a longer period, choices made where not driven by financial literacy but by other factors. As rewards paid become larger over time, subjects could have used intuition to make choices. Since time preferences measure long run optimization, we included the mean risk parameter variable calculated from elicited risk preference from MPL games to cater for short-run temptation. In all our regressions analysis risk preferences are significantly related with university students' time preferences. In all cases risk preferences induce all subjects to be impatient showing that exposure to risk increase impatience among university students. Our findings could have been driven by subjects making time preference choices under risk (Andersen et al., 2008) Another variable that we concluded to be significantly linked to time preferences of subjects in tasks played by the university students are age, income, race, degree one is enrolled, family size, marital status, geographical location and whether a person is a financial decision maker.

In a bid to understand how financial literacy is associated with decision making on time preference choices. The study ran an OLS regression model on financial literacy with multiple switching on lottery A or B as well as the impatient choices made by university students. The regression analysis for all respondents shows that multiple switching increases with low levels of financial literacy. The results show the difficulties encountered by university students with a low level of financial literacy in making time preferences choices. In addition, our regression results show that for all university students, impatience increases with low levels of financial literacy, revealing that high financial literacy is associated with perseverance and self-control for the whole group (Gathergood and Weber, 2014). The research split the analysis across gender, multiple switching between lotteries A or B significantly increases with the low level of financial literacy for both male and female university students. Again confirming the importance of financial literacy in decision making, university students with low levels of financial literacy are more likely to be undecided on the most suitable time preference lottery. Turning on to impatient choices made by male university students, an increase in impatient choices is associated with low levels of financial literacy. If these findings are practically true in the real world, then individuals with different levels of financial literacy might not achieve

similar financial life outcomes. Conversely, female university students' increase in impatient choices is associated with high financial literacy. Confirming that female university students with high financial literacy were generally impatient.

The study investigated whether there is a reverse causality between time preferences and financial literacy level (Meier and Sprenger, 2013). Our results confirm evidence of the presence of reverse causality. Subjects' willingness to persevere or not to persevere shape their level of financial literacy. A parsimonious probit regression analysis on mean individual discount rates shows that being neutral or impatient is significantly related to financial literacy for the whole group. For females being neutral or impatient is associated with higher levels of financial literacy especially as the time horizon for payment of rewards increases. The finding shows that for longer time horizon impatient females are more likely to be having higher levels of financial literacy. The study ran an elaborate probit model to explore whether there is the presence of reverse causality between financial literacy and time preferences controlling for a set of variables. Our results confirm the presence of reverse causality for the whole group and female subjects, where being neutral or impatient is associated with individuals with a higher level of financial literacy. Other variables which significantly determine financial literacy level are marital status, family size, belonging to an urban centre and being a decision maker. Our results show that if one is a non-decision maker or is a joint decision maker their financial literacy is more likely to be lower pointing to the fact that getting involved in financial issues is the powerful procedure to learn (Van Rooij et al., 2011). Belonging to an urban centre is also significantly associated with higher financial literacy. The research findings confirm the importance of increasing financial literacy among university students as it is a powerful tool in assisting in financial decision making.

Our study has its own fair share of limitations; time preferences of university students might not be a true representation of South African population time preferences. Instruments used to measure time preferences have their own challenges, it is difficult to conclude if the prizes offered elicited true preferences of subjects. The behaviour exhibited by subjects in making risk and time preference choices could have been prompted by the complexity of the instruments used to elicit data. Multiple price lists, questionnaire and financial literacy test involve filling a number of responses which may bring about fatigue in the respondents. Further study can explore variation in time preference before teaching financial literacy course and after teaching a financial module on students. It will be more interesting to investigate the impact of financial literacy on the time preferences of other society groups other than university students using the instruments used in this study.

5.6 References

Alan, S., Ertac, S., 2015. Patience, self-control and the demand for commitment: Evidence from a large-scale field experiment. J. Econ. Behav. Organ. 115, 111–122.

Andersen, S., Harrison, G.W., Lau, M.I., Rutström, E.E., 2008. Eliciting risk and time preferences. Econometrica 76, 583–618.

Banks, J., o'Dea, C., Oldfield, Z., 2010. Cognitive Function, Numeracy and Retirement Saving Trajectories*. Econ. J. 120, F381–F410.

Benjamin, D. J., Brown, S. A. & Shapiro, J. M. 2013. WHO is "behavioral"? Cognitive ability and anomalous preferences. *Journal of the European Economic Association*, 11(6), 1231–1255. https://doi.org/10.1111/jeea.12055

Bernanke, B.S., 2006. Financial literacy. Testimony before Comm. Banking, Hous. Urban Aff. United States Senat. May 23.

Braunstein, S., Welch, C., 2002. Financial literacy: An overview of practice, research, and policy. Fed. Res. Bull. 88, 445.

Castillo, M., Ferraro, P.J., Jordan, J.L., Petrie, R., 2011. The today and tomorrow of kids: Time preferences and educational outcomes of children. J. Public Econ. 95, 1377–1385.

Chabris, C.F., Laibson, D., Morris, C.L., Schuldt, J.P., Taubinsky, D., 2008. Individual laboratory-measured discount rates predict field behavior. J. Risk Uncertain. 37, 237–269.

Clark, R.L., d'Ambrosio, M.B., McDermed, A., Sawant, K., 2006. Retirement plans and saving decisions: the role of information and education. J. Pension Econ. Financ. 5, 45–67.

Courtney, James F. 2001. "Decision Making and Knowledge Management in Inquiring Organizations: Toward a New Decision-Making Paradigm for DSS." Decision Support Systems 31(1): 17–38. https://www.sciencedirect.com/science/article/pii/S0167923600001172 (January 26, 2019).

Delavande, A., Rohwedder, S., Willis, R.J., 2008. Preparation for Retirement, Financial Literacy and Cognitive Resources. SSRN Electron. J. doi:10.2139/ssrn.1337655

Dohmen, T., Falk, A., Huffman, D., Sunde, U., 2010. Are Risk Aversion and Impatience Related to Cognitive Ability? Am. Econ. Rev. 100, 1238–1260. doi:10.1257/aer.100.3.1238

Frederick, S., 2005. Cognitive Reflection and Decision Making. J. Econ. Perspect. 19, 25–42. doi:10.1257/089533005775196732

Frederick, S., Loewenstein, G., O'donoghue, T., 2002. Time Discounting and Time Preference: A Critical Review. J. Econ. Lit. 40, 351–401. doi:10.1257/jel.40.2.351

Fuchs, V., 1980. Time Preference and Health: An Exploratory Study. doi:10.3386/w0539

Fudenberg, D., Levine, D.K., 2006. A dual-self model of impulse control. Am. Econ. Rev. 1449–1476.

Gathergood, J., Weber, J., 2014. Self-control, financial literacy & the co-holding puzzle. J. Econ. Behav. Organ. 107, 455–469. doi:10.1016/j.jebo.2014.04.018

Gathergood John, 2012. Self-control, financial literacy and consumer over-indebtedness. J. Econ. Psychol. 33, 590–602. doi:10.1016/J.JOEP.2011.11.006

Goda, G.S., Levy, M.R., Manchester, C.F., Sojourner, A., Tasoff, J., 2015. The Role of Time Preferences and Exponential-Growth Bias in Retirement Savings [WWW Document]. Natl. Bur. Econ. Res. Inc, NBER Work. Pap. 21482.

Gorbachev, O., Luengo-Prado, M., 2016. The credit card debt puzzle: the role of preferences, credit risk, and financial literacy. Rev. Econ. Stat. 98, 1–11.

Harrison, G.W., Harstad, R.M., Rutström, E.E., 2004. Experimental methods and elicitation of values. Exp. Econ. 7, 123–140.

Harrison, G.W., Lau, M.I., Rutström, E.E., Sullivan, M.B., 2005. Eliciting risk and time preferences using field experiments: Some methodological issues. pp. 125–218. doi:10.1016/S0193-2306(04)10005-7

Jacobson, S., Petrie, R., 2009. Learning from mistakes: What do inconsistent choices over risk tell us? J. Risk Uncertain. 38, 143–158. doi:10.1007/s11166-009-9063-3

Kirby, K.N., Maraković, N.N., 1995. Modeling Myopic Decisions: Evidence for Hyperbolic Delay-Discounting within Subjects and Amounts. Organ. Behav. Hum. Decis. Process. 64, 22–30. doi:10.1006/obhd.1995.1086

Kotrlik, J., Higgins, C., 2001. Organizational research: Determining appropriate sample size in survey research appropriate sample size in survey research. Inf. Technol. Learn. Perform. J. 19, 43. doi:10.1109/LPT.2009.2020494

Laborde, P.M., Mottner, S., Whalley, P., 2013. Personal Financial Literacy : Perceptions of Knowledge , Actual Knowledge and Behavior of College Students. J. Financ. Educ. 39, 1–31. doi:10.2307/23608645

Lahav, E., Rosenboim, M., Shavit, T., 2015. Financial Literacy's Effect on Elicited Subjective Discount Rate [WWW Document]. Econ. Bull.

Laibson, D., 1997. Golden eggs and hyperbolic discounting. Q. J. Econ. 443–477.

Laibson, D., 1997. Golden Eggs and Hyperbolic Discounting. Q. J. Econ. 112, 443–478. doi:10.1162/003355397555253

Lusardi, A., Mitchell, O.S., 2011. Financial literacy around the world: an overview Financial literacy around the world : an overview. J. Pension Econ. Financ. 10, 497–508. doi:10.1017/

Lusardi, A., Mitchell, O.S., 2005. Financial literacy and planning: Implications for retirement wellbeing. Michigan Retire. Res. Cent. Res. Pap. No. WP 108.

Mandell, L., 2008. Financial Literacy of High School Students. New York 163–183.

Meier, S., Sprenger, C., 2008. Discounting Financial Literacy: Time Prefer- ences and Participation in Financial Education Programs. J. Econ. Behav. Organ.

Meier, S., Sprenger, C.D., 2013a. Discounting financial literacy: Time preferences and participation in financial education programs. J. Econ. Behav. Organ. 95, 159–174.

Meier, S., Sprenger, C.D., 2013b. Discounting financial literacy: Time preferences and participation in financial education programs. J. Econ. Behav. Organ. 95, 159–174.

Roberts, B., Struwig, J., Gordon, S., 2014. Financial Literacy in South Africa: Results from the 2013 South African Social.

Roberts, B., Struwig, J., Gordon, S., Viljoen, J., Wentzel, M., 2012. Financial Literacy in South Africa: Results of a baseline national survey. Rep. Prep. by Hum. Sci. Res. Counc. behalf Financ. Serv. Board. Pretoria Financ. Serv. Board.

Rubinstein, A., 2003. "Economics and Psychology"? The Case of Hyperbolic Discounting*. Int. Econ. Rev. (Philadelphia). 44, 1207–1216. doi:10.1111/1468-2354.t01-1-00106

Sayinzoga, A., Bulte, E., Lensink, R., 2014. Financial Literacy and Financial Behavior : Experimental Evidence from Rural Rwanda. Econ. J. 1–29. doi:10.1111/ecoj.12217

Shambare, R., Rugimbana, R., 2012. Financial Literacy Among the Educated : An Exploratory Study of Selected University Students in South Africa By. Featur. Artic. 4425, 581–590. doi:10.1002/tie

Shoji, I., Kanehiro, S., 2012. Intertemporal dynamic choice under myopia for reward and different risk tolerances. Econ. Theory 50, 85–98. doi:10.1007/s00199-010-0534-1

Struwig, J., Roberts, B., Gordon, S., 2012. Financial Literacy in South Africa. Results a.

Van der Pol, M., 2011. Health, education and time preference. Health Econ. 20, 917–929. doi:http://dx.doi.org/10.1002/hec.1655

Van Rooij, M, A Lusardi, and R Alessie. 2011. "Financial Literacy and Stock Market Participation." Journal of Financial Economics 101(2): 449–72. https://www.sciencedirect.com/science/article/pii/S0304405X11000717 (August 6, 2018).

Wooldridge, J.M. 2010. Econometric analysis of cross section and panel data. The MIT Press, London.

5.7 APPENDIX C

Table 5.14: Ordered Probit Regression: Individual discount rate and demographics

IDR$_{(0,6)}$	All	high_lit	low_lit	male_high_lit	male_low_lit	female_high_lit	female_low_lit
ltest	-0.11	-0.38	-0.56	-14.9**	-0.22	0.039	-1.18**
	(0.231)	(0.948)	(0.394)	(6.221)	(0.661)	(1.513)	(0.597)
age	0.086**	0.014	0.16***	-1.34**	0.31***	0.18	0.10
	(0.037)	(0.089)	(0.055)	(0.543)	(0.085)	(0.119)	(0.089)
lnm_expend	-0.062	-0.42**	0.074	-0.17	-0.20	-0.37	0.24
	(0.114)	(0.206)	(0.146)	(0.774)	(0.267)	(0.356)	(0.270)
African	-0.079	-0.13	-0.0021		4.78***		-1.69**
	(0.368)	(0.476)	(0.669)		(0.757)		(0.665)
Investment degree	0.22	-0.10	0.55	1.56	1.37*	-0.016	0.81
	(0.251)	(0.496)	(0.349)	(1.141)	(0.702)	(0.794)	(0.619)
Other degree	-0.25	-0.87	0.39	-9.43***	0.30	0.13	0
	(0.490)	(0.709)	(0.803)	(1.913)	(1.067)	(0.752)	(.)
Admin degree	-0.15	-1.17**	0.53	-3.90***	0.13	-1.36**	1.23*
	(0.292)	(0.511)	(0.414)	(1.443)	(0.841)	(0.633)	(0.709)
Management degree	-0.16	-0.45	0.36	6.50**	1.23*	-1.32**	-0.29
	(0.288)	(0.545)	(0.434)	(3.037)	(0.654)	(0.594)	(0.805)
Family size	-0.026	-0.017	-0.084	0.29	0.026	-0.043	-0.13
	(0.029)	(0.031)	(0.077)	(0.238)	(0.114)	(0.046)	(0.135)
single	-0.31	-4.95**	-0.22	-42.5***	-5.84***	-0.51	0.74
	(0.637)	(2.078)	(0.628)	(11.379)	(0.557)	(1.937)	(0.897)
urban	-0.17	-0.12	-0.17	0.034	0.38	-0.75	-0.56
	(0.226)	(0.462)	(0.279)	(1.045)	(0.491)	(0.860)	(0.422)
Non decision maker	-0.13	-0.42	-0.061	-5.98***	1.14	0.16	-1.46**
	(0.254)	(0.376)	(0.366)	(2.187)	(0.721)	(0.518)	(0.598)
Joint decision maker	-0.073	0.28	-0.17	-1.30	-0.86	0.88	-0.49
	(0.227)	(0.406)	(0.301)	(1.076)	(0.556)	(0.621)	(0.605)
risk_mean	0.48***	1.10***	0.36***	3.65***	1.22***	1.36***	0.30**
	(0.106)	(0.266)	(0.111)	(1.224)	(0.274)	(0.526)	(0.127)
cut1							
_cons	0.12	-10.3**	2.25	-116.6***	4.10	-1.22	-0.43
	(1.635)	(4.365)	(2.267)	(40.774)	(2.981)	(5.621)	(3.389)
cut2							
_cons	0.69	-9.40**	2.74	-114.0***	4.88	-0.43	0.17
	(1.632)	(4.363)	(2.263)	(40.458)	(2.975)	(5.649)	(3.388)
N	184	77	107	32	54	45	53

