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## The effect of religiosity and overconfidence on risk tolerance and excessive trading

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| Item Type     | Thesis  |
| Authors       | Alam, Arwa Adel   |
| Publisher     | Effat University  |
| Download date | 2026-03-06 20:52:21   |
| Link to Item  | <a href="http://hdl.handle.net/20.500.14131/274">http://hdl.handle.net/20.500.14131/274</a> |



**The Effect of Religiosity and Overconfidence on Risk  
Tolerance and Excessive Trading:  
the Case of Individual Investors in SSE**

A thesis submitted in partial fulfillment of the requirements for the  
Degree of Master of Science in Islamic Financial Management

**by**  
Arwa Adel Alam

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Dr. Tahar Tayachi & Dr. Walid Mansour

January 1, 2017

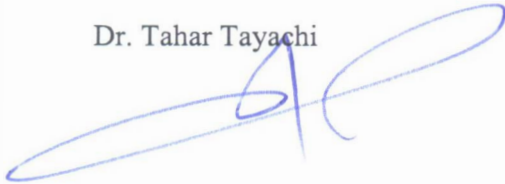
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**Jeddah, Saudi Arabia**  
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This thesis, written by Arwa Adel Alam under the direction of his/her thesis supervisor and approved by his/her thesis committee, has been presented to and accepted by the Dean of Graduate Studies and Research on January 1, 2016 in partial fulfillment of the requirements for the degree of MASTER OF SCIENCE in Islamic Financial Management.

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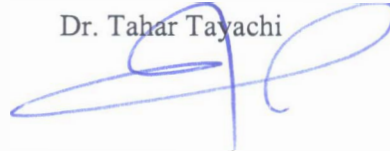
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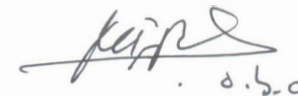
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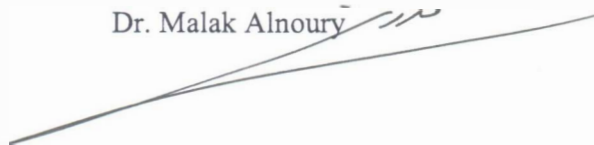
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## **Declaration**

This work is original and has not been previously submitted in support of any degree qualifications or course.

Arwa Adel Alam

## Abstract

This thesis is an attempt to examine the effect of the level of religiosity and the overconfidence bias on the risk tolerance and excessive trading of individual investors in Saudi Arabia. It is assumed that the level of religiosity is negatively related to the level risk tolerance and the trading frequency. As for the overconfidence bias, it is assumed that it is positively related to risk-taking and it leads investors to trade excessively. For this purpose, a questionnaire is distributed among individual investors. The set of data obtained was analyzed using PLS-based SEM.

The results of this thesis show that there is a negative relationship between miscalibration, which is one aspect of the overconfidence bias, and risk tolerance. Further, the illusion of control, which is another aspect of overconfidence, was found to have a positive relationship with the propensity to gamble. These two relationships are supported by statistical significance. As for the rest of the variables, there was not any strong evidence neither to conclude that relationships do exist between them nor to state that they are not at all related.

**Key words:** Religiosity, overconfidence, excessive trading, speculative trading, risk tolerance, individual investor behavior, Saudi stock exchange.

## Acknowledgements

"No one who achieves success does so without the help of others. The wise and confident acknowledge this help with gratitude."

Alfred North Whitehead

I am grateful first to Allah the Almighty for the so many blessings bestowed upon me throughout my journey in pursuing this degree. Second, I am grateful to my parents: my mom, who has always wished the best for me and has always encouraged me in attaining the best, and my dad, in whose eyes I am always the best, no matter how mistaken and unreasonable I may sometimes be. Thirdly, I am grateful to the chance given to me by this respectable edifice, Effat University, the affiliation to which makes me proud and confident.

Finally, but surely not the least important, I am indeed grateful to each and every person who has helped and supported me while completing this thesis. I would like to thank Dr. Walid Mansour, from the Islamic Economics Institute/KAU, for accepting my supervision request, his mentorship and guidance were crucial. Further, I cannot be thankful enough to Dr.Sadiq Mohamad Sait, from KFUPM, who has tremendously helped me in securing an adequate sample size to conduct this study. Also, the number of amazing and welcoming people who has responded to my inquiries and requests -Dr. Faisal Rana, Dr. Uzma Javid, Mr. Yaser Alahmad, Mr. Sultan Almajroub, Mr. Abdullah Alsaloum and Dr. Mohamad Ramady- from all of whom I learnt that sometimes only replying to an inquiry may be the source of encouragement that pushes one a bit more than a hundred miles ahead instantly.

On a separate note, as a very special one should be, I am so much grateful to my classmates, my companions in this journey and, as I hope will be the case, my lifelong friends. I would like to thank each and every one of them for the support, the cooperation, the encouragement, the laughter and the happiness we have had over the course of our study. Sincerely, I would say that being one of them, the MIFM graduates; Class of 2017- makes me so much proud as they are, in the full sense of the word, valuable assets.

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## **Introduction**

Studying the behavior of individual investors has become a major concern among researchers in the field of behavioral finance. This interest is justified by the fact that investors are human, and so their decisions are not solely dependent on means and variances, rather they are the outcome of a number of behavioral (Aldomy & Fuad, 2015), cognitive (Frederick 2005) and preferential factors (Derwall et al., 2011). These factors play a major role in the soundness of the decision investors make, and hence are determinants of the future wellbeing of those individuals and their households. Furthermore, the fact that individual investors usually err when attempting to take an investment decision, which is mostly a complicated task, necessitate the exploration and examination of the main drivers of these errors; the behavioral biases (Dhaoui, 2011). The accomplishment of such a mission requires a multi-disciplinary approach where a knowledge base that combines the fields of psychology, sociology, investments and finance is necessary.

It is argued by psychologists that people are innately overconfident, with a tendency to overestimate their judgments, skills and knowledge (Fischhoff et al., 1977). They tend to assume that they are better than others (Alicke, 1985; Brown, 1986; Taylor & Brown 1988), and they are usually too certain of the accuracy of their points of view (Tversky et al., 1996).

One of the decisions that individual investors usually erroneously make is to trade excessively. In this regard, the overconfidence bias, among other biases, was found to be associated with excessive trading. Overconfident investors tend to overestimate the accuracy of the information they receive, and even when they do receive accurate

information, they tend to overrate their skills to interpret this information correctly. These two aspects of overconfidence result in excessive trading (Barber & Odean, 1999, 2001, 2002; Glaser & Weber, 2007; Trinugroho & Sembel, 2011), which will not yield enough return to cover transaction costs and might sometimes lead to a loss beyond transaction costs (Odean, 1998; Barber & Odean, 2000).