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5.15: Ordered Probit Regression: Individual discount rate and demographics

IDR(0,12)	All	high_lit	low_lit	male_high_lit	male_low_lit	female_high_lit	female_low_lit
ltest	0.050	0.93	-0.24	-1.42	0.10	0.086	-0.53
	(0.243)	(1.089)	(0.373)	(4.448)	(0.553)	(1.685)	(0.593)
age	0.077**	-0.060	0.16***	-0.38	0.26***	-0.023	0.15
	(0.034)	(0.071)	(0.055)	(0.373)	(0.091)	(0.123)	(0.094)
lnm_expend	-0.020	-0.47**	0.15	-0.77	-0.13	-0.40	0.52**
	(0.121)	(0.230)	(0.162)	(0.919)	(0.315)	(0.360)	(0.246)
_African	-0.066	0.029	-0.041	11.1*	3.73***	-0.014	-1.23
	(0.364)	(0.397)	(0.691)	(6.083)	(0.833)	(0.751)	(0.801)
Investment degree	0.35	0.62	0.32	1.79	0.55	1.01	0.48
	(0.252)	(0.558)	(0.340)	(1.345)	(0.678)	(0.724)	(0.511)
Other degree	0.076	-0.16	0.10	3.97	-0.71	0.45	0
	(0.419)	(0.544)	(0.871)	(2.897)	(1.169)	(1.037)	(.)
Admin degree	-0.22	-1.01	0.050	-6.83**	-0.95	-1.13	0.44
	(0.299)	(0.614)	(0.404)	(3.042)	(0.835)	(0.775)	(0.609)
Management degree	-0.033	-0.18	0.25	1.57	0.17	-0.55	-0.40
	(0.278)	(0.474)	(0.404)	(1.844)	(0.724)	(0.724)	(0.750)
Family size	-0.044	-0.044	-0.14**	-0.13	-0.11	-0.087*	-0.24*
	(0.029)	(0.029)	(0.061)	(0.207)	(0.081)	(0.044)	(0.125)
single	0.11	-6.61***	0.49	-7.36	0.37	-1.64	0.71
	(0.601)	(1.732)	(0.648)	(8.336)	(0.980)	(2.511)	(0.858)
_urban	-0.35	-0.98**	-0.31	-6.09	-0.31	-1.55***	-0.40
	(0.220)	(0.392)	(0.287)	(3.806)	(0.401)	(0.485)	(0.445)
Non decision maker	0.100	0.35	0.19	-2.52**	1.47*	0.90*	-0.79
	(0.270)	(0.401)	(0.392)	(1.081)	(0.786)	(0.503)	(0.641)
Joint decision maker	-0.021	0.16	0.12	0.16	-0.12	0.42	0.21
	(0.217)	(0.387)	(0.306)	(1.331)	(0.617)	(0.545)	(0.530)
risk_mean	0.56***	1.65***	0.39***	5.68**	1.16***	1.67**	0.29**
	(0.123)	(0.334)	(0.128)	(2.654)	(0.314)	(0.692)	(0.136)
cut1							
_cons	0.87	-10.7***	3.68*	-22.2	7.58**	-7.49	3.83
	(1.479)	(3.955)	(2.072)	(15.619)	(3.381)	(5.773)	(3.469)
cut2							
_cons	1.63	-9.47**	4.35**	-20.3	8.55**	-6.27	4.57
	(1.478)	(3.939)	(2.086)	(15.485)	(3.412)	(5.757)	(3.466)
N	184	77	107	32	54	45	53

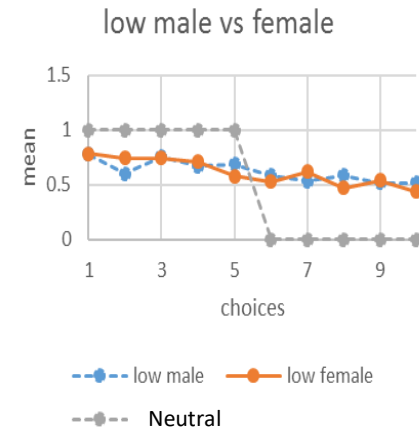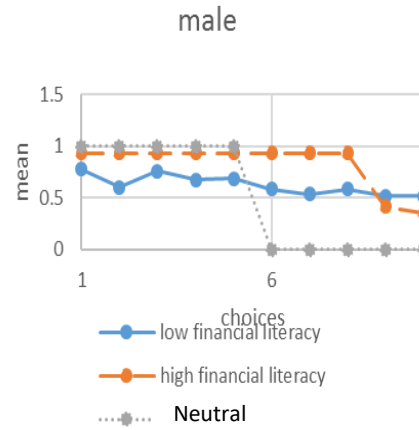Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
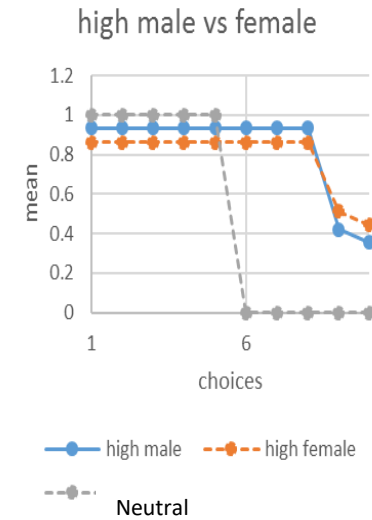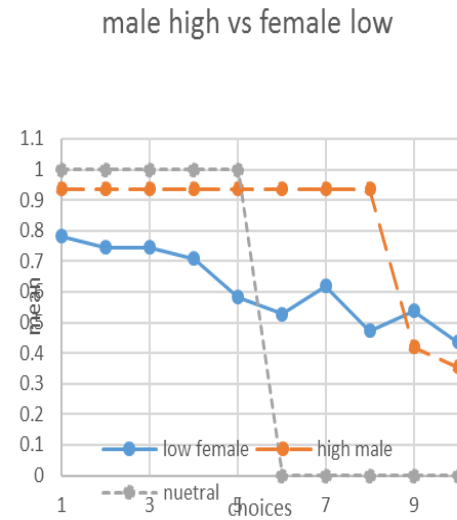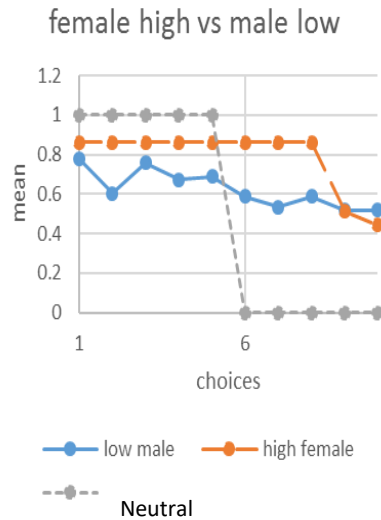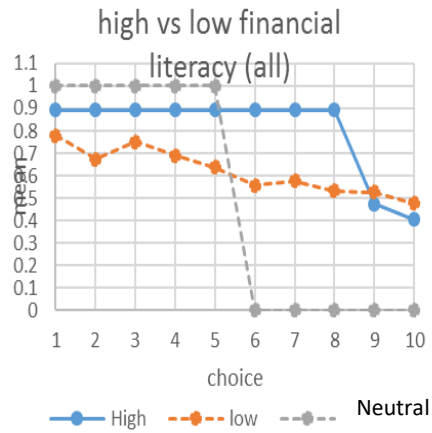
Figure 5.4: Time preferences Task 1/game 1 (table A)

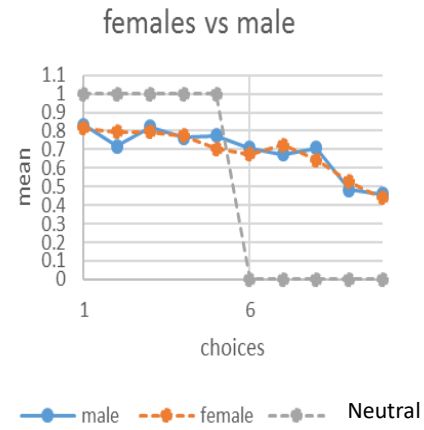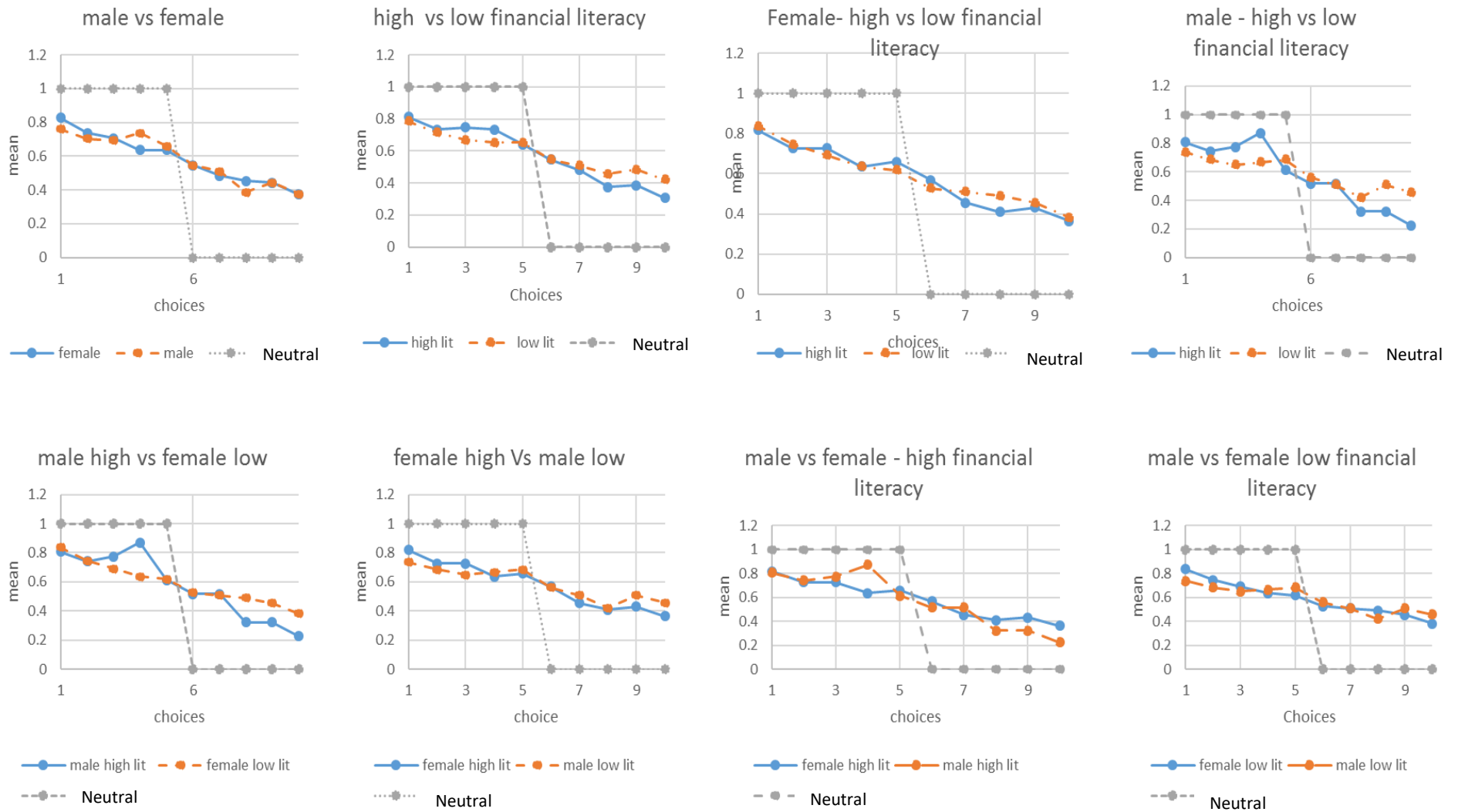Figure 5.5: Time preferences task 2/game 2(Table B)
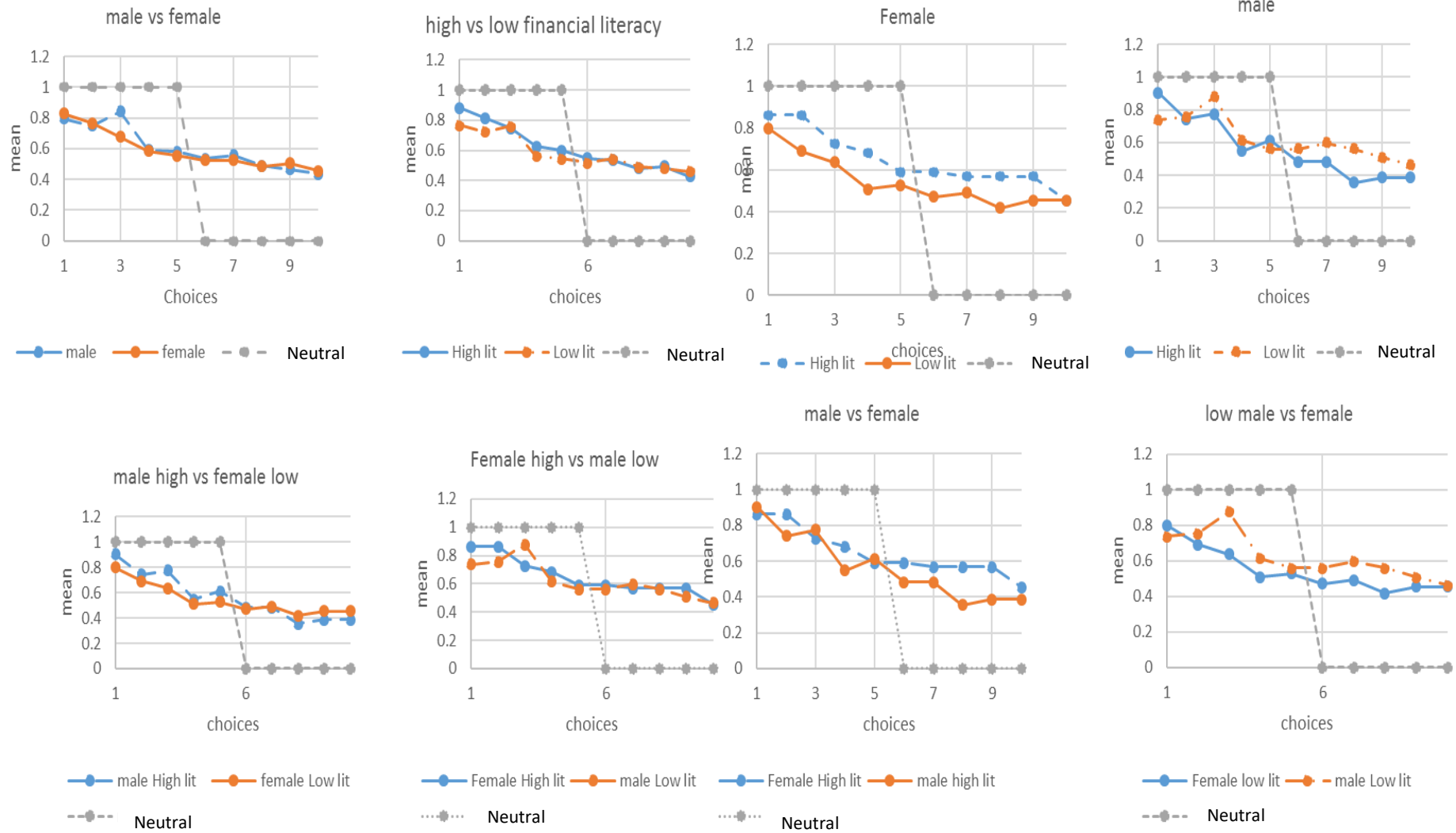
Figure 5.6: Time preferences task 3/game 3(Table C)

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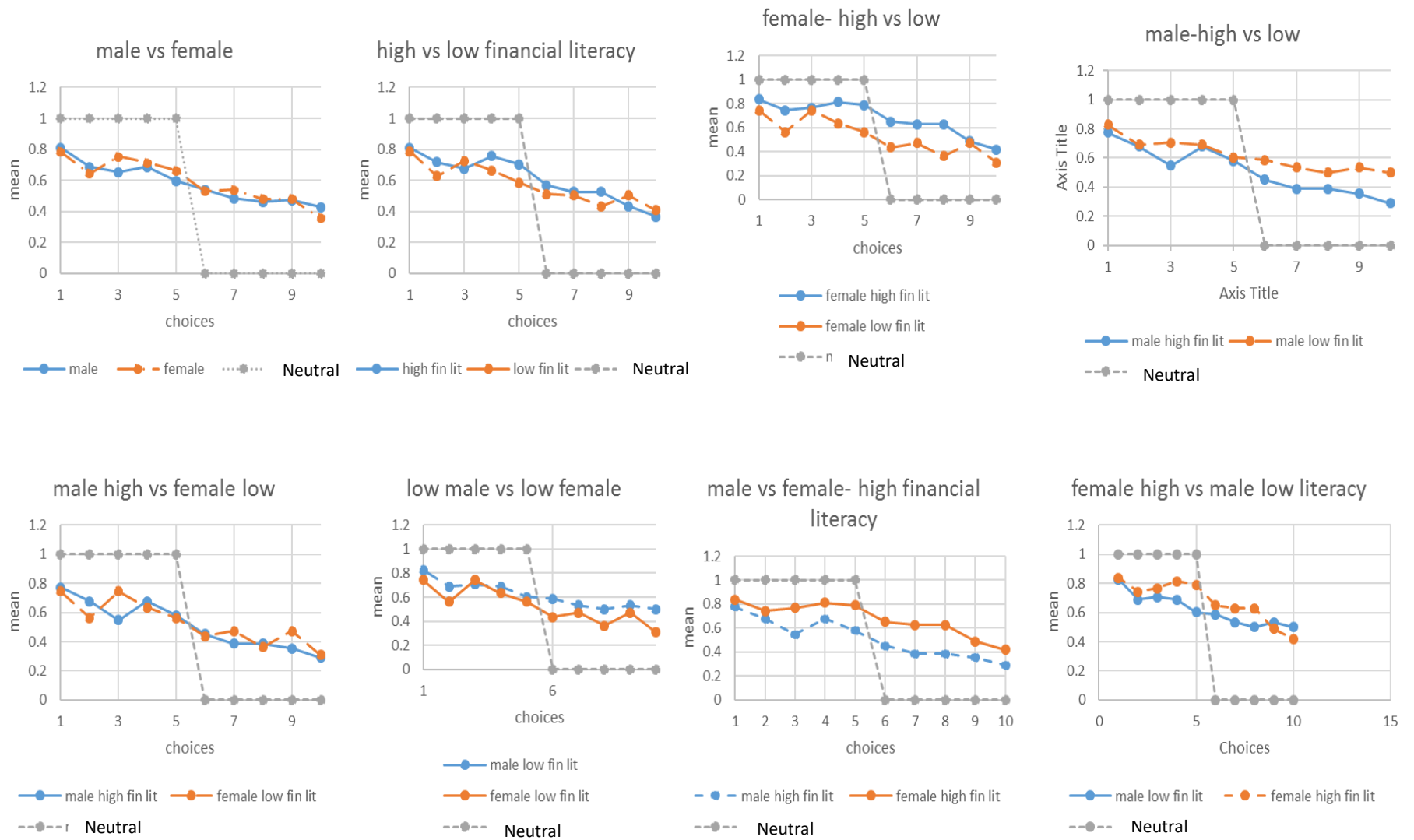
Figure 5.7: Time preferences task 4/game 4(Table D)

Figure 5.8: Time preferences all four tasks

Figure 5.9: Risk preferences Task 1 (Table E)

Risk preference choices: game 2

Figure 5.10: Risk preferences Task 2 (Table F)

Risk preferences choices: game 3

Figure 5.11: Risk preferences Task 3 (Table G)

Risk preferences choices: game 4
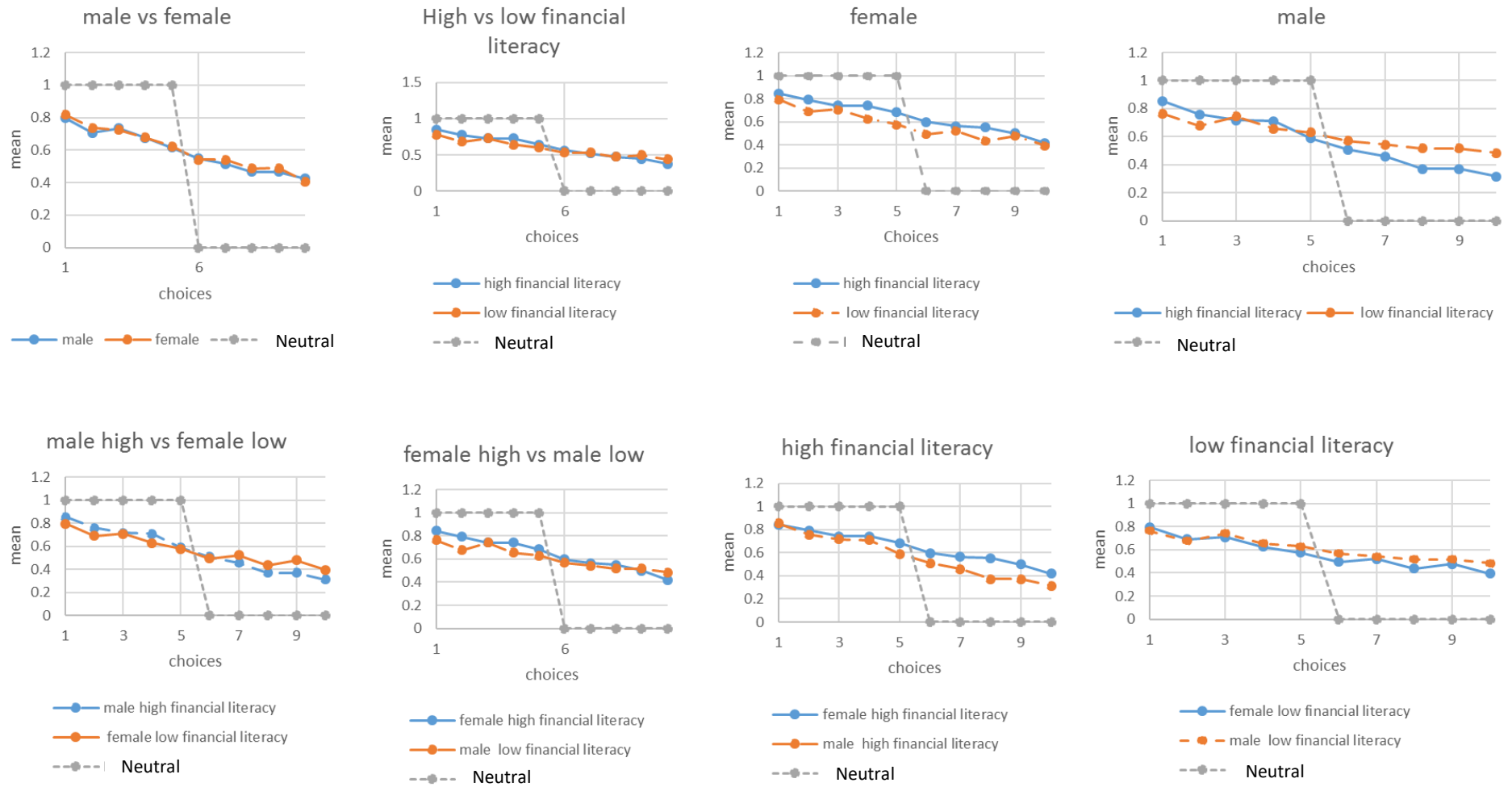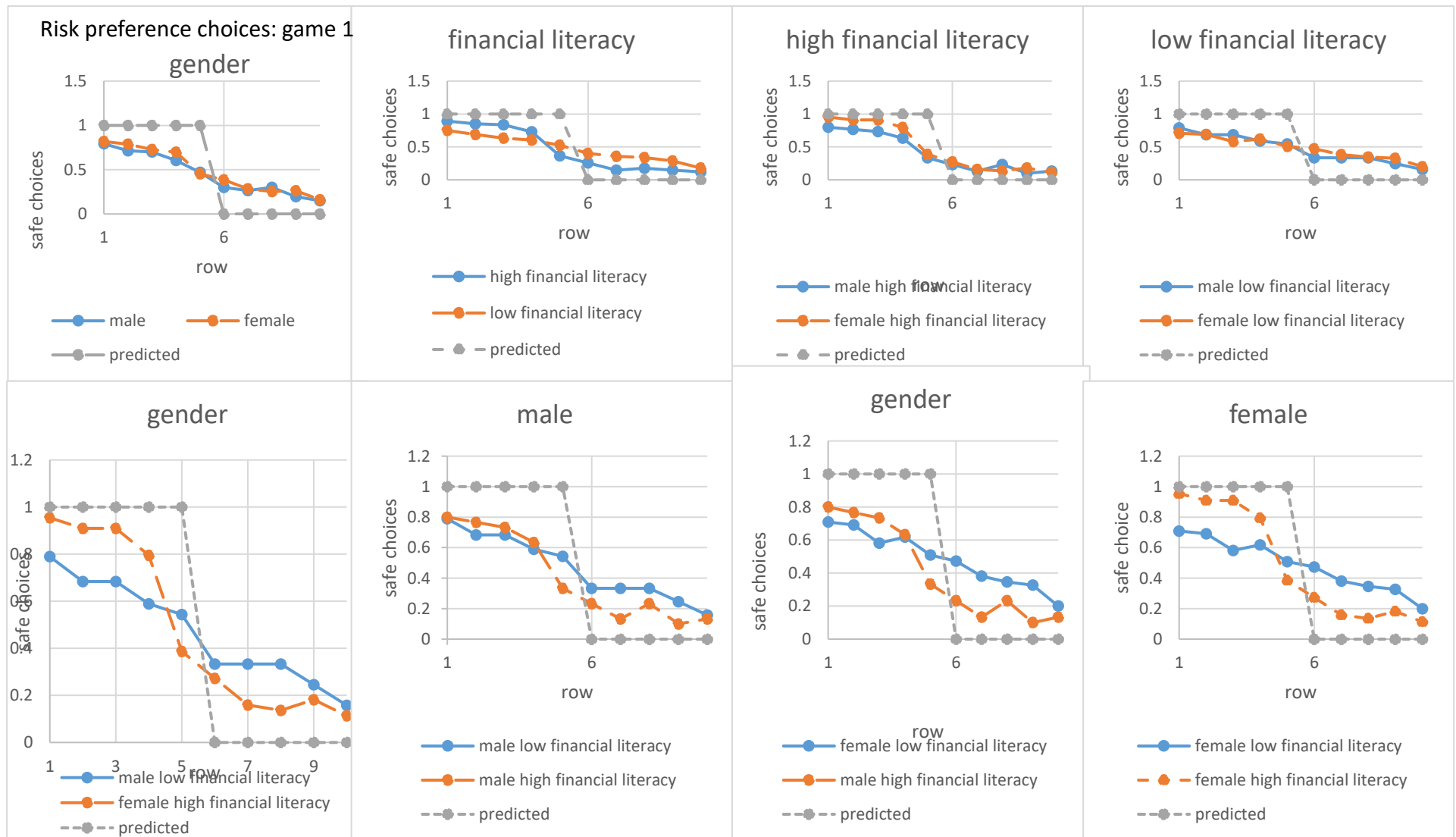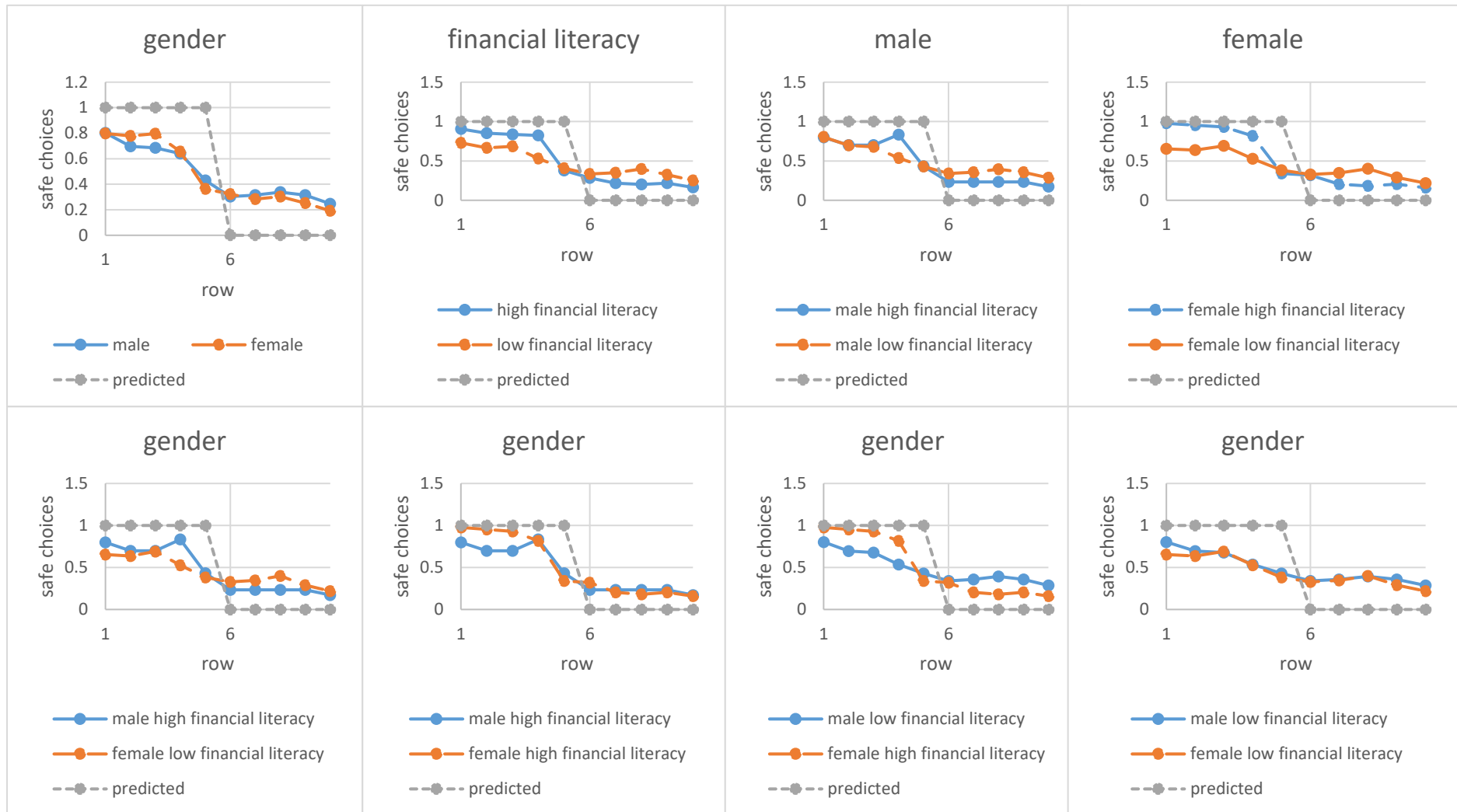

Figure 5.12: Risk preferences Task 4 (Table H)

All four risk preference game choices

Figure 5.13: Risk preferences all four tasks

CHAPTER 6: GENERAL CONCLUSION

6.1 Introduction

The focus of this conclusion is to discuss the major findings from the research. The chapter provides a conceptual framework and then discusses the research findings.