Furthermore, overconfident investors were found to underestimate the risk of the decisions they make; this is to say that they have a higher level of risk tolerance. Risk tolerance- the willingness to accept higher levels of risk – is positively associated with the level of overconfidence and optimism and negatively related to risk perception (Broihanne et al., 2014) which means that overconfident individuals do not *perceive* the amount of risk associated with their decisions yet they willingly take this risk. This description of the overconfident investor brings to mind the features of his “rational” counterpart - the risk- averse, mean-variance optimizer - and highlights the inapplicability of such features on real, human investors.

Likewise, the relationship between the level of religiosity and investment decision-making has been an intriguing matter for researches in the field of finance. Religiosity may impact decision-making due to its relationship to risk tolerance (Bartke & Schwarze, 2008; Noussair, et al, 2013; Leon & Pfeifer, 2013; (Renneboog & Spaenjers, 2012; Diaz 2000).

Furthermore, when it comes to the relationship between the level of religiosity and overconfidence, an idea worthy of investigation was studied by Mansour & Jlassi (2014) who connect the religiosity of individuals with the psychological state of being in a “high social mood,” as religious individuals tend to be “friendlier, happier, cooperative,

and more satisfied in their lives.” Despite the fact that it is a positive feature and an appealing trait to be in a “high social mood,” individuals who possess this trait are found to be more exposed to psychological biases like overconfidence and optimism (Nofsinger, 2005).

### **The Problem Statement**

Taking all of the above into consideration, it can be concluded that overconfidence, religiosity, excessive trading, and risk tolerance are factors that, if successfully combined in a system by a set of relations, may prove to be an insightful addition to the literature on behavioral finance, religiosity, investment decision-making and Islamic behavioral finance. Such an addition is important for two reasons. First, the individual investor behavior in the emerging markets is an area that still needs to be further explored. Secondly, the rationale behind the interest in studying the behavior of individual investors arises from the fact that they constitute the majority of the market participants, as they account for 83 % of all the participants in SSE, the Saudi Stock Exchange. (Tadawul, May 2016). Thirdly, thinking about the teachings of the Islamic commercial law, one cannot overlook the importance it gives to the approach assumed by individuals to matters like risk-taking and excessive trading. In other words, the importance of examining the behavioral aspects of financial dealings cannot be made more obvious in the field of Islamic finance. Regarding this, an important distinction must be made between productive, value-adding trading and speculative trading. This is because the Islamic commercial law condemns the latter while it strongly encourages the prior. In this study, the tendency to gamble is used as a proxy for speculative trading.

This study attempts to initiate an examination of the relationships between the variables in question in order to provide some insight into the strength and direction of these relationships. Furthermore, it aims to provide a description of the behaviors of individual investors as participants in an emerging market. This will be done by surveying the tendencies, beliefs and attitudes of a sample of individual investors in SSE and then examining how the variables interconnect.

### **Research Objective**

Based on all of the above arguments, this study aims to:

- Examine the relationship between the following variables; the level of religiosity, the overconfidence bias, excessive trading, and risk tolerance.

### **Research Questions**

Achieving this objective requires answering the following questions:

- Are the variables- overconfidence, religiosity, excessive trading, and risk tolerance, in anyway, related by a set of relationships?
- Do the levels of overconfidence and religiosity explain the variability in the level of risk tolerance?
- Do the levels of overconfidence and religiosity explain the variability in the trading frequency?

For this objective to be achieved and questions to be answered, a set of questionnaire data will be analyzed using Structural Equation Modeling (SEM), which is a method that is broadly used in behavioral studies.

### **Outline**

This thesis consists of *four parts* and is structured as follows: *Part One* presents a review of the relevant literature, *Part Two* explains the method of analysis, *Part Three* discusses the results and states the limitations, and *Part Four* concludes

## 1. Literature Review

Literature on behavioral finance has stressed the importance of considering the human side of economic agents as opposed to the assumptions that claim that they are rational decision makers. One of the biases studied in this field is the overconfidence bias, which was found to be related to excessive trading and a high level of risk tolerance. On the other hand, religiosity was an intriguing subject matter for researchers in the field of finance. So, its effect on risk tolerance and excessive trading was examined. The following review provides an insight into the findings of these studies and aims to find a connection between them.

Behavioral finance as movement is based on two main ideas. First, investors are human; therefore, they cannot be always “rational”. Second, opportunities to make abnormal returns by trading mispriced securities, or arbitrage, are limited, i.e. the ability of the rational investors to correct the mispricing in the market is limited for a number of reasons (Bodie, Kane, & Marcus, 2011) therefore, under and overvalued securities will remain mispriced.

In the elaboration of the first idea, one can logically argue that investors usually tend to ignore, overweigh and misperceive information. This is because of the fact that when people are obliged to take decisions under uncertainty, they revert to heuristics in order to simplify the decision-making process. *Heuristics* can be defined as the set of mental shortcuts, such as past experiences, rules of thumb, educated guesses and common sense, which people use to take decisions when faced with uncertainty.

Heuristics are useful in some situations; however, they may lead to cognitive biases when the situation in question is complicated like the case of investment decision-making (Shefrin, 2000).

So, it can be said that the decisions of individual investors are not dependent on, only, the risk and return characteristics of an investment opportunity as it has been assumed. Further, some investors surpass the mean-variance criteria when taking investment decisions and take other factors into account, such factors depend on the different preferences investors may have, such as social responsibility (Renneboog et al., 2011) and Sharia compliance. Socially responsible investing (SRI) is, in many ways, analogous to Sharia compliant investing (Wilson, 1997; Ghoul and Karam, 2007). In both cases, investors willingly accept a set of constraints that may affect the return generated by their investments. Literature on socially responsible investors insinuates that SRI investors willingly accept to have a suboptimal performance for the sake of fulfilling social and ethical investment objectives (Chong and Anderson, 2008). In conclusion, it can be stated that investors hold objectives and constraints that goes beyond risk and return.

Regarding the second idea, the limits to arbitrage, advocates of behavioral finance argue that the deviation of prices of securities from fundamental values will “remain unchallenged,” most of the time. This is due to the fact that an exploitation of such an opportunity is risky and costly, and so is mostly avoided by rational traders. Further, they elaborate that the lack of opportunities to make excess returns in a market does not necessarily mean that this is an efficient market, where the prices of securities reflect their fundamental value (Barberis & Thaler, 2003).