6.2 Theoretical framework

The literature on financial literacy lacks a strong theoretical framework and theories of behaviour change in the financial education field are taken from the health literature (Kennedy, 2013). According to Kennedy (2013), the approaches emphasize that behaviour change results from a combination of attitudes, social norms, perceived behaviour control and behaviour intentions. The aim of providing financial literacy is to help individuals to develop positive beneficial financial behaviour. This is typical of Ajzen's Theory of Planned Behaviour (see Figure 6.1 below). This model recognizes that knowledge and behaviour may interact through an unobserved feedback mechanism (Ajzen, 2011). For example, financial knowledge gained through past experience may be associated with future behaviour via attitudes and perceptions.
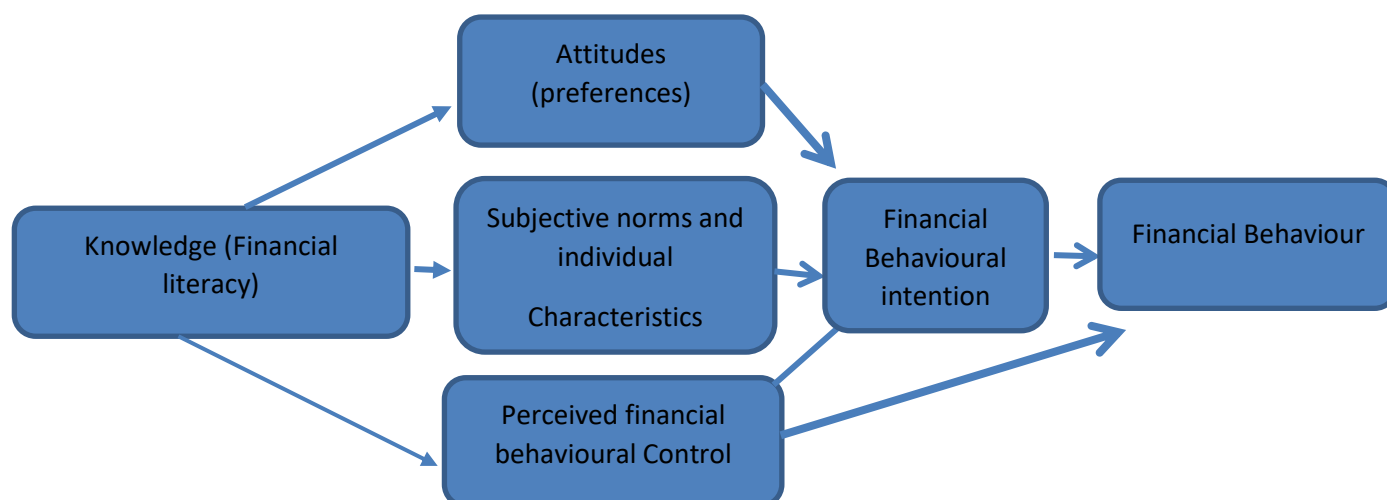
Figure 6.1: Theory of Planned Behaviour

Source: (Koropp et al., 2014)

If financial literacy is related to one's subjective norms, financial perceptions and attitudes such as risk preferences, social preferences and time preferences that should have a bearing on one's financial behaviour. Financial behaviour intention is the last step to one's financial behaviour (Ajzen, 2011). Students can acquire financial literacy but if they do not show an intention to make use of the knowledge it will be difficult to measure their literacy levels. Financial behaviour of university students can be split between actual and intended financial behaviour. Some university students' financial behaviour can be constrained by lack of resources and can only be measured by their financial behavioural intentions. Lack of financial literacy can be an impediment to an individual in making beneficial financial decisions that are good for one's financial wellbeing (Huston, 2010). Financial education provides financial knowledge which transforms an individual into a financially literate person. However, education on financial literacy has positive and negative outcomes. Financial education can result in information over

burden on subjects resulting in them failing to use the acquired knowledge (Willis, 2008). On a positive note, financial literacy is known to be helpful to individuals in achieving better financial life outcomes (Becchetti, Caiazza & Coviello, 2013).

The ultimate aim of influencing financial behaviour is to ensure improvement in wellbeing. Good financial behaviour is related with better financial life outcomes. Financial literacy helps citizens to be active participants in an economy. This study investigated the impact of financial literacy gaps in attaining welfare improvement. Unobserved interaction of financial literacy with perceptions, preferences, beliefs, norms and individual characteristics is associated with an individual's financial behaviour, which ultimately determine one's wellbeing.

6.3 Findings

Our results show that financial literacy is associated with a patient behaviour in aggregated university students. In paper 1 financial literacy is significantly associated with time preferences of students with low levels of financial literacy and the coefficient of financial literacy is negative showing patience amongst the subjects. In addition, students with higher financial literacy made a high number of patient choices, that is, larger later choices. In paper 2 students with high financial literacy, student exhibited a patient attitude when compared with subjects with low financial literacy. In paper 3, the ordinary least squares regression analysis on the whole group of university students show that an increase in financial literacy is associated with a low discount rate, showing that as financial literacy increases patience also increases. Finally, in paper 4, the increase in financial literacy is associated with an increase in patient choices among university students. There are studies that confirmed that an increase in education increases patience among individuals (Van der Pol, 2011; Lawrance, 1991). The study findings show that an increase in financial literacy is associated with perseverance, a trait critical in realising higher benefits in life. Our results emphasise the importance of providing financial literacy to university students. On the other hand, an analysis of subjects split by gender found that female university students were generally impatient (Papers 3 and 4). The results could explain the financial challenges encountered by the girl-child in her day to day life.

The significant impact of financial literacy on risk preferences and time preferences of university students with low financial literacy shows that financial literacy is more beneficial to people with low levels of financial literacy. It also reflects that time preferences and risk preferences of university students with high financial literacy are driven by other factors other than financial literacy. Studies have recorded increased benefits of financial education on people who initially had low levels of financial literacy (Becchetti, Caiazza & Coviello, 2013; Lusardi & Mitchell, 2007). Provision of financial literacy education should be targeted more on individuals who lack it. Communities in remote areas should be targeted for the provision of financial literacy. The study results show that students residing in urban areas are associated with higher levels of financial literacy revealing that university students from rural areas were more likely to have low levels of financial literacy.

An examination of the impact of financial literacy on decision making reveals that university students with low financial literacy are more likely to be indifferent on risk preference and time preference lottery choices. Multiple switching increases on risk preferences and time preference choices with low levels of financial literacy. Showing that university students with

low levels of financial literacy have high levels of indecision and struggle to make risk preference and time preference decisions. These results can help in explaining the challenges faced by individuals with low levels of financial literacy in society as they make risk preference and time preference choices. The findings in this research support conclusion made by Lusardi & Mitchell (2007), they revealed that an individual with low levels of financial literacy is more likely to make financial mistakes when compare with individuals with high financial literacy. Again this confirms the importance of providing financial literacy education in society as it reduces financial decision mistakes resulting in people achieving better financial life outcomes.

The study findings on subjects that did not engage in multiple switching on lotteries show that university students are generally risk averse and impatient. Showing reluctance in risk seeking and perseverance, revealing that university students have no culture of saving and investment. The study also concluded a significant behavioural error where individuals tremble when they make risk preference and time preference choices showing that in general people have difficulties in making the best financial decision for themselves. Further, our joint risk preference and time preference analysis which included an individual that engaged in multiple switching lotteries show that the total group of university students are risk loving and patient. The study findings further reveal that students with low financial literacy are more risk-loving, more impatient and are more overconfident. Being over-confident may lead to people ignoring crucial market information when making financial decisions. The traits of students with low levels of financial literacy are synonymous with the major causes of financial crises across the world. Individuals require financial literacy education to instil the right dose of confidence, risk preferences and time preferences (Asaad, 2015).

The study revealed that financial behaviour, confidence, risk preferences, time preferences and decision-making status significantly differ between university students with low financial literacy when compared with students with high financial literacy. In addition, confidence, risk preferences, income, age, financial decision status and financial literacy perceptions are significantly associated with financial behaviour of categorised university students. The research found that the highest level of education in a household is significantly linked to time preferences of university students, showing and intergenerational positive externality of education. In addition, the researchers found evidence of reverse causality between time preferences and financial literacy, showing that those who strive to have financial literacy improve their time preferences choices. The study emphasises the efforts of the South Africa National Treasury in its quest to increase financial literacy levels among South African citizens. Availing financial literacy to university students especially those with low levels of financial literacy will go a long way in improving their welfare. The fact that university students were found to be risk averse and impatient, calls for policy intervention. Government should consider availing a financial literacy curriculum and awareness to primary, secondary and tertiary education as a way of moulding good financial behaviour to enhance citizens' wellbeing. This will assist South African citizens in making time preference and risk preference choices, such as, investing and saving.

6.4 Conclusion

The study findings confirm the benefits of providing financial literacy to university students and South African citizens, especially those with low levels of financial literacy.

6.5 References

Ajzen, I. 1991. The theory of planned behavior. *Organizational behavior and human decision processes*. 50(2):179–211. Available: http://www.sciencedirect.com/science/article/pii/074959789190020T.

Ajzen, I. 2011. The theory of planned behaviour: Reactions and reflections. *Psychology & Health*. 26(9):1113–1127. DOI: 10.1080/08870446.2011.613995.

Asaad, C.T. 2015. Financial literacy and financial behavior: Assessing knowledge and confidence. *Financial Services Review*. 24(2):101–117. Available: http://search.ebscohost.com/login.aspx?direct=true&db=eoh&AN=EP103068434&site=ehost-live.

Becchetti, L., Caiazza, S. & Coviello, D. 2013. Financial education and investment attitudes in high schools: evidence from a randomized experiment. *Applied Financial Economics*. 23(10):817–836.

Huston, S.J. 2010. Measuring financial literacy. *Journal of Consumer Affairs*. 44(2):296–316. Available: http://onlinelibrary.wiley.com/doi/10.1111/j.1745-6606.2010.01170.x/full.

Kennedy, B.P. 2013. The theory of planned behavior and financial literacy: A predictive model for credit card debt? *ProQuest Dissertations and Theses*. (January, 1):84. DOI: Paper 480.

Koropp, C., Kellermanns, F.W., Grichnik, D. & Stanley, L. 2014. Financial Decision Making in Family Firms An Adaptation of the Theory of Planned Behavior. *Family Business Review*. 0894486514522483.

Lawrance, E.C. 1991. Poverty and the Rate of Time Preference: Evidence from Panel Data. *Journal of Political Economy*. 99(11):54–77. DOI: 10.1086/261740.

Lusardi, A. & Mitchell, O.S. 2007. Baby boomer retirement security: The roles of planning, financial literacy, and housing wealth. *Journal of monetary Economics*. 54(1):205–224. Available: http://www.sciencedirect.com/science/article/pii/S0304393206002467.

Van der Pol, M. 2011. Health, education and time preference. *Health Economics*. 20(8):917–929. DOI: http://dx.doi.org/10.1002/hec.1655.

Willis, L.E. 2008. Against financial-literacy education. *Iowa L. Rev.* 94:197. Available: http://heinonlinebackup.com/hol-cgi-bin/get_pdf.cgi?handle=hein.journals/ilr94&section=7.

6.6 ANNEXURE 1: MPL tasks, Questionnaire and financial literacy test
FINANCIAL LITERACY STUDY

CONSENT – INFORMATION DOCUMENT

Study title: The impact of financial literacy on risk and time preferences and financial behavioural intentions

Time and Risk Preferences: An Economics experiment

Greeting: Thank you for taking the time to come to the venue today and to listen to an explanation of the research study we will be conducting today.

Introduction: We, researchers from the Department of Economics at the University of the Free State, are doing research on time and risk preferences in humans.

Invitation to participate: We are inviting you to participate in this research study.

What is involved in the study: In this study, we want to investigate discount rate and risk parameter on time and risk preferences of students. An important component of this work is to conduct experiments. You have been selected to be part of this experiment. In an experiment, subjects such as yourself, is typically asked to complete various tasks or games in addition to completing a questionnaire(s) as well as a knowledge test. The experiment will take approximately 120 minutes.

Risks of being involved in the study: There are no risks to taking part in the study.

Benefits of being in the study: You will receive a show-up fee of R50. If you agree to take part in the study you may earn more money if you happen to be one of the luck 10% of the participants, depending on the specific tasks you will be required to complete as part of the experiment.

Participation is voluntary, and refusal to participate will involve no penalty. If you do not agree to take part, you may terminate the interview at any time and you have the right to decline to answer any questions you might not want to respond to.

Confidentiality: Your answers will be confidential. The answers will be put together with information collected from other people and the data will be safely stored. Results of the study may be published or presented at a meeting in an anonymous aggregated form.

The **R50** appearance fee will be paid in cash and all other payments will via FNB ewallet.

Contact details of researcher(s): Mr Calvin Mudzingiri at 058 718 5069.

Contact details of Secretariat and Chair: Ethics Committee Faculty of Economic & Management Sciences, University of the Free State – for reporting of complaints and problems and for questions regarding your rights as a research subject: Telephone number 051 - 401 2310.

PLEASE DO NOT TURN THE PAGE
UNTIL INSTRUCTED TO DO SO

FINANCIAL LITERACY STUDY

CONSENT FORM: DECISION-MAKING EXPERIMENT

RESPONDENT:

I, _____

[FULL NAME OF RESPONDENT IN BLOCK LETTERS]

have read and understood all the above information;	Yes / No
was given the opportunity to discuss this information and ask questions;	Yes / No
volunteer to take part in this study;	
gave the investigator permission to access and use my matric AP as well as mathematics proficiency score. The investigator undertakes to ensure anonymity, data collected will be aggregated for analysis purposes.	Yes / No
Confirm that I have received a copy of this consent form.	Yes / No
	Yes / No

Signature of respondent: Date:

_____   _____

RESEARCH ASSISTANT:

I, _____

[FULL NAME OF RESEARCH ASSISTANT IN BLOCK LETTERS]

have explained the study to the respondent; and	Yes / No
have given the respondent a copy of this consent form.	Yes / No

Signature of Research Assistant: Date:

_____   _____

B

BEFORE WE CONTINUE PLEASE NOTE THE FOLLOWING:

!! Please make sure your cell phone is switched off!!