It is widely believed in the literature on stock market behavior that individual investors are more likely to be noise traders and that their trading behaviors affect the market causing volatility and return reversals.

Noise traders are described as uninformed traders who tend to follow trends, over or under-react to news and also herd, rather than basing their decisions on fundamentals. The driving force of the decisions made by these investors is a number of behavioral biases such as overconfidence, loss aversion, and representativeness among other biases. Such behaviors affect the performance and return of individual investors and, in the aggregate, they may lead to the deviation of stock prices from their intrinsic value (Barber, Odean & Zhu, 2006). In other words, retail trading is one of the factors that were found to account for the volatility and reversal of returns (Shiller, 2000). It is important to note though that these findings do not assume that all retail investors are noise traders, however, they prove that they are *more likely* to be noise traders (Foucault, Sraer & Thesmar, 2011).

### **1.1 On Overconfidence**

Overconfidence or the competence effect is one of the many behavioral biases studied by researchers in behavioral finance. It was found that the individual investors' education, income and gender have an impact on the *perceived* competence level of these investors (Barber & Odean, 2001; Bhandari & Deaves, 2006; Lin, 2011; Dahlbom et al., 2011; Korniotis & Kumar, 2011). Competence here is perceived, i.e. it is a subjective judgment of how competent investors *think* they are. In this regard, it can be said that people tend to be overconfident by nature; it is only the level – the extent to which different individuals are overconfident – that differs (Benoît et al., 2015).

This misperception is manifested in *three facets* of the term known as “overconfidence,” which were proven to be three distinct concepts, i.e. they do not come under a single construct (Moore & Healy, 2008). Following their taxonomy of the three aspects of overconfidence, below is a detailed explanation of each:

The first manifestation or definition of overconfidence is what Moore and Healy (2008) call “*overestimation*.” This is when individuals tend to overestimate their performance by thinking that they have performed better than the way they have really performed.

Secondly, the *over-placement* or BTA, better- than-average effect, is when individuals have a tendency to over-place themselves relative to the average when it comes to their performance in some task, their general culture and, sometimes, even them being better “human beings.” (Haslam et al., 2005). This tendency was found to be positively related to the level of ambiguity of the task in question. (Alicke, 1985; Dunning et al., 1989)

Thirdly, *over-precision* is to overestimate the degree of accuracy of ones opinions beliefs and estimations. In this regard, individuals were found to exceedingly overestimate the precision of their answers when answering general-knowledge questions (Fischhoff et al., 1977). The method of evaluating the degree of over-precision is explained more thoroughly in the appendix where the questionnaire is explained in detail.

The overconfidence bias, including all of the above-mentioned aspects, was found to substantially affect the trading behavior of individual investors. A high level of overconfidence in general is associated with excessive trading, the thing which is considered irrational since it results in transaction costs, and so in a less than optimal

outcome (Odean, 1998; Barber & Odean, 2000; Chandra, 2009). This relationship was proven to be valid on the individual and aggregate levels (Bhandari & Deaves, 2009). Particularly, the miscalibration level, or over-precision, is positively related to excessive trading and risk taking (Cheng 2007; Trinugroho & Sembel 2011), while it is negatively related to trading performance (Biais et al., 2005). Similarly, Odean (1998) argues that the better-than-average effect is positively related to excessive trading.

In addition to the three aspects of overconfidence mentioned above, the illusion of control is also an aspect of overconfidence. The “illusion of control” can be defined as an overestimation of one’s ability to control uncontrollable events (Langer 1975). Individuals with a high self-esteem were found to be more prone to the illusion of control bias (Taylor & Brown, 1988; Taylor & Armor, 1996). Some studies have examined the relationship between the illusion of control bias and the gambling behavior. The findings indicate that the illusion of control bias indicates a propensity to gamble (Steenbergh, Meyers, May, & Whelan 2002), sometime pathologically (MacKillop et al., 2006). Since the two behaviors, excessive trading and gambling, were found to be similar in many ways as stated above, we can say that gambling may be another aspect of excessive trading. So, we can say that gambling tendency may be used as a proxy for excessive trading. This is related to the distinction mentioned earlier between excessive trading and speculative trading, as it may not be always the case that excessive trading is uninformed trading.

Psychologists argue that overconfident individuals tend to attribute success to their own abilities, rather than allowing for the possibility that this success might be attributed merely to chance or other circumstances, while attributing failures to circumstances that are not under their control (Bettman & Weitz, 1983). In this regard, Statman et al., 2006 found that there is a positive relationship between the trading volume of stocks and their past returns, which may indicate that relationship between return, as a performance indicator, and overconfidence and excessive trading.

Moreover, excessive trading or “speculative trading” was found to be the result of the heterogeneity of opinions and beliefs among overconfident market participants, who are willing to buy shares that they know the prices of which are not justified by fundamentals, only because they are *confident* that they will find buyers who are willing to pay even a higher price for the shares (Scheinkman & Xiong, 2003).

Connecting the last two ideas, it can be concluded that past returns may indicate overconfidence, on the aggregate level, since investors might start attributing the rising market to their own abilities. In other words, it can be said that a bull market can be indicative of overconfidence and consequently excessive trading. These arguments combined portrays a picture that explains the role of overconfidence in the formation of bubbles, starting from the glory of a bull market phase and the enthusiastically biased investor associated with it, until the collapse of all, and the realization, in hindsight, of the irrational, overconfident exuberance that took place. This relationship between, price bubbles, excessive/speculative trading and overconfidence, was validated by studies using experimental markets to build models explaining the relationship (Scheinkman &

Xiong, 2003; Michailova & Schmidt, 2011; Daniel & Hirshleifer, 2016). Further, examining real world data, Jlassi & Mansour (2014) state that overconfidence is more obvious in advanced markets, relative to emerging markets and that it is a main contributor to market volatility and financial crises.

Studies on risk tolerance examined its relationship to a number of demographic variables (Charness & Gneezy, 2012; Montford & Goldsmith, 2016). Some demographics, such as being male, older (Wang & Hanna, 1997) married, and highly educated, were found to be associated with the level of risk tolerance (Grable, 2000). Likewise, overconfidence was found to be associated with being a highly- educated, about-to-retire male (Bhandari & Deaves, 2006). Since the same demographics affect both, it can be assumed that there is a relationship between the level of overconfidence and risk tolerance. Breuer, Riesener, and Salzmann, (2014) validate this assumption. Their findings indicate that the propensity to assume higher levels of risk is positively related to overconfidence, individualism and optimism. Similarly, Broihanne et al, (2014); Meisel et al., (2015) proved that, in addition to the positive relationship between risk tolerance and the overconfidence level, the overconfidence level is negatively related to the level of risk perception.