During the experiment, please remain silent and do not communicate with other subjects.

If you should have any question(s), please raise your hand so the experimenter and/or an assistant can attend to your question in person.

Importantly, please closely follow the experimenter's instructions to the letter and do not turn the page until you are instructed to do so by the experimenter.

When on each page, please fill in the unique ID number on your recruitment flyer in the space provided at the top right hand side of the page – make sure you fill in the number on each page.

PLEASE DO NOT TURN THE PAGE
UNTIL INSTRUCTED TO DO SO

C

PAYMENT

As mentioned before, you stand to earn real money by participating in this experiment.

As part of this experiment, you will complete a total of **TWO** tasks or games. In each of these **TWO** tasks, as will be explained below, you stand to earn real money. For each task, we will explain how the task works and how payment is calculated for each task. At the end of the experiment we will randomly select 10 percent of the participants and ONLY one of these tasks for payment.

[Experimenter: Illustrate use of 10-sided dice.]

The number on the 10-sided dice will pay out the following tasks, each of which we will now explain and play in turn:
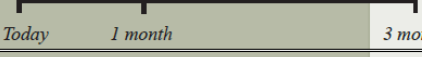
1-4	=	TIME PREFERENCES
5-8	=	RISK ATTITUDES
9-10	=	roll the dice again

D

TIME PREFERENCES

For this task, let us first explain how the game works using the example below:

PRACTICE TABLE:

Decision	Option A (Pays amount below in 1 month)	Option B (Pays amount below in 3 months)	Your Choice (Circle A or B)
1	R250.00 + 10% interest =	R254.20	A B
2	R250.00 + 20% interest =	R258.47	A B
3	R250.00 + 30% interest =	R262.81	A B
4	R250.00 + 40% interest =	R267.23	A B
5	R250.00 + 50% interest =	R271.71	A B
6	R250.00 + 60% interest =	R276.27	A B
7	R250.00 + 70% interest =	R280.90	A B
8	R250.00 + 80% interest =	R285.62	A B
9	R250.00 + 90% interest =	R290.40	A B
10	R250.00 + 100% interest =	R295.27	A B

9

Decision row selected:	
Roll 10-sided dice	
Number on dice (1-10)	
Choice (A/B)	
Payment (R):	

E

How do I play the table?
1. Please look at the above 'Practice Table'.
2. On the left of the table there are 10 rows.
3. You will need to play A or B on EVERY ROW.
4. You will play by marking A or B on the right of the table for each row under 'Your Choice'.

How does the timeline work?
1. On every row there is a timeline that starts with 'Today'.
2. You will be playing today so you are at the start of the timeline.
3. As you can see, with A you win R250 in 1 month from today. That is why R250 is 1 month from today on the timeline.
4. Look at the calendar to see the date 1 month from today.
5. With B you win money that is paid 3 months from today. That is why B is 3 months from today on the timeline.
6. Look at the calendar to see the date 3 months from today.
How is the amount in option B calculated?
1. As you can see, the B money increases as you move down the table from row 1 to row 10.
2. On row 1, with B you win R254.20 in 3 months from today. On row 10, with B you win R295.27 in 3 months from today.
3. B money increases as you move down the table because we are adding more interest to A money on every row.
4. On row 1 we add 10% interest to R250 in 1 month from today (A) and this gives us R254.20 in 3 months from today (B). On row 10 we add 100% interest to R250 in 1 month from today (A) and this gives us R295.27 in 3 months from today (B).
5. Note that interest represents the price of money. If you leave money in a bank account the bank pays you interest. The bank basically pays you for borrowing your money until you need it.
6. These tables use the same idea. If you play B then you have to wait 3 months to win B. If you play A you have to wait only 1 month to win A. So B money is bigger than A money because of interest that is added to A money over 2 months (the difference between 1 month and 3 months).
7. Please note that interest is usually calculated over 12 months. On this table, you win A after 1 month and you win B after 3 months. So with B money you only get interest for 2 months, i.e. the difference between 1 month (when you win A) and 3 months (when you win B).

How do I know whether to play A or B?
1. Now, you need to play A or B on every row of the table.
2. For row 1, you need to decide if you want R250 in 1 month from today (A) or R254.20 in 3 months from today (B).3. If you play A then you want R250 in 1 month from today.
4. If you play B then you want R254.20 in 3 months from today.
5. On row 2 you need to decide if you want R250 in 1 month from today (A) or R258.47 in 3 months from today (B).
6. If you play A then you want R250 in 1 month from today.
7. If you play B then you want R258.47 in 3 months from today.
8. **So all that you need to do is mark A if you want to play A and mark B if you want to play B.**
9. **There is no right or wrong answer in this game**. Please just play A if you want A and play B if you want B on every row of the table.

F

10. Do you have any questions?

It's now time for you to play the practice table (see table above)

1. Now it's time for you to play 'D Practice Table'.

2. **Please note that you will not win money for playing this table.**

3. It's important that you play the 'Practice Table' so that you know how to play the other tables and so that you can ask any questions if you have them.

How does payment work again?

1. We will roll the 10-sided dice to see your winning row in the table.

2. Look at if you played A or B on that row.

3. You will win what you played (A or B) when it's time to win what you played (in this case, in 1 month from today or 3 months from today, depending on whether you played option A or option B).

Do you have any other questions?

It's now time for you to start the game

1. Please play the next tables in the game pack (Table A-D).

2. You win A and B at different times.
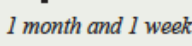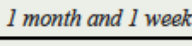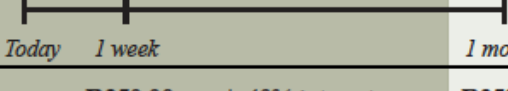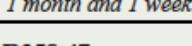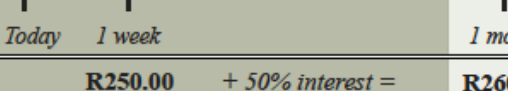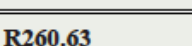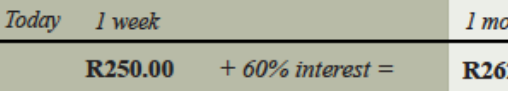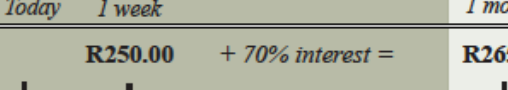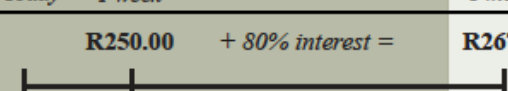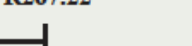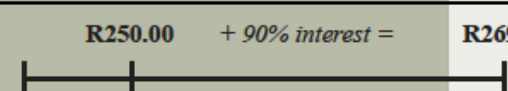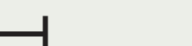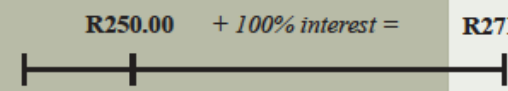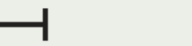
3. So please look at the table carefully so that you can decide whether to play A or B.

4. **Please take your time to play the tables and remember that there is no right or wrong answer in this game. Please just play A if you want A and play B if you want B on each row of every table.**

TIME PREFERENCES (continued)

Please play the table below: **TABLE A**

Decision	Option A (Pays amount below in 1 week)	Option B (Pays amount below in 1 month and 1 week)	Your Choice (Circle A or B)
1	R250.00 + 10% interest = Today 1 week	R252.09 1 month and 1 week	A B
2	R250.00 + 20% interest = Today 1 week	R254.20 1 month and 1 week	A B
3	R250.00 + 30% interest = Today 1 week	R256.33 1 month and 1 week	A B
4	R250.00 + 40% interest = Today 1 week	R258.47 1 month and 1 week	A B
5	R250.00 + 50% interest = Today 1 week	R260.63 1 month and 1 week	A B
6	R250.00 + 60% interest = Today 1 week	R262.81 1 month and 1 week	A B
7	R250.00 + 70% interest = Today 1 week	R265.00 1 month and 1 week	A B
8	R250.00 + 80% interest = Today 1 week	R267.22 1 month and 1week	A B
9	R250.00 + 90% interest = Today 1 week	R269.45 1 month and 1 week	A B
10	R250.00 + 100% interest = Today 1 week	R271.70 1 month and 1 week	A B

H

TIME PREFERENCES (continued)

Please play the table below: **TABLE B**

Decision	Option A (Pays amount below in 1 week)		Option B (Pays amount below in 3 months and 1 week)	Your Choice (Circle A or B)
1	**R250.00** + *10% interest =*	Today — 1 week — 3 months and 1 week	**R256.33**	A B
2	**R250.00** + *20% interest =*	Today — 1 week — 3 months and 1 week	**R262.81**	A B
3	**R250.00** + *30% interest =*	Today — 1 week — 3 months and 1 week	**R269.46**	A B
4	**R250.00** + *40% interest =*	Today — 1 week — 3 months and 1 week	**R276.28**	A B
5	**R250.00** + *50% interest =*	Today — 1 week — 3 months and 1 week	**R283.26**	A B
6	**R250.00** + *60% interest =*	Today — 1 week — 3 months and 1 week	**R290.42**	A B
7	**R250.00** + *70% interest =*	Today — 1 week — 3 months and 1 week	**R297.76**	A B
8	**R250.00** + *80% interest =*	Today — 1 week — 3 months and 1 week	**R305.28**	A B
9	**R250.00** + *90% interest =*	Today — 1 week — 3 months and 1 week	**R312.99**	A B
10	**R250.00** + *100% interest =*	Today — 1 week — 3 months and 1 week	**R320.90**	A B

TIME PREFERENCES (continued)

Please play the table below: **TABLE C**

Decision	Option A (Pays amount below in 1 week)	Option B (Pays amount below in 6 months and 1 week)	Your Choice (Circle A or B)
1	R250.00 + 10% interest = Today 1 week	R262.82 6 months and 1 week	A B
2	R250.00 + 20% interest = Today 1 week	R276.29 6 months and 1 week	A B
3	R250.00 + 30% interest = Today 1 week	R290.44 6 months and 1 week	A B
4	R250.00 + 40% interest = Today 1 week	R305.32 6 months and 1 week	A B
5	R250.00 + 50% interest = Today 1 week	R320.95 6 months and 1 week	A B
6	R250.00 + 60% interest = Today 1 week	R337.38 6 months and 1 week	A B
7	R250.00 + 70% interest = Today 1 week	R354.65 6 months and 1 week	A B
8	R250.00 + 80% interest = Today 1 week	R372.79 6 months and 1 week	A B
9	R250.00 + 90% interest = Today 1 week	R391.86 6 months and 1 week	A B
10	R250.00 + 100% interest = Today 1 week	R411.90 6 months and 1 week	A B

TIME PREFERENCES (continued)

Please play the table below: **TABLE D**

Decision	Option A (Pays amount below in 1 week)	Option B (Pays amount below in 1 year and 1 week)	Your Choice (Circle A or B)
1	R250.00 + 10% interest = Today — 1 week	R276.29 — 1 year and 1 week	A B
2	R250.00 + 20% interest = Today — 1 week	R305.33 — 1 year and 1 week	A B
3	R250.00 + 30% interest = Today — 1 week	R337.42 — 1 year and 1 week	A B
4	R250.00 + 40% interest = Today — 1 week	R372.87 — 1 year and 1week	A B
5	R250.00 + 50% interest = Today — 1 week	R412.04 — 1 year and 1 week	A B
6	R250.00 + 60% interest = Today — 1 week	R455.31 — 1 year and 1 week	A B
7	R250.00 + 70% interest = Today — 1 week	R503.10 — 1 year and 1 week	A B
8	R250.00 + 80% interest = Today — 1 week	R555.90 — 1 year and 1 week	A B
9	R250.00 + 90% interest = Today — 1 week	R614.22 — 1 year and 1 week	A B
10	R250.00 + 100% interest = Today — 1 week	R678.64 — 1 year and 1 week	A B

K

RISK ATTITUDES

For this task, let us explain how the game works using the example below:

PRACTICE TABLE:

Decision	Option A	Option B	Your Choice (Circle A or B)
1	R90 if dice is ❶ R60 if dice is ❷❸❹❺❻❼❽❾⓿	R160 if dice is ❶ R20 if dice is ❷❸❹❺❻❼❽❾⓿	A B
2	R90 if dice is ❶❷ R60 if dice is ❸❹❺❻❼❽❾⓿	R160 if dice is ❶❷ R20 if dice is ❸❹❺❻❼❽❾⓿	A B
3	R90 if dice is ❶❷❸ R60 if dice is ❹❺❻❼❽❾⓿	R160 if dice is ❶❷❸ R20 if dice is ❹❺❻❼❽❾⓿	A B
4	R90 if dice is ❶❷❸❹ R60 if dice is ❺❻❼❽❾⓿	R160 if dice is ❶❷❸❹ R20 if dice is ❺❻❼❽❾⓿	A B
5	R90 if dice is ❶❷❸❹❺ R60 if dice is ❻❼❽❾⓿	R160 if dice is ❶❷❸❹❺ R20 if dice is ❻❼❽❾⓿	A B
6	R90 if dice is ❶❷❸❹❺❻ R60 if dice is ❼❽❾⓿	R160 if dice is ❶❷❸❹❺❻ R20 if dice is ❼❽❾⓿	A B
7	R90 if dice is ❶❷❸❹❺❻❼ R60 if dice is ❽❾⓿	R160 if dice is ❶❷❸❹❺❻❼ R20 if dice is ❽❾⓿	A B
8	R90 if dice is ❶❷❸❹❺❻❼❽ R60 if dice is ❾⓿	R160 if dice is ❶❷❸❹❺❻❼❽ R20 if dice is ❾⓿	A B
9	R90 if dice is ❶❷❸❹❺❻❼❽❾ R60 if dice is ⓿	R160 if dice is ❶❷❸❹❺❻❼❽❾ R20 if dice is ⓿	A B
10	R90 if dice is ❶❷❸❹❺❻❼❽❾⓿	R160 if dice is ❶❷❸❹❺❻❼❽❾⓿	A B

Roll 10-sided dice	
Number on dice (1-10)	
Choice (A/B)	
Payment (R):	

PLEASE DO NOT TURN THE PAGE
UNTIL INSTRUCTED TO DO SO

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How do I play the table?

1. Please look at the above 'Practice Table'.
2. On the left of the table there are 10 rows.
3. You will need to play A or B on every row.
4. You will play by marking A or B on the right of the table under 'Your Choice'

How do A and B change on the table?