## **1.2 On Religiosity**

Kishimoto (1961) defines religion as follows:

“Religion is an aspect of culture centered upon activities which are taken by those who participate in them to elucidate the ultimate meaning of life and to be related to the ultimate solution of its problems. Many religious systems contain the notion of deity and/or holiness in relation with such activities”

From this definition it can be said that religiosity is the level of commitment to the *teachings, instructions* and *restrictions* enacted by religion, or the extent of assuming and implementing a “system of religious *attitudes, beliefs, and practices*” (Merriam-Webster). Furthermore, the above definition establishes a link between religion and the mundane, secular life as being the “ultimate solution” to the difficulties and challenges associated with it, the thing that shows how involved religion is in the dealings of life, one of which is financial dealings, namely, the matter of wealth acquisition.

Regarding this, both Christianity and Islam explicitly promote avoiding risky transactions (Leon & Pfeifer, 2013). In the case of Islam, the necessity to avoid the speculative kind of risk-taking, which is void of any kind of commercial and productive activities, is emphasized. Grasping the rationale of this prohibition must have a significant effect on the investor’s approach to risk.

Therefore, it can be said that religiosity is one of the factors that have an impact on the behaviors of individuals and consequently, their preferences and decision-making processes (Keller et al., 2007). People living in highly religious communities were found to have higher credit worthiness and demonstrated minimal bankruptcies and foreclosures rates relative to those living in communities that are not as religious (Hess, 2012). Also, on the institutional level, banks located in more religious areas were found to be less risk-taking and less exposed to crises (Kanagaretnam et al., 2015; Adhikari & Agrawal, 2016).

The relationship between religiosity and behavioral biases is a matter worthy of investigation. In this regard, religiosity was found to be a determinant of the preference to adopt a risk-averse behavior while avoiding risk-taking (Bartke & Schwarze, 2008;

Noussair, et al, 2013; Leon & Pfeifer, 2013). This preference, caused by religiosity, hampers the tendency to gamble as it was found to be negatively associated with the frequency to gamble, as a measure of the level of risk-tolerance (Diaz, 2000). Furthermore, the level of religiosity creates a tendency to save (Renneboog & Spaenjers, 2012), which is indicative of seeking a sense of security and assurance.

Excessive trading was said to be analogous to gambling. Grall-Bronnec et al. (2015) argue that excessive trading and gambling are two activities that share the same structure or sequence of events, i.e. initial wins, followed by a belief of the possibility to recover losses and ending up losing huge amounts. Therefore, they state that excessive trading *may* become, sometimes, a sort of a gambling disorder, which is addictive. Likewise, it was found that a high level of “gambling risk-taking propensity” measured by a gambling scale is associated with a higher trading frequency (Markiewicz & Weber, 2013).

Thinking of this resemblance, one can logically conclude the adverse effect excessive trading may have on the performance of investments. Individual investors were found to turn over 75% of their portfolios per year, which leads to an increment of costs resulting in a “poor” net return when compared to the market return. Furthermore, after accounting for the risk assumed by these investors, the performance gap between their portfolios and the market portfolio, substantially, increased. (Barber & Odean, 2000).

An interesting argument was raised, in the field of psychology, stating that it is actually the level of risk tolerance that explains some of the variability in the level of religiosity among individuals, and that these two variables are inversely related (Miller &

Hoffmann, 1995; Miller & Stark, 2002; Freese, 2004;). In other words, they state that highly religious individuals have actually preferred to be so because they tend to avoid the risk associated with the consequences of not being religious.

Whether it causes or is caused by religiosity, the level of risk tolerance affects the behavior of investors and hence their investment decision-making process through its connection with overconfidence as stated above. Also, a connection can be drawn from studies proving that men are more overconfident than women, they are more risk taking and they trade more excessively (Barber & Odean, 2001).

In conclusion, based on previous research it can be hypothesized that the variables in question are interconnected. Overconfidence is a bias that, usually, results in erroneous decisions. When it comes to investments, it was found that this bias leads to excessive trading, that is not justified by fundamental, which results in a suboptimal performance and, on the aggregate, leads to the formation of price bubbles. Religiosity is a factor that affects the choices and decisions of individuals and was found to also be negatively related to excessive-trading and risk-taking. So, this study attempts to test if these relationships between these variables also exist in the Saudi context and to examine the strength and direction of these relationships.

## 2. Methodology

### 2.1 Research design

**Data collection.** This study employs a structured questionnaire as the data collection tool. The questionnaire was distributed online among individual inventors via email. Also, the help of a number of influential social media users in the field of investments and the Saudi stock market was sought in order to further broadcast the questionnaire. A number of 336 individuals responded, however, only 148 complete responses were obtained. After excluding the unengaged responses - the cases that answered identically to a large number of questions- the final sample size consisted of 144 cases. The questionnaire was created and published by the Survey Monkey online survey tool.

**The measurement tool.** The questionnaire used in this study consists of six sections, each measuring one of the constructs in the model:

Section 1: measures the miscalibration or over-precision. It consists of 11 items. Items 1 -10 measure miscalibration by asking respondents to answer general knowledge questions, the answers to which are numerical figures, like ages, dates, heights... etc. They are asked to respond to each question by choosing one out of four ranges, the one within which they think the correct answer lies. They are also asked to specify the probability of them answering accurately. A 50 % level of subjective probability indicates that the respondent has no idea what the answer might be. Then, to calculate the miscalibration score, the proportion of correct answers is subtracted from the average of the subjective probability provided by respondents. The method of subjective probability was first proposed by Russo & Schoemaker (1990). Item 11 aims at measuring the “retrospective overconfidence”. Participants are asked to estimate the number of

questions that they answered correctly. Then the answer is compared to the actual number of correct answers to obtain a measure of retrospective miscalibration.

Section 2: measures the extent to which the respondents are prone to BTA effect. It consists of three items.

Section 3: measures the extent to which the participants are prone to the illusion of control. It consists of four items.

All of the sections to measure overconfidence mentioned above were adapted from a study by Lambert et al., (2012).

Section 4: measures the level of religiosity. The Religious Commitment Inventory-10 is a measure developed by Worthington et al., 2003 and it consists of 10 items.