1. Please look at row 1 at the top of the 'Practice Table'.
2. With A you win R90 if you roll 1 on the 10-sided dice and you win R60 if you roll the number 2, 3, 4, 5, 6, 7, 8, 9 or 10.
3. With B you win R160 if you roll 1 on the 10-sided dice and you win R20 if you roll the number 2, 3, 4, 5, 6, 7, 8, 9, or 10.
4. On every row in this table the money under A is R90 or R60 and the money under B is R160 or R20.
5. Please look at the table at the top of the page. As you move down the table from row 1 to row 10, you will see that there are more numbers next to R90 under A. What this means is that the chance of winning R90 under A gets bigger as you move down the table.
6. As you move down the table, there are less numbers next to R60 under A. What this means is that the chance of winning R60 under A is smaller as you move down the table.
7. As you move down the table from row 1 to row 10, you will see that there are more numbers next to R160 under B. What this means is that the chance of winning R160 under B gets bigger as you move down the table.
8. As you move down the table, there are less numbers next to R20 under B. What this means is that the chance of winning R20 under B is smaller as you move down the table.
9. Please look at row 2 on the 'Practice Table'. With A you win R90 if you roll 1 or 2 and you win R60 if you roll 3, 4, 5, 6, 7, 8, 9 or 10. So now you can roll 1 or 2 to win R90 under A on row 2. On row 1 you could only roll 1 to win R90 under A.
10. On row 2, with B you win R160 if you roll 1 or 2 and you win R20 if you roll 3, 4, 5, 6, 7, 8, 9 or 10. So now you can roll 1 or 2 to win R160 under B on row 2. On row 1 you could only roll 1 to win R160 under B.
11. Please look at row 5. With A you win R90 if you roll 1, 2, 3, 4 or 5 and you win R60 if you roll 6, 7, 8, 9 or 10. So now you can roll 1, 2, 3, 4 or 5 to win R90 under A on row 5. On row 1 you could only roll 1 to win R90 under A.

12. On row 5, with B you win R160 if you roll 1, 2, 3, 4 or 5 and you win R20 if you roll 6, 7, 8, 9 or 10. So now you can roll 1, 2, 3, 4 or 5 to win R160 under B on row 5. On row 1 you could only roll 1 to win R160 under B.
13. Finally, look at row 10. With A you win R90 if you roll 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10. With B you win R160 if you roll 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10. So, on row 10, you can roll any number on the 10-sided dice and you will win R90 if you played A. If you played B on row 10, you can roll any number on the 10-sided dice and you will win R160. So, on row 10, you need to choose between R90 (A) and R160 (B).

How do I know whether to play A or B?

1. Now, you need to play A or B on every row of the table.
2. For row 1 you need to decide if you want to play A or B. In A, the big money is R90 and the small money is R60. In B, the big money is R160 and the small money is R20.
3. So as you can see the big money in B (R160) is always more than the big money in A (R90).
4. But the small money in A (R60) is always more than the small money in B (R20).

M

5. So if you play A on row 1, there is a low chance of winning R90 and a high chance of winning R60.

6. If you play B on row 1, there is a low chance of winning R160 and a high chance of winning R20.

7. On row 5, if you play A then there is a 50:50 chance of winning R90 or R60.

8. On row 5, if you play B then there is a 50:50 chance of winning R160 or R20.

9. **So all that you need to do is mark A if you want to play A and mark B if you want to play B**.

10. **There is no right or wrong answer in this game**. Please just play A if you want A and play B if you want B on every row of the table.

11. Do you have any questions?

It's now time for you to play the practice table

1. Now it's time for you to play the 'Practice Table'.

2. **Please note that you will not win money for playing this table**.

3. Its important that you play 'R Practice Table' so that you know how to play the other tables and so that you can ask any questions if you have them.

How does payment work again?

1. Roll the 10-sided dice to see your winning row in the table.

2. Look at if you played A or B on that row.

3. Now roll the 10-sided dice once more to see which amount of money you win.

Do you have any other questions?

It's now time for you to start the game

1. Please play Tables E-H in the game pack.

2. The money under A and B is different on every table.

3. So please look at the tables carefully so that you can decide whether to play A or B.

4. Please take your time to play the tables and remember that there is no right or wrong answer in this game. Please just play A if you want A and play B if you want B on each row of every table.

RISK ATTITUDES (continued)

Now play the table below: **TABLE E**

Decision	Option A	Option B	Your Choice (Circle A or B)
1	R60 if dice is ❶ R50 if dice is ❷❸❹❺❻❼❽❾❿	R100 if dice is ❶ R25 if dice is ❷❸❹❺❻❼❽❾❿	A B
2	R60 if dice is ❶❷ R50 if dice is ❸❹❺❻❼❽❾❿	R100 if dice is ❶❷ R25 if dice is ❸❹❺❻❼❽❾❿	A B
3	R60 if dice is ❶❷❸ R50 if dice is ❹❺❻❼❽❾❿	R100 if dice is ❶❷❸ R25 if dice is ❹❺❻❼❽❾❿	A B
4	R60 if dice is ❶❷❸❹ R50 if dice is ❺❻❼❽❾❿	R100 if dice is ❶❷❸❹ R25 if dice is ❺❻❼❽❾❿	A B
5	R60 if dice is ❶❷❸❹❺ R50 if dice is ❻❼❽❾❿	R100 if dice is ❶❷❸❹❺ R25 if dice is ❻❼❽❾❿	A B
6	R60 if dice is ❶❷❸❹❺❻ R50 if dice is ❼❽❾❿	R100 if dice is ❶❷❸❹❺❻ R25 if dice is ❼❽❾❿	A B
7	R60 if dice is ❶❷❸❹❺❻❼ R50 if dice is ❽❾❿	R100 if dice is ❶❷❸❹❺❻❼ R25 if dice is ❽❾❿	A B
8	R60 if dice is ❶❷❸❹❺❻❼❽ R50 if dice is ❾❿	R100 if dice is ❶❷❸❹❺❻❼❽ R25 if dice is ❾❿	A B
9	R60 if dice is ❶❷❸❹❺❻❼❽❾ R50 if dice is ❿	R100 if dice is ❶❷❸❹❺❻❼❽❾ R25 if dice is ❿	A B
10	R60 if dice is ❶❷❸❹❺❻❼❽❾❿	R100 if dice is ❶❷❸❹❺❻❼❽❾❿	A B

Decision row selected:	
Roll 10-sided dice	
Number on dice (1-10)	
Choice (A/B)	
Payment (R):	

o

RISK ATTITUDES (continued)

Now play the table below: **TABLE F**

Decision	Option A	Option B	Your Choice (Circle A or B)
1	R70 if dice is ❶ R45 if dice is ❷❸❹❺❻❼❽❾❿	R110 if dice is ❶ R10 if dice is ❷❸❹❺❻❼❽❾❿	A B
2	R70 if dice is ❶❷ R45 if dice is ❸❹❺❻❼❽❾❿	R110 if dice is ❶❷ R10 if dice is ❸❹❺❻❼❽❾❿	A B
3	R70 if dice is ❶❷❸ R45 if dice is ❹❺❻❼❽❾❿	R110 if dice is ❶❷❸ R10 if dice is ❹❺❻❼❽❾❿	A B
4	R70 if dice is ❶❷❸❹ R45 if dice is ❺❻❼❽❾❿	R110 if dice is ❶❷❸❹ R10 if dice is ❺❻❼❽❾❿	A B
5	R70 if dice is ❶❷❸❹❺ R45 if dice is ❻❼❽❾❿	R110 if dice is ❶❷❸❹❺ R10 if dice is ❻❼❽❾❿	A B
6	R70 if dice is ❶❷❸❹❺❻ R45 if dice is ❼❽❾❿	R110 if dice is ❶❷❸❹❺❻ R10 if dice is ❼❽❾❿	A B
7	R70 if dice is ❶❷❸❹❺❻❼ R45 if dice is ❽❾❿	R110 if dice is ❶❷❸❹❺❻❼ R10 if dice is ❽❾❿	A B
8	R70 if dice is ❶❷❸❹❺❻❼❽ R45 if dice is ❾❿	R110 if dice is ❶❷❸❹❺❻❼❽ R10 if dice is ❾❿	A B
9	R70 if dice is ❶❷❸❹❺❻❼❽❾ R45 if dice is ❿	R110 if dice is ❶❷❸❹❺❻❼❽❾ R10 if dice is ❿	A B
10	R70 if dice is ❶❷❸❹❺❻❼❽❾❿	R110 if dice is ❶❷❸❹❺❻❼❽❾❿	A B

Decision row selected:	
Roll 10-sided dice	
Number on dice (1-10)	
Choice (A/B)	
Payment (R):	

P

RISK ATTITUDES (continued) Now play the table below: **TABLE G**

Decision	Option A	Option B	Your Choice (Circle A or B)
1	R250 if dice is ❶ R150 if dice is ❷❸❹❺❻❼❽❾⓿	R400 if dice is ❶ R40 if dice is ❷❸❹❺❻❼❽❾⓿	A B
2	R250 if dice is ❶❷ R150 if dice is ❸❹❺❻❼❽❾⓿	R400 if dice is ❶❷ R40 if dice is ❸❹❺❻❼❽❾⓿	A B
3	R250 if dice is ❶❷❸ R150 if dice is ❹❺❻❼❽❾⓿	R400 if dice is ❶❷❸ R40 if dice is ❹❺❻❼❽❾⓿	A B
4	R250 if dice is ❶❷❸❹ R150 if dice is ❺❻❼❽❾⓿	R400 if dice is ❶❷❸❹ R40 if dice is ❺❻❼❽❾⓿	A B
5	R250 if dice is ❶❷❸❹❺ R150 if dice is ❻❼❽❾⓿	R400 if dice is ❶❷❸❹❺ R40 if dice is ❻❼❽❾⓿	A B
6	R250 if dice is ❶❷❸❹❺❻ R150 if dice is ❼❽❾⓿	R400 if dice is ❶❷❸❹❺❻ R40 if dice is ❼❽❾⓿	A B
7	R250 if dice is ❶❷❸❹❺❻❼ R150 if dice is ❽❾⓿	R400 if dice is ❶❷❸❹❺❻❼ R40 if dice is ❽❾⓿	A B
8	R250 if dice is ❶❷❸❹❺❻❼❽ R150 if dice is ❾⓿	R400 if dice is ❶❷❸❹❺❻❼❽ R40 if dice is ❾⓿	A B
9	R250 if dice is ❶❷❸❹❺❻❼❽❾ R150 if dice is ⓿	R400 if dice is ❶❷❸❹❺❻❼❽❾ R40 if dice is ⓿	A B
10	R250 if dice is ❶❷❸❹❺❻❼❽❾⓿	R400 if dice is ❶❷❸❹❺❻❼❽❾⓿	A B

Decision row selected:	
Roll 10-sided dice	
Number on dice (1-10)	
Choice (A/B)	
Payment (R):	

Q

RISK ATTITUDES (continued)

Now play the tables below:**TABLE H**

Decision	Option A	Option B	Your Choice (Circle A or B)
1	R200 if dice is ① R120 if dice is ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⓪	R300 if dice is ① R50 if dice is ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⓪	A B
2	R200 if dice is ① ② R120 if dice is ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⓪	R300 if dice is ① ② R50 if dice is ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⓪	A B
3	R200 if dice is ① ② ③ R120 if dice is ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⓪	R300 if dice is ① ② ③ R50 if dice is ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⓪	A B
4	R200 if dice is ① ② ③ ④ R120 if dice is ⑤ ⑥ ⑦ ⑧ ⑨ ⓪	R300 if dice is ① ② ③ ④ R50 if dice is ⑤ ⑥ ⑦ ⑧ ⑨ ⓪	A B
5	R200 if dice is ① ② ③ ④ ⑤ R120 if dice is ⑥ ⑦ ⑧ ⑨ ⓪	R300 if dice is ① ② ③ ④ ⑤ R50 if dice is ⑥ ⑦ ⑧ ⑨ ⓪	A B
6	R200 if dice is ① ② ③ ④ ⑤ ⑥ R120 if dice is ⑦ ⑧ ⑨ ⓪	R300 if dice is ① ② ③ ④ ⑤ ⑥ R50 if dice is ⑦ ⑧ ⑨ ⓪	A B
7	R200 if dice is ① ② ③ ④ ⑤ ⑥ ⑦ R120 if dice is ⑧ ⑨ ⓪	R300 if dice is ① ② ③ ④ ⑤ ⑥ ⑦ R50 if dice is ⑧ ⑨ ⓪	A B
8	R200 if dice is ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ R120 if dice is ⑨ ⓪	R300 if dice is ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ R50 if dice is ⑨ ⓪	A B
9	R200 if dice is ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ R120 if dice is ⓪	R300 if dice is ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ R50 if dice is ⓪	A B
10	R200 if dice is ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⓪	R300 if dice is ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⓪	A B

Decision row selected:	
Roll 10-sided dice	
Number on dice (1-10)	
Choice (A/B)	
Payment (R):	

R

6.7 Financial Literacy Questionnaire

Thank you very much for participating in this research.

• Please be assured that **all of your answers will be completely ANONYMOUS and CONFIDENTIAL**. Therefore, please try to answer these questions as openly and honestly as possible.

A2)   Please enter your Student Number.

[_____]

1. What is your gender?

    Male 1
    Female..2
2. What is your age……………………..
3. Which of the following best describes your race or ethnicity?

    White 1
    African 2
    Asian 3
    colored...4
    Other 5
    Prefer not to say 99

4. What is you marital status
    Married...1
    Single 2
    Separated...3
    Divorced..4
    Widowed/widower 5
    Prefer not to say 99

5. How many family members are you in your family?...........................
6. In total how much money do you have in your bank account(s) and cash equivalence (money you have now and at home)? ……………..
7. Roughly how much money do you spend in a month?..
8. What is the name of the degree that you are studying? Specify eg Bcomm. General, Bcomm Economics etc……………………………………...
9. Which of the following best describes where you live?

    Rural 1
    Urban...2

10. Who in the household is most knowledgeable about saving, investing and debt?

    You...1

S

Someone else 2
You and someone else are equally knowledgeable.............................3
Don't know 98
Prefer not to say 99

These days, a lot of people are thinking about financial issues. We are interested in your opinions on some of these issues. Note: Only Circle ONE option ONLY.

11. Imagine a six step ladder where the poorest in South Africa stand at the bottom (the first step) and the richest people in south Africa stand on the highest step (the sixth step). On which step is your household today?

poorest					richest
1	2	3	4	5	6

12. How will you describe your financial situation today?

Very broke	Broke	Neither	In good shape	In very good shape
1	2	3	4	5

13. Overall, thinking of your assets, debts and savings, how satisfied are you with your current personal financial condition? Please use a 10-point scale, where 1 means "Not At All Satisfied" and 10 means "Extremely Satisfied."

Not At All Satisfied 1	2	3	4	5	6	7	8	9	Extremely Satisfied 10	Don't know	Prefer not to say
1	2	3	4	5	6	7	8	9	10	98	99

14. When thinking of your financial investments, how willing are you to take risks? Please use a 10-point scale, where 1 means "Not At All Willing" and 10 means "Very willing."

Not At All Willing 1	2	3	4	5	6	7	8	9	Very Willing 10	Don't know	Prefer not to say
1	2	3	4	5	6	7	8	9	10	98	99

15. Over the past six months, would you say your spending was less than, more than, or about equal to your income? Please do not include the purchase of a new house or car, or other big investments you may have made.

Spending **less** than income..1
Spending **more** than income...2

T

Spending about **equal** to income 3
Don't know 98
Prefer not to say 99

16. In a typical month, how difficult is it for you to cover your expenses and pay all your bills?

Very difficult...1
Somewhat difficult...2
Not at all difficult..3
Don't know 98
Prefer not to say 99

17. Have you set aside emergency or rainy day funds that would cover your expenses for 3 months, in case of sickness or other emergencies?

Yes 1
No..2
Don't know 98
Prefer not to say 99

18. How confident are you that you could come up with R12,000 if an unexpected need arose within the next month?

I am certain I could come up with the full R12,000 1
I could probably come up with R12,000...2
I could probably not come up with R12,000..3
I am certain I could not come up with R12,000....................................4
Don't know 98
Prefer not to say 99

19. How did you receive most of your income in the past 12 months?

Cash...1
Checks (i.e., paper checks that need to be deposited or cashed) 2
Direct deposit to a checking account or savings account 3
Prepaid debit cards (e.g., a payroll card from an employer, or alimony or unemployment payments that you receive on a card) 4

.Other…………………………………………………………………… …… 5
Don't know 98
Prefer not to say 99

If other specify…………………………………………………….

20. How often do you use each the following methods to make payments (e.g., for shopping, for paying bills, or for any other purposes)? (Select an answer for each)

		Frequently	Sometimes	Never	Don't Know	Prefer not to Say
1	Cash	1	2	3	98	99
2	Paper checks	1	2	3	98	99
3	Credit cards	1	2	3	98	99
4	Debit cards tied to a bank account	1	2	3	98	99
5	Pre-paid debit cards	1	2	3	98	99
6	Online payments directly from your bank account	1	2	3	98	99
7	Money orders	1	2	3	98	99
8	Tapping/waving your mobile phone over a sensor at checkout	1	2	3	98	99
9	0ther	1	2	2	98	99

If other specify………………………………………………….

21. Do you have a check account?

Yes 1
No..2
Don't know 98
Prefer not to say………………………………………………99

22. Do you have a savings account, money market account, or Certificate Deposits?

Yes 1
No..2
Don't know 98
Prefer not to say………………………………………99

23. Do you have any investments in stocks, bonds, mutual funds, or other securities?

Yes 1
No..2
Don't know 98
Prefer not to say 99

24. Do you currently have any student loans?

Yes..1
No..2
Don't know 98
Prefer not to say 99

25. Are you concerned that you might not be able to pay off your student loans?

Yes...1

No...2

Don't know 98

Prefer not to say…………………………………………………………99

26. Who is funding you education studies?

NFAS………………………………………………………………………1

Bursary……………………………………………………………………….2

Loan…………………………………………………………………………..3

Parent/Guardian…………………………………………………………….4

Other………………………………………………………………………….5

If other, specify……………………………..

27. How strongly do you agree or disagree with the following statement? Please give your answer on a scale of 1 to 7, where 1 = "Strongly Disagree," 7 = "Strongly Agree," and 4 = "Neither Agree Nor Disagree". You can use any number from 1 to 7.

	Strongly Disagree 1	2	3	Neither Agree nor Disagree 4	5	6	Strongly Agree 7	Don't Know	Prefer not to Say
I have too much debt right now	1	2	3	4	5	6	7	98	99

28. Are you covered by health insurance?

Yes 1

No...2

Don't know 98

Prefer not to say 99

29. Do you have a life insurance policy?

Yes 1

No...2

Don't know 98

Prefer not to say 99

30. How strongly do you agree or disagree with the following statements? Please give your answer on a scale of 1 to 7, where 1 = "Strongly Disagree," 7 = "Strongly Agree," and 4 = "Neither Agree Nor Disagree". You can use any number from 1 to 7. (Select an answer for each)

		Strongly Disagree 1	2	3	Neither Agree nor Disagree 4	5	6	Strongly Agree 7	Don't Know	Prefer not to Say
1	I am good at dealing with day-to-day financial matters, such as checking accounts, credit and debit cards, and tracking expenses	1	2	3	4	5	6	7	98	99
2	I am pretty good at math	1	2	3	4	5	6	7	98	99

31. On a scale from 1 to 7, where 1 means very low and 7 means very high, how would you assess your overall financial knowledge?

Very Low 1	2	3	4	5	6	Very High 7	Don't know	Prefer not to say
1	2	3	4	5	6	7	98	99

32. Was financial education offered by a school or college you attended, or a workplace where you were employed?

Yes, but I <u>did not</u> participate in the financial education offered 1

Yes, and I <u>did</u> participate in the financial education 2

No 3

Don't know 98

Prefer not to say 99

33. Where did you receive that financial education?

		Yes	No	Don't Know	Prefer not to Say
1	In high school	1	2	98	99
2	In college/university	1	2	98	99
3	From an employer	1	2	98	99
4	From parents	1	2	98	99

x

34. Do you think financial education should be taught in schools?

Yes..1
No..2
Don't know 98
Prefer not to say 99

Following are some multiple choice questions. If you don't know the answer, just select "don't know."

35. Suppose you had R100 in a savings account and the interest rate was 2% per year. After 2 years, how much do you think you would have in the account if you left the money to grow?

More than R102 1
Exactly R102...2
Less than R102..3
Don't know 98
Prefer not to say 99

36. Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, how much would you be able to buy with the money in this account?

More than today 1
Exactly the same 2
Less than today 3
Don't know 98
Prefer not to say 99

37. If interest rates rise, what will typically happen to bond prices?

They will rise 1
They will fall...2
They will stay the same...3
There is no relationship between bond prices and the interest rate 4
Don't know 98
Prefer not to say 99

Following are two statements. Please indicate whether each statement is true or false. If you don't know, just select "don't know."

38. A 15-year mortgage typically requires higher monthly payments than a 30-year mortgage, but the total interest paid over the life of the loan will be less.

True...1
False 2
Don't know 98
Prefer not to say 99

39. Buying a single company's stock usually provides a safer return than a stock mutual fund.

True...1

False 2
Don't know 98
Prefer not to say 99

40. Suppose you owe R1,000 on your credit card and the interest rate you are charged is 20% per year compounded annually. If you didn't pay anything off, at this interest rate, how many years would it take for the amount you owe to double?

2 years;…………………………………………………………1

Less than 5 years;…………………………………………...2

5 to 10 years;…………………………………………..3

More than 10 years;………………………………………4

Do not know………………………………………………98

Prefer not to answer……………………………………….99

41. You owe R3,000 on your credit card. You pay a minimum payment of R30 each month. At an Annual Percentage Rate of 12% (or 1% per month), how many years would it take to eliminate your credit card debt if you made no additional new charges?

Less than 5 years;…………………………………………1

Between 5 and 10 years;…………………………………..2

Between 10 and 15 years;…………………………………3

Never, you will continue to be in debt;……………………...4

Do not know;………………………………………………98

Prefer not to answer……………………………………….99

42. You purchase an appliance which costs R1,000. To pay for this appliance, you are given the following two options: a) Pay 12 monthly installments of R100 each; b) Borrow at a 20% annual interest rate and pay back R1,200 a year from now. Which is the more advantageous offer?

Option (a);…………………………………………………1

Option (b);…………………………………………………2

They are the same;…………………………………………3

Do not know;………………………………………………98

Prefer not to answer……………………………………...99

Questions 41-47

How strongly do you agree or disagree with the following statement? Please give your answer on a scale of 1 to 7, where 1 = "Strongly Disagree," 7 = "Strongly Agree," and 4 = "Neither Agree or Disagree". You can use any number from 1 to 7.

z

43. Understanding Debt

I know what makes me a good or bad credit risk.	Strongly Disagree 1	2	3	Neither Agree nor Disagree 4	5	6	Strongly Agree 7	Don't Know	Prefer not to Say
	1	2	3	4	5	6	7	98	99

i)

I understand what affects the credit terms I am offered by different lending institutions.	Strongly Disagree 1	2	3	Neither Agree nor Disagree 4	5	6	Strongly Agree 7	Don't Know	Prefer not to Say
	1	2	3	4	5	6	7	98	99

44. Insurance

i)

I feel comfortable with my ability to make decisions about what kind of life insurance (if any) to purchase in the future.	Strongly Disagree 1	2	3	Neither Agree nor Disagree 4	5	6	Strongly Agree 7	Don't Know	Prefer not to Say
	1	2	3	4	5	6	7	98	99

ii)

I understand the difference between various types of insurance.	Strongly Disagree 1	2	3	Neither Agree nor Disagree 4	5	6	Strongly Agree 7	Don't Know	Prefer not to Say
	1	2	3	4	5	6	7	98	99

iii)

I understand the difference between the different types	Strongly Disagree 1	2	3	Neither Agree nor	5	6	Strongly Agree 7	Don't Know	Prefer not to Say

of automobile insurance.				Disagree 4					
	1	2	3	4	5	6	7	98	99

45. Investing and saving

i)

I am comfortable with my ability to make decisions about savings instruments based on their fixed and compounded interest rates.	Strongly Disagree 1	2	3	Neither Agree nor Disagree 4	5	6	Strongly Agree 7	Don't Know	Prefer not to Say
	1	2	3	4	5	6	7	98	99

ii)

I understand the general relationship between risk and reward in investing.	Strongly Disagree 1	2	3	Neither Agree nor Disagree 4	5	6	Strongly Agree 7	Don't Know	Prefer not to Say
	1	2	3	4	5	6	7	98	99

iii)

I feel confident in my understanding of the differences between bonds, stocks, U.S. Treasury bills and mutual funds.	Strongly Disagree 1	2	3	Neither Agree nor Disagree 4	5	6	Strongly Agree 7	Don't Know	Prefer not to Say
	1	2	3	4	5	6	7	98	99

iv)

I feel comfortable with my understanding of the various financial terms that go along with buying a home someday.	Strongly Disagree 1	2	3	Neither Agree nor Disagree 4	5	6	Strongly Agree 7	Don't Know	Prefer not to Say
	1	2	3	4	5	6	7	98	99

46. Money management

i)

I understand what personal net worth means.	Strongly Disagree 1	2	3	Neither Agree nor Disagree 4	5	6	Strongly Agree 7	Don't Know	Prefer not to Say
	1	2	3	4	5	6	7	98	99

ii)

I am confident in my ability to write a monthly budget.	Strongly Disagree 1	2	3	Neither Agree nor Disagree 4	5	6	Strongly Agree 7	Don't Know	Prefer not to Say
	1	2	3	4	5	6	7	98	99

47. Retirement

i)

I feel comfortable with my ability to financially plan for my retirement.	Strongly Disagree 1	2	3	Neither Agree nor Disagree 4	5	6	Strongly Agree 7	Don't Know	Prefer not to Say
	1	2	3	4	5	6	7	98	99
I feel comfortable with my ability to make decisions about pension plans.	Strongly Disagree 1	2	3	Neither Agree nor Disagree 4	5	6	Strongly Agree 7	Don't Know	Prefer not to Say
	1	2	3	4	5	6	7	98	99

Instruction: Please use the scale to indicate the degree to which your answers accurately describe your own situation and feelings.

During the past 6 months....

48. Investment and saving

1. How often have you considered saving and investing your money?

1	2	3	4	5	6	7
Never						Always

2. To what extent are your current savings and investments satisfying your personal needs?

1	2	3	4	5	6	7
To no extent						To a very larger

3. How often you are frustrated when fail to have the opportunity to save and invest?

1	2	3	4	5	6	7
Never						Always

4. How often do you dream about investing and saving money one day?

1	2	3	4	5	6	7
Never						Always

5. How likely are you prepared to start saving and investing if opportunity arise?

1	2	3	4	5	6	7
Highly						Highly

How often have you looked for information on savings and investment?

1	2	3	4	5	6	7
Always						Never

Investment and saving Intentions

Instruction: Indicate your level of agreement with the following statements.

1. As soon as I can find a better job, I will start investing and saving money.	1	2	3	4	5	6	7
2. I am actively looking for investment and saving opportunities.	1	2	3	4	5	6	7
3. I am seriously thinking of investing and saving my money.	1	2	3	4	5	6	7

49. Planning for retirement
1. How often have you considered planning for retirement?

1	2	3	4	5	6	7
Never						Always

2. To what extent are your current retirement plans satisfying your personal needs?

1	2	3	4	5	6	7
To no extent						To a very larger

3. How often are you frustrated when you fail to have the opportunity to plan for your retirement?

1	2	3	4	5	6	7
Never						Always

4. How often do you dream about planning for retirement?

1	2	3	4	5	6	7
Never						Always

5. How likely prepared to start saving for retirement if opportunity arise?

1	2	3	4	5	6	7
Highly						Highly

6. How often have you looked for information on retirement plans?

1	2	3	4	5	6	7
Always						Never

Planning for retirement Intentions

Instruction: Indicate your level of agreement with the following statements.

(where 1=strongly disagree – 7=strongly agree)

1. As soon as I can find a job, I will start saving for retirement.	1	2	3	4	5	6	7
2. I am actively looking for retirement investment plan opportunities.	1	2	3	4	5	6	7
3. I am seriously thinking of having a retirement plan.	1	2	3	4	5	6	7

50. Debt

1. How often have you considered borrowing money?

1	2	3	4	5	6	7
Never						Always

2. To what extent are your current borrowings satisfying your personal needs?

1	2	3	4	5	6	7
To no extent						To a very larger

3. How often do you have the opportunity to borrow?

1	2	3	4	5	6	7
Never						Always

4. How often do you dream about borrowing money?

1	2	3	4	5	6	7
Never						Always

5. How likely prepared to start borrowing if opportunity arise?

1	2	3	4	5	6	7
Highly						Highly

6. How often have you looked for information on borrowing money?

1	2	3	4	5	6	7
Always						Never

borrowing Intentions

Instruction: Indicate your level of agreement with the following statements.

(where 1=strongly disagree – 7=strongly agree)

1. As soon as I start working, I will finance my consumption using borrowing.	1	2	3	4	5	6	7
2. I am actively looking for borrowing opportunities.	1	2	3	4	5	6	7
3. I am seriously thinking of seriously thinking of borrowing money.	1	2	3	4	5	6	7

51. Insurance

1. How often have you considered having an insurance?

1	2	3	4	5	6	7
Never						Always

2. To what extent is your insurance satisfying your personal needs?

1	2	3	4	5	6	7
To no extent						To a very larger

3. How often do you have the opportunity insure your goods and services?

1	2	3	4	5	6	7
Never						Always

4. How often do you dream about insuring your goods and services?

1	2	3	4	5	6	7
Never						Always

5. How likely are you prepared to have an insurance if opportunity arises?

1	2	3	4	5	6	7
Highly						Highly

6. How often have you looked for information about insurance?

1	2	3	4	5	6	7
Always						Never

Planning to have insurance Intentions

Instruction: Indicate your level of agreement with the following statements.

(where 1=strongly disagree – 7=strongly agree)

	1	2	3	4	5	6	7
1. As soon as I start working, I will have insurance.	1	2	3	4	5	6	7
2. I am actively looking for insurance opportunities.	1	2	3	4	5	6	7
3. I am seriously thinking of seriously thinking of insuring my goods and services.	1	2	3	4	5	6	7

52. Personal finance

1. How often have you tracked your daily expenditure?

1	2	3	4	5	6	7
Never						Always

2. To what extent are your daily expenses satisfying your personal needs?

1	2	3	4	5	6	7
To no extent						To a very lar

3. How often are you frustrated when your budget fail to meet your expenses?

1	2	3	4	5	6	7
Never						Always

4. How often do you dream about having a bigger budget to spend?

1	2	3	4	5	6	7
Never						Always

5. How likely are you prepared to track your daily expenses?

1	2	3	4	5	6	7
Highly						Highly

6. How often have you prepared a monthly budget?

1	2	3	4	5	6	7
Always						Never

Personal finance Intentions

Instruction: Indicate your level of agreement with the following statements.