Section 5: measures risk tolerance. This section consists of three items. First, the SCF Risk-Tolerance Item was proven to be a valid measure of, specifically, investment risk tolerance (Grable & Lytton, 2001). Second, an item adopted from Lambert et al (2012) which asks respondents to choose between two investment offers, one of them is risky while the other yields guaranteed payments. The third item requires a subjective judgment by the respondents on how risk averse/taker they are.

Section 6: measures excessive trading. It consists of two items, requiring the respondents to specify how frequently they trade and how frequently they follow-up on market news. (Mansi & Khizindar, 2014).

Section 7: measures the tendency to gamble by asking the respondents to state their opinion about trading derivatives only to make profit and not hedging. Also, it asks for opinions about short selling and margin trading.

**Sampling.** The sampling technique used in this study was the convenience, purposive sampling. See the appendix for a description of the demographic distribution of the sample.

**Data Analysis.** The primary data collected by the questionnaire was analyzed by structural equation modeling, using Smart PLS.

Structural Equation Modeling (SEM) is an estimation method or framework where latent (unobservable) variables are estimated by the help of indicator (observed) variables. For example, the quality of life is a latent variable that cannot be measured, however, it can be given a value by the help of a number of observed variables, such as wealth, level of education, recreation and leisure time, and social belonging etc. These indicator variables serve as measures of the latent variable. The aim of an SEM model is to estimate the relationship between the latent, dependent and independent variables by measuring the correlation and covariance between those variables.

An SEM consists of two models; a measurement model and a structural model. The *measurement model* links the observed variables to the latent variables. The role of a measurement model is to verify if the observed variable accurately represents/measures their underlying latent variable, in which we are interested. In the *structural model*, the hypothesized relations between the latent variables are tested through a system of simultaneous equations in the structural model.

Corresponding to the above mentioned parts of an SEM, there are two analytical tools, namely factor analysis and path analysis, which are used in analyzing the data. *Factor analysis* is used to show the relationships between the latent and observed variables. While, *Path analysis* is used to see whether the theoretical, conceptual model fits the data provided by the survey.

Finally, SEM is a suitable method for this study since it has been widely used in behavioral studies and in the literature on individual investor behavior. There are so many different types of SEM but all of them have some characteristics in common; for example, all SEMs depend on covariance, a measure of the strength of the relationship between two variables, as the basic statistical measure. Further, all SEMs require a large sample. In addition, SEMs make a distinction between observed and latent variables and allows for multiple dependent variables, the thing which enables researchers to test large numbers of hypotheses (Kline, 2015).

**PLS-Based SEM.** Using a particular approach of SEM depends on the type of data in question. In this study, the Partial-Least-Squares path modeling was used. PLS-Based SEM is suitable for analyzing data that is not normally distributed, like in the case of the Likert-scale, ordinal data used in this study. This is because PLS-based SEM employs the nonparametric techniques of bootstrapping and blindfolding to analyze the data. This approach to SEM does not require the testing of the SEM assumptions (Hair et al., 2016).

## 2.2 Variables

Table 1 Variables and indicators

| <b>Endogenous variables</b> |   |
|-----------------------------|---|
| <b>Latent variable</b>      | <b>Indicator/observed variable<br/>(questionnaire items)</b>  |
| Risk tolerance              | <ol style="list-style-type: none"> <li>Option to choose one of two investments; one that renders a lump sum that is <i>not</i> guaranteed while the other renders a guaranteed regular income.</li> <li>A statement made by the respondents on how risk taking they think they are.</li> </ol>  |
| Excessive trading           | <ol style="list-style-type: none"> <li>Trading frequency.</li> <li>Market follow-up.</li> </ol>   |
| Gambling tendency           | <ol style="list-style-type: none"> <li>The level of agreement with the statement “risky investments like short selling, trading derivatives and margin trading is the best way to invest if the investor is capable of expecting the prices of securities in the future.”</li> <li>Attitude toward short selling.</li> <li>Opinion about trading derivatives only to make profits.</li> <li>Attitude towards margin trading.</li> </ol> |

| <b>Exogenous variables</b>       |   |
|----------------------------------|---|
| <b>Latent Variable</b>           | <b>Indicator/observed variable<br/>(questionnaire items)</b>  |
| Overconfidence effect            | <ol style="list-style-type: none"> <li>Miscalibration of probabilistic judgment: the difference between the mean of probability and the proportion of correct answers.</li> <li>Miscalibration of frequency judgment: the difference between the estimated and actual number of correct answers.</li> </ol> |
| Better-than-average effect (BTA) | <ol style="list-style-type: none"> <li>Self-assessment of the respondent’s level of general knowledge relative to others.</li> <li>Self-assessment of the respondent’s driving skills.</li> </ol>   |
| Illusion of Control (IoC)        | <ol style="list-style-type: none"> <li>Self-assessment of the ability to anticipate fraud by a broker.</li> </ol>   |

| <b>Exogenous variables</b> |   |
|----------------------------|---|
| <b>Latent Variable</b>     | <b>Indicator/observed variable<br/>(questionnaire items)</b>  |
|                            | 2. Self-assessment of the ability to handle whatever happens.   |
| Religiosity                | <ol style="list-style-type: none"> <li>1. Importance of religion in answering questions about the meaning of life.</li> <li>2. Adopting one's religious belief as a basis for the whole approach to life.</li> <li>3. Enjoying spending time with people belonging to the same religious affiliation.</li> <li>4. Effect of religious belief on one's dealings in life.</li> <li>5. Importance of spending time in private religious thought and reflection.</li> </ol> |

### **2.3 Hypotheses**

H1: The level of religiosity explains the variation in the level of risk tolerance.

H2: The level of religiosity explains the variation in excessive trading.

H3: Miscalibration explains the variation in the level of risk tolerance.

H4: The Illusion-of-Control bias explains the variation in the level of risk tolerance.

H5: The Illusion-of-Control bias explains the variation in the gambling tendency.

H6: The Better-than-average effect explains the variation in excessive trading.