(where 1=strongly disagree – 7=strongly agree)

	1	2	3	4	5	6	7
1. As soon as I start working, I will start tracking my expenses.	1	2	3	4	5	6	7
2. I am actively tracking my expenses.	1	2	3	4	5	6	7
3. I am seriously thinking of tracking my expenses.	1	2	3	4	5	6	7

53. Knowledge Assessment Survey Questions

Answer all the questions, circle the answer of your choice. You stand a chance to win R200 if you score the highest mark in the case of a tie a random selection will be carried.

1. Under which of the following circumstances would it be financially beneficial to you to borrow money to buy something now and repay it with future income?

   A. When you need to buy a car to get a much better paying job.

   B. When you really need a week vacation.
   C. When some clothes you like go on sale.

   D. When the interest on the loan is greater than the interest you get on your savings.

2. Most lender's policies for extending credit are based on the "five Cs of credit." What are the five Cs of credit?
   A. Credit history, Crime record, Commitment, Collateral and Capacity
   B. Credit history, Cost of Credit, Credit Opportunity, Collateral, and Commitment
   C. Credit history, Conditions, Capacity, Capital, and Collateral
   D. Credit history, Credit consumption, Credit Opportunity, Credit File, and Credit report

3. Barbara has just applied for a credit card. She is an 18-year-old high school graduate with few valuable possessions and no credit history. If Barbara is granted a credit card, which of the following is the most likely way that the credit card company will reduce risk?

   A. It will make Barbara's parents pledge their home to repay Karen's credit card debt.

   B. It will require Barbara to have both parents co-sign for the card.

   C. It will charge Barbara twice the finance charge rate it charges older cardholders.

   D. It will start Barbara out with a small line of credit to see how she handles the account.
4. If you are behind on your debt payments and go to a responsible credit counselling service such as the Consumer Credit Counselling Services, what help can they give you?
   A. They can cancel and cut up all of your credit cards without your permission.

   B. They can get the government to apply your income taxes to pay off your debts.

   C. They can work with those who loaned you money to set up a payment schedule that you can meet.
   D. They can force those who loaned you money to forgive all your debts

5. Scott and Eric are young men. Each has a good credit history. They work at the same company and make approximately the same salary. Scott has borrowed R6,000 to take a foreign vacation. Eric has borrowed R6,000 to buy a car. Who is likely to pay the lowest finance charge?

   A. Eric will pay less because the car is collateral for the loan.

   B. They will both pay the same because the rate is set by law.

   C. Scott will pay less because people who travel overseas are better risks.

   D. They will both pay the same because they have almost identical financial backgrounds.

6. Many young people receive health insurance benefits through their parents. Which of the following statements is true about health insurance coverage?
   A. You are covered by your parents' insurance until you marry, regardless of your age.

   B. If your parents become unemployed, your insurance coverage may stop, regardless of your age.

   C. Young people don't need health insurance because they are so healthy.

   D. You continue to be covered by your parents' insurance as long as you live at home, regardless of your age.

7. If each of the following persons had the same amount of take home pay, who would need the greatest amount of life insurance?

   A. An elderly retired man, with a wife who is also retired.

   B. A young married man without children.

   C. A young single woman with two young children.

   D. A young single woman without children.

8. If you have caused an accident, which type of automobile insurance would cover damage to your own car?
   A. Comprehensive.

   B. Liability.

   C. Term.

   D. Collision.

9. Don and Bill work together in the finance department of the same company and earn the same pay. Bill spends his free time taking work-related classes to improve his computer skills; while Don spends his free time socializing with friends and working out at a fitness centre. After five years, what is likely to be true?

A. Don will make more because he is more social.

B. Don will make more because Bill is likely to be laid off.

C. Bill will make more money because he is more valuable to his company.

D. Don and Bill will continue to make the same money

10. Rob and Mary are the same age. At age 25 Mary began saving R2,000 a year while Rob saved nothing. At age 50, Rob realized that he needed money for retirement and started saving R4,000 per year while Mary kept saving her R2,000. Now they are both 75 years old. Who has the most money in his or her retirement account?

A. They would each have the same amount because they put away exactly the same

B. Rob, because he saved more each year

C. Mary, because she has put away more money

D. Mary, because her money has grown for a longer time at compound interest

11. Sara and Joshua just had a baby. They received money as baby gifts and want to put it away for the baby's education. Which of the following tends to have the highest growth over periods of time as long as 18 years?

A. A checking account.

B. Stocks.

C. A South African Government savings bond.

D. A savings account

12. Which of the following types of investment would best protect the purchasing power of a family's savings in the event of a sudden increase in inflation?
A. A 10-year bond issued by a corporation.

B. A certificate of deposit at a bank.

C. A twenty-five year corporate bond.

D. A house financed with a fixed-rate mortgage.

13. Inflation can cause difficulty in many ways. Which group would have the greatest problem during periods of high inflation that last several years?
A. Older, working couples saving for retirement.

B. Older people living on fixed retirement income.

C. Young couples with no children who both work.

D. Young working couples with children.

14. Rebecca has saved R12,000 for her college expenses by working part-time. Her plan is to start college next year and she needs all of the money she saved. Which of the

following is the safest place for her college money?

A. Locked in her closet at home.

B. Stocks.

C. Corporate bonds.

D. A bank savings account.

15. David just found a job with a take-home pay of R2,000 per month. He must pay R900 for rent and R150 for groceries each month. He also spends R250 per month on transportation. If he budgets R100 each month for clothing, R200 for restaurants and R250 for everything else, how long will it take him to accumulate savings of R600.

A. 3 months.

B. 4 months.

C. 1 month.

D. 2 months.

16. Many people put aside money to take care of unexpected expenses. If Juan and Elva have money put aside for emergencies, in which of the following forms would it be of LEAST benefit to them if they needed it right away?

A. Invested in a down payment on the house.

B. Check account.

C. Stocks.

D. Savings account

17. Being on budget means:
    A. You pay bills every month at the due date
    B. You made a plan of your expenses to be less than or equal to your income
    C. You are earning enough money to be able to live well
    D. our bills are generally paid by every due date

18. Robbie buys a bottle of water from the vending machine for R1.25 and a candy bar for R1.35 every day when he arrives at his after-school job. Robbie makes R6.50 per hour and works for four hours each day. What percentage of his after-school gross pay is he spending for bottled water and candy?
    A. 20%
    B. 5%
    C. 10%
    D. 2.60%
19. Retirement income paid by a company is called:

A. Grant.

B. Pension.

C. Rents and profits.

D. Old age money.

20. What is an advantage of enrolling in your employer's pension fund?
    A. The amount you choose to contribute is automatically deducted from your pay check and deposited in your employee credit union account.
    B. The amount you choose to contribute is automatically deducted from your pay check and deposited in your savings account.
    C. The amount you choose to contribute is automatically deducted from your pay check and is sent to the Internal Revenue Service (IRS) to apply to your taxes for that year.
    D. The amount you choose to contribute is automatically deducted from your pay check and is not subject to tax until it is withdrawn--usually at retirement age.

21. Matt has a good job on the production line of a factory in his home town. During the past year or two, the state in which Matt lives has been raising taxes on its businesses to the point where they are much higher than in neighbouring states. What effect is this likely to have on Matt's job?

    A. Higher business taxes will cause more businesses to move into Matt's state, raising wages.

    B. Higher business taxes can't have any effect on Matt's job.

    C. Matt's company may consider moving to a lower-tax state, threatening Matt's job.

    D. He is likely to get a large raise to offset the effect of higher taxes.

22. Which of the following is true about Value Added Tax?

    A. The national sales tax percentage rate is 6%.

    B. The South African government will deduct it from your pay check.

    C. You don't have to pay the tax if your income is very low.

    D. It makes things more expensive for you to buy.

6.8 ANNEXURE 2: Questionnaire, binary choice task and Financial literacy test-Qwaqwa Campus.

Student number

BIOGRAPHIC INFORMATION OF STUDENTS

Mark applicable block with **X**		

i)   GENDER

Male/	Female

ii)   AGE IN
        YEARS

Years

iii)   ETHNIC
        GROUP

1	2	3	4
Black	Coloured	Indian Asian	White

iv)   NUMBER OF FAMILY MEMBERS

v)   EXCLUDING YOURSELF, WHAT IS THE HIGHEST QUALIFICATION HELD
        BY MEMBER OF THE FAMILY

1.Less than matric	
2.matric	
3.diploma	
4.First degree/ honours degree	
5.Masters/ PhD	
6.Other	

vi)   Who is funding you education studies?

NFAS…………………………………………………………………………1

Bursary……………………………………………………………………2

Loan………………………………………………………………………3

Parent/Guardian……………………………………………………………4

Self………………………………………………………………5

vii)   You are allocated 5 coupons/tokens. If you place the coupon in column A you will be
        paid R20 per coupon paid after 2 weeks. If you place the coupon in column B you will

be paid R25 per coupon paid after 6 weeks. To win you should pick a winning ticket from a raffle.

Colum A	Column B

viii) In total how much money do you have in your bank account(s) and cash equivalence? R……………..

ix) How strongly do you agree or disagree with the following statements? Please give your answer on a scale of 1 to 7, where 1 = "Strongly Disagree," 7 = "Strongly Agree," and 4 = "Neither Agree Nor Disagree". You can use any number from 1 to 7. (Select an answer for each)

	Strongly Disagree 1	2	3	Neither Agree nor Disagree 4	5	6	Strongly Agree 7	Don't Know	Prefer not to Say
I am good at dealing with day-to-day financial matters, such as checking accounts, credit and debit cards, and tracking expenses	1	2	3	4	5	6	7	98	99
I am pretty good at math	1	2	3	4	5	6	7	98	99

x) On a scale from 1 to 7, where 1 means very low and 7 means very high, how would you assess your overall financial knowledge?

Very Low 1	2	3	4	5	6	Very High 7	Don't know	Prefer not to say
1	2	3	4	5	6	7	98	99

Circle the correct answer

1. Net worth is:

A.   The difference between expenditures and income
B.   The difference between liabilities and assets
C.   The difference between cash inflow and outflow
D.   The difference between borrowings and savings

2. Considering a long time period (for example 10 or 20 years), which asset normally gives the highest return?

 A.   Savings accounts
 B.   Bonds
 C.   Stocks
 D.   Commodities

3. Which account usually pays the MOST interest?

 A.   Certificate of deposit
 B.   Government bonds
 C.   Company bonds
 D.   Money Market account

4. The MOST important factors that lenders use when deciding whether to approve a loan are

 A.   Marital status and number of children
 B.   Education and occupation
 C.   Age and gender
 D.   Bill-paying record and income

5. Assume you are in your early twenties and you would like to build up your nest egg for a secure retirement in 30 years. Which of the following approaches would best meet your needs?

 A.   Start to build up your savings account gradually in a bank
 B.   Save money in certificate of deposit accounts
 C.   Put monthly savings in a diversified growth unit trust fund
 D.   Invest in long-term Treasury bonds

6. Which of the following combination of investments is most risky?

 A.   A unit trust fund containing 80% stocks and 20% bonds
 B.   A unit trust fund containing 80% bonds and 20% stocks
 C.   An index fund (like the Satrix 40)
 D.   Stock in a single company

7. Hector and Maria just had a baby. They received money as baby gifts and want to put it away for the baby's education. Which of the following tends to have the highest growth over periods of time as long as 18 years?

 A.   Government bonds
 B.   Stocks and unit trust funds
 C.   A savings account
 D.   A money market account

8. Many people put aside money to take care of unexpected expenses. If Susan and Joe have money put aside for emergencies, in which of the following forms would it be of LEAST benefit to them if they needed it right away?

 A.   Savings account
 B.   A house
 C.   Stocks

D.   Unit trust

9. The most liquid asset is:

A.   money in a certificate of deposit
B.   money in a bank account
C.   a car
D.   shares

10. If interest rates rise, the price of a Treasury Bond will:

A.   increase
B.   decrease
C.   remains the same.
D.   trade at a premium.

11. Rand –cost averaging to investing involves:

A.   buy high and sell low.
B.   buying fixed amounts to average out the cost of investments
C.   calculating risk and return
D.   selling investments to minimize losses.

12. Imagine that the interest rate on your savings account was 1 percent per year and inflation was 2 percent per year. After 1 year, how much would you be able to buy with the money in this account?

A.   More than today
B.   Exactly the same
C.   Less than today
D.   None of the above

13. Suppose you had R100 in a savings account and the interest rate is 20 percent per year and you never withdraw money or interest payments. After 5 years, how much would you have on this account in total?

A.   R200
B.   R215
C.   R248
D.   depends on the inflation rate

14. Assume a friend inherits R10,000 today and his sibling inherits R10,000 3 years from now. Who is richer because of the inheritance?

A. My friend
B. His sibling
C. They are equally rich
D. Unable to calculate the effect

15. When an investor spreads his money among different assets does the risk of losing money:

   A. Increase
   B. Decrease
   C. Stay the same
   D. Not allowed.

16. Home loan deposits are required when:

A. the applicant is a risk.
B. the property poses a risk
C. property laws requires a deposit
D. A & B

17. The maximum term for a car loan is between:

A . 24 – 36 months
B. 36 – 48 months
C. 60 – 72 months
D. 72 – 84 months

18. A balloon payment is:

A. a lump sum owed to the financier at the end of the loan term
B. a lump sum owed to the financier at the beginning of the loan term.
C. a lump sum owed to car dealer.
D. none of the above.

19. Health Scheme plans can be changed every year in:

A. January
B. February
C. December
D. Throughout the year

20. Consider the following then choosing a Health Scheme plan:

A. Lifestyle, day-to-day needs, affordability.
B. Age, affordability.
C. Affordability, the cheapest quote.
D. Affordability, life cycle.

21. I follow financial news on

A. TV
B. Magazines
C. News papers
D. Internet
E. I do not follow

6.9 Ethical clearance

Faculty of Economic and Management Sciences

05-Jul-2016

Dear **Mr Calvin Mudzingiri**

Ethics Clearance: **The impact of financial literacy on risk and time preferences and financial behavioural intentions**

Principal Investigator: **Mr Calvin Mudzingiri**

Department: **Economics (Qwaqwa Campus)**

APPLICATION APPROVED

With reference to your application for ethical clearance with the Faculty of Economic & Management Sciences, I am pleased to inform you on behalf of the Ethics Committee of the faculty that you have been granted ethical clearance for your research.

Your ethical clearance number, to be used in all correspondence is: **UFS-HSD2016/0079**

This ethical clearance number is valid from **01-Jul-2016** to **30-Jun-2021**. Should you require more time to complete this research, please apply for an extension.

We request that any changes that may take place during the course of your research project be submitted to the ethics office to ensure we are kept up to date with your progress and any ethical implications that may arise.

Thank you for submitting this proposal for ethical clearance and we wish you every success with your research.

Yours Sincerely

Dr. Petrus Nel

Chairperson: Ethics Committee Faculty of Economic & Management Sciences
Economics Ethics Committee

Office of the Dean: Economic and Management Sciences

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