## 2.4 The Measurement Model

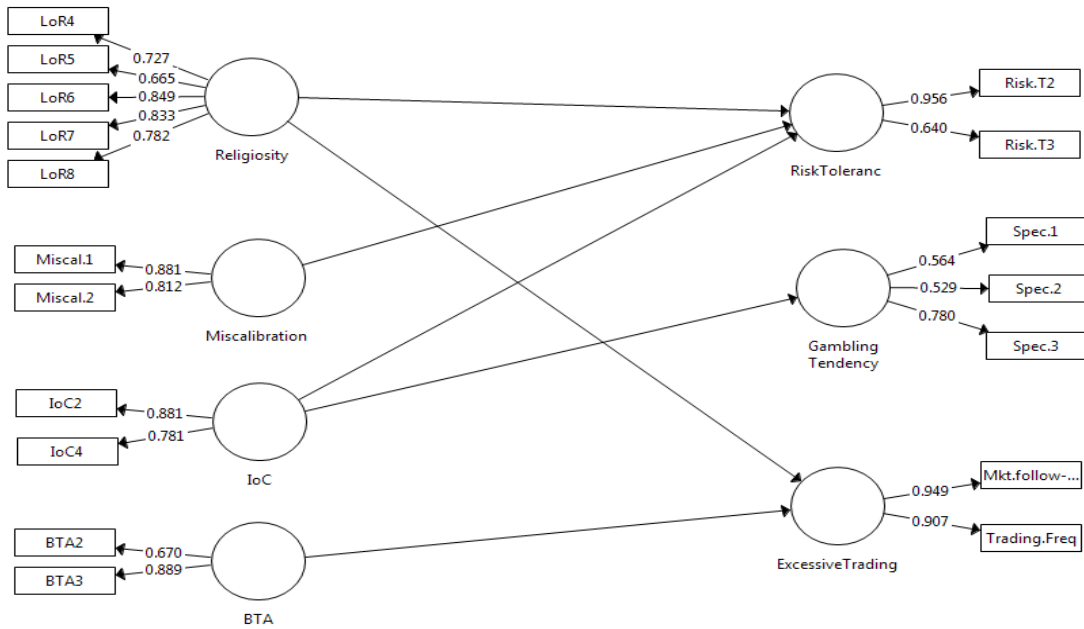


Figure 1 The measurement model

A measurement model was tested for both the exogenous and the endogenous constructs. This was to verify if the questionnaire items actually represent the underlying constructs. The items with cross-loadings and those with loadings that are below .30 were excluded. The rest of the items shown in the table below were found to be adequate measures, as their average loadings were above 0.7, which is acceptable for a measurement model (Hair et al., 2014).

Table 2 The measurement model: outer loadings

| Items         | BTA   | IoC   | Relig. | Miscal. | Risk.T | Gamb.T | Excess.T |
|---------------|-------|-------|--------|---------|--------|--------|----------|
| BTA2          | 0.670 |       |        |         |        |        |          |
| BTA3          | 0.889 |       |        |         |        |        |          |
| IoC2          |       | 0.881 |        |         |        |        |          |
| IoC4          |       | 0.781 |        |         |        |        |          |
| LoR4          |       |       | 0.727  |         |        |        |          |
| LoR5          |       |       | 0.665  |         |        |        |          |
| LoR6          |       |       | 0.849  |         |        |        |          |
| LoR7          |       |       | 0.833  |         |        |        |          |
| LoR8          |       |       | 0.782  |         |        |        |          |
| Miscal.1      |       |       |        | 0.881   |        |        |          |
| Miscal.2      |       |       |        | 0.812   |        |        |          |
| Risk.T2       |       |       |        |         | 0.956  |        |          |
| Risk.T3       |       |       |        |         | 0.640  |        |          |
| Spec.1        |       |       |        |         |        | 0.564  |          |
| Spec.2        |       |       |        |         |        | 0.529  |          |
| Spec.3        |       |       |        |         |        | 0.780  |          |
| Trading.Freq  |       |       |        |         |        |        | 0.907    |
| Mkt.follow-up |       |       |        |         |        |        | 0.949    |

Since factor loadings, alone, are not enough to determine if the model can be analyzed as an SEM, reliability and validity analyses was conducted to find if the model is valid and reliable.

## 2.5 Reliability and Validity Analysis

**Reliability analysis.** Cronbach's Alpha, and composite reliability measures were used to evaluate the reliability of the items as measures of the constructs. A Cronbach's Alpha value of 0.7 or greater is considered good, 0.6 or greater is moderate, and a value less than 0.5 indicates lack of reliability. It was stated that Cronbach's Alpha may over- or underestimates reliability (Raykov, 1997, 1998). Therefore, composite reliability was also used. The composite reliability measures show that the items reliably represent their

underlying constructs. As shown in Table 3 below all of the composite reliability values are greater than 0.7, as recommended, except for the one for gambling tendency. So, it can be said that the questionnaire items specified in the table above are reliable in measuring the underlying factors.

*Table 3 Reliability measures*

| <b>Construct</b> | <b>Cronbach's Alpha</b> | <b>Composite Reliability</b> |
|------------------|-------------------------|------------------------------|
| BTA              | 0.407                   | 0.762                        |
| Excess.T         | 0.843                   | 0.926                        |
| IoC              | 0.564                   | 0.818                        |
| Miscal.          | 0.610                   | 0.835                        |
| Risk.T           | 0.557                   | 0.790                        |
| Relig            | 0.849                   | 0.881                        |
| Gamb.T           | 0.434                   | 0.662                        |

**Validity analysis.** The convergent and discriminant validity of the model were evaluated by the average variance extracted (AVE) and HTMT measures. Convergent validity indicates the proportion of variability in the observed variables that is explained by the underlying constructs. It is stated that the value of AVE need to be greater than 0.50 ( Hair et al., 2014) in order to assume that the model is valid . As shown in table 4 below, all the constructs' AVE values are greater than 0.5.except for the gambling tendency. So, it can be said that the model is valid.

Table 4 Convergent validity measures: Average Variance Extracted

| <b>Construct</b> | <b>Average Variance Extracted (AVE)</b> |
|------------------|---|
| BTA              | 0.620                                   |
| Excessive.T      | 0.862                                   |
| IoC              | 0.693                                   |
| Miscal.          | 0.718                                   |
| Risk.T           | 0.661                                   |
| Religiosity      | 0.599                                   |
| Gamb.T           | 0.402                                   |

According to Ghadi et al., (2012);

“Discriminant validity is a test to ensure there is no significant variance among different variables that could have the same reason. Discriminant validity indicates to differentiate between one construct and another in the same model.”

So, it can be said that discriminant validity serves as an indicator none of the variables is redundant in explaining the variance in other variables. HTMT is a measure used to evaluate this kind of validity. HTMT values that are above 0.90 indicate that one of the variables in question is redundant. As shown in table 5 below, each variable uniquely contributes to the explanation of the variability in other variables in this model as all the values are under 0.90 (Henseler et al., 2015, Hair et al., 2014).

Table 5 Discriminant validity measure: Heterotrait-monotrait ratio

|          | BTA   | Excess.T | Gamb.T | IoC   | Miscal. | Relig. | Risk.T |
|----------|-------|----------|--------|-------|---------|--------|--------|
| BTA      |       |          |        |       |         |        |        |
| Excess.T | 0.189 |          |        |       |         |        |        |
| Gamb.T   | 0.326 | 0.202    |        |       |         |        |        |
| IoC      | 0.441 | 0.092    | 0.466  |       |         |        |        |
| Miscal.  | 0.153 | 0.095    | 0.172  | 0.163 |         |        |        |
| Relig    | 0.328 | 0.124    | 0.564  | 0.247 | 0.150   |        |        |
| Risk.T   | 0.169 | 0.350    | 0.253  | 0.201 | 0.337   | 0.181  |        |

### 3. Findings and Discussion

#### 3.1 The Structural Model

The structural analysis reveals that the hypothesized relationships between the variables are all rejected except for two relationships as shown in table 6 below. First, miscalibration is negatively related to risk tolerance. The R-squared value shows that the miscalibration effect explains 9% of the variability in risk tolerance. Second, the illusion of control is positively related to the gambling tendency. The R-squared value shows that the illusion of control bias explains 11% of the variation in the tendency to gamble.

Table 6 The structural model

| No |                           | Path Coefficients | Sample Mean (M) | Standard Deviation (STDEV) | T Statistics (O/STDEV) | P Values |
|----|---------------------------|-------------------|-----------------|----------------------------|------------------------|----------|
| H1 | Religiosity ---> Risk.T   | 0.157             | 0.147           | 0.134                      | 1.174                  | 0.240    |
| H2 | Religiosity ---> Excess.T | -0.130            | -0.138          | 0.119                      | 1.099                  | 0.272    |
| H3 | Miscal ---> Risk.T        | -0.244            | -0.251          | 0.085                      | 2.886                  | 0.004    |
| H4 | IoC ---> Risk.T           | 0.113             | 0.117           | 0.088                      | 1.277                  | 0.202    |
| H5 | IoC ---> Gambl.T          | 0.334             | 0.357           | 0.074                      | 4.490                  | 0.000    |
| H6 | BTA ---> Excess.T         | 0.132             | 0.147           | 0.102                      | 1.288                  | 0.198    |

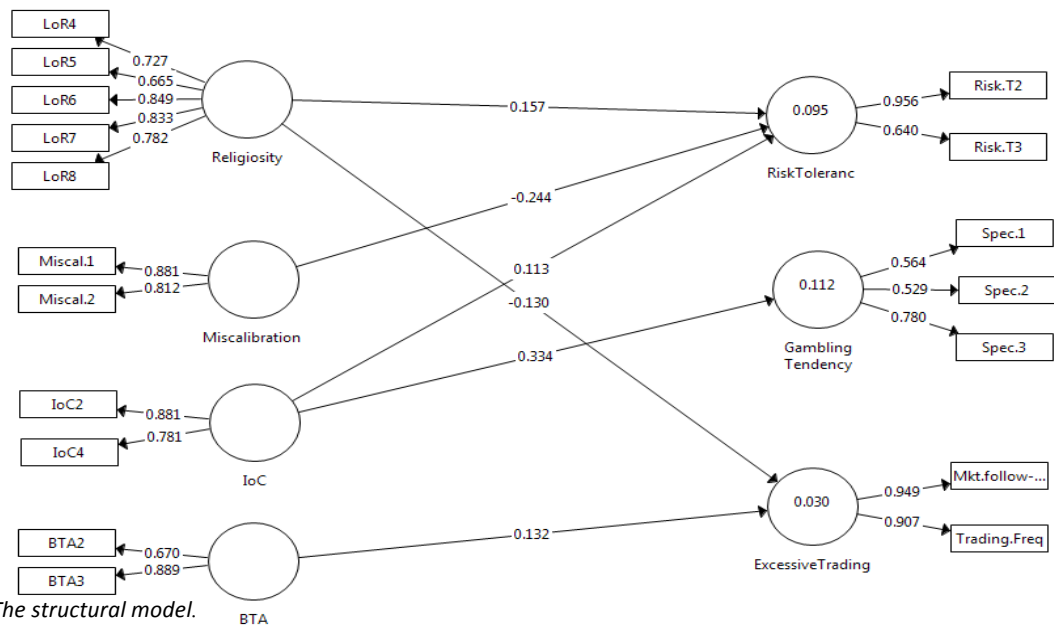


Figure 2 The structural model.

### **3.2 Discussion of the Findings**

The findings of this thesis indicate that overconfident individuals, when overconfidence is measured by miscalibration, are risk averse. This result is contrary to the common findings in the literature on behavioural finance. This contradiction may be the result of the cultural differences of the Saudi context where this study is conducted as opposed to that where the previous studies were conducted. In addition, it is indicated that individuals who are more exposed to the illusion of control, which is an overconfidence bias, are more likely to have a higher propensity to gamble. Gambling tendency is used as proxy for speculative trading. So, it can be said that investors who are overconfident, when overconfidence is measured by IoC, tend to trade based on speculations. Furthermore, the findings indicates that only a small amount of the variation in the dependent variables- risk tolerance, excessive trading, and the gambling tendency- is explained by the independent variables as shown by the R-squared variables, which means that there are other variables that still needs to be examined as possible predictors of the dependent variables.

As for the rest of the variables examined, there is not enough evidence neither to prove the hypothesized relationships among them nor to state that there are not any, as their p values are all above the accepted significance level of 0.05. However, and for future attempts to verify these relationships, we can say that: first, the relationship between the level of religiosity and risk tolerance is insignificant and positive with a confidence level of 76%. Similarly, the relationship between the level of religiosity and excessive trading is insignificant and negative with a confidence level of 73%. Also, the relationship between IoC and risk tolerance is insignificant and positive with a

confidence level of 80%. Finally, the relationship between the BTA effect and excessive trading is insignificant and positive with a confidence level of 81%.

The findings of the thesis, also, validate the use of some of the questionnaire items as indicators of the constructs under consideration. The validated items are presented in table 2 above.

### **3.3 Limitations**

The time restriction was a limitation in the case of this study. As is the custom, questionnaires need to be validated by conducting pilot studies. The questionnaire in this study was conducted only once. Using the obtained data, EFA was conducted and a number of items were found to be loading under more than one construct and some had very low loadings, so these items were excluded. Usually, after excluding items, a questionnaire is redistributed in order to be checked again for validity and reliability, which was not the case here because of the time restriction.

Furthermore, the sample can be said to be one of the limitations, as SEM is a technique that requires large samples, such as 300 and above.

To undertake further research on this topic, the questionnaire survey must be conducted more than once in order to obtain a thorough tool of measurement that is valid and reliable. Also, researchers must include additional predictors of risk tolerance, excessive trading and speculative trading/gambling tendency. Other behavioral biases are most likely to explain the variation not explained by the predictors considered in this study. For example, in addition to the predictors considered here, regret aversion and loss aversion might be predictors of risk aversion and under-reaction. Likewise, gamblers

fallacy, representativeness bias, and herding might be predictors of excessive trading or speculative trading. Including these and demographic data as predictors might contribute in explaining the unexplained variation in the dependent variables.

## 4 Conclusion

This thesis aimed to examine the type of relationships among a number of variables related to the individual investor behavior. Religiosity, overconfidence bias, risk tolerance and excessive/speculative trading were assumed to be related based on previous research. A questionnaire that consisted of a number of standard scales that were previously developed by studies in the fields in question was distributed among individual investors in SSE. The results of analyzing the questionnaire data show that overconfident individuals - when overconfidence is measured by the level of miscalibration- tend to be risk averse. Also, IoC was found to be positively related to the gambling tendency/speculative trading. Other relationships were found to be statistically insignificant, which means that there is not enough evidence to prove whether these relationships do or do not exist. Therefore, further research is needed in order to either prove or disprove the existence of the relationships among the variables in question.

Implications of the results of the study pertains to raising awareness among individual investors when it comes to the behaviors that affect their decision-making through affecting key indicators of sound decision-making, such as risk tolerance. It also pertains to shedding light on the subtle drivers of behaviors like excessive and speculative trading, which results in volatility of returns and the deviation of prices from their fundamental values.

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## **Appendix**

### Questionnaire

Demographic information:

Please specify the following:

#### **1. Your gender**

Male

Female

#### **2. Your age**

Less than 25

25-35

36-45

46-55

56-65

Above 65

#### **3. Marital status**

Single

Married

#### **4. Academic qualification**

High school diploma

Bachelor's degree

Master's degree

PhD

## **5. Occupation**

Employee

Freelancer

Unemployed and looking for a job

Unemployed and not looking for job

Student

Other

## **6. Monthly income**

Less than 10,000

10,000 - 19,999

20,000 - 29,999

30,000 - 39,999

40,000 - 49,999

50,000 - 59,000

60,000 and above

## **7. Place of residence**

Central

Makkah region

Eastern region

Northern region

Other

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1. For each of the following, choose the range (low and high estimate) within which you think the correct answer lies. Then, choose the percentage of your confidence that you have answered correctly. 50% means that you have no idea what the answer might be.

| Statement   | Low – High estimate | Probability                              |
|---|---------------------|--|
| 1. King Faisal’s age at death                           | 45 - 50             | 50 %<br>60%<br>70%<br>80%<br>90%<br>100% |
|   | 55 - 60             |  |
|   | 65 - 70             |  |
|   | 75 - 80             |  |
|   | 85 - 90             |  |
| 2. Length of the Nile river (in km).                    | 3,000 – 4,000       |  |
|   | 4,000 – 5,000       |  |
|   | 6,000 – 7,000       |  |
|   | 7,000 – 8,000       |  |
| 3. Number of OPEC member countries                      | 10 – 15             |  |
|   | 15- 20              |  |
|   | 20 -25              |  |
|   | 25 – 30             |  |
|   | 30 – 35             |  |
| 4. Average distance from the earth to the moon (in km). | 150,000 – 250,000   |  |
|   | 250,000 – 350,000   |  |
|   | 350,000 – 450,000   |  |
|   | 450,000 - 550,000   |  |
|   | 550,000 – 650,000   |  |
|   | 60,000 – 90,000     |  |
|   | 90,000- 120,000     |  |
|   | 120,000 – 150,000   |  |
|   | 150,000 – 180,000   |  |
|   | 180,000 - 210,000   |  |

| Statement   | Low – High estimate | Probability |      |
|---|---------------------|-------------|------|
| 6. Year in which Leonardo da Vinci was born                           | 1200 – 1299         |             |      |
|   | 1300 – 1399         |             |      |
|   | 1400 – 1499         |             |      |
|   | 1500 – 1599         |             |      |
|   | 1600 - 1699         |             |      |
| 7. Air distance from Jeddah to London in (km)                         | 2,000 – 3,000       |             |      |
|   | 3,000 – 4,000       |             | 50 % |
|   | 4,000- 5,000        |             | 60%  |
|   | 5,000 – 6,000       |             | 70%  |
|   | 6,000 – 7,000       |             | 80%  |
| 8. Depth of the deepest known point in the oceans (in meters)         | 7,000 – 8,000       | 90%         |      |
|   | 8,000 – 9,000       | 100%        |      |
|   | 9,000 – 10,000      |             |      |
|   | 10,000 – 11,000     |             |      |
|   | 11,000 – 12,000     |             |      |
| 9. Gestation period of an African elephant (in months)                | 6- 9                |             |      |
|   | 10 -11              |             |      |
|   | 12 – 15             |             |      |
| 10. The area of the Empty Quarter, the largest desert (in squared km) | 450,000 –           |             |      |
|   | 500,000             |             |      |
|   | 500,000 –           |             |      |
|   | 550,000             |             |      |
|   | 550,000 –           |             |      |
|   | 600,000             |             |      |
|   | 650,000 –           |             |      |
| 600,000   |                     |             |      |

2. How many answers do you think you have correctly estimated:

|      |      |      |      |      |      |      |      |      |       |
|------|------|------|------|------|------|------|------|------|-------|
| 1/10 | 2/10 | 3/10 | 4/10 | 5/10 | 6/10 | 7/10 | 8/10 | 9/10 | 10/10 |
|------|------|------|------|------|------|------|------|------|-------|

3. How do you rate the following:

| <b>Statement</b>  | <b>Excellent</b> | <b>Above average</b> | <b>Average</b> | <b>Below average</b> | <b>Weak</b> | <b>NA</b> |
|---|------------------|----------------------|----------------|----------------------|-------------|-----------|
| 1. Your risk analysis skills in comparison to your colleagues |                  |                      |                |                      |             |           |
| 2. Your general culture in comparison to your friends         |                  |                      |                |                      |             |           |
| 3. Your driving skills  |                  |                      |                |                      |             |           |

4. How much do you agree with each of the following statements?

| <b>Statement</b>  | <b>Agree</b> | <b>Somehow agree</b> | <b>Neutral</b> | <b>Somehow disagree</b> | <b>Disagree</b> |
|---|--------------|----------------------|----------------|-------------------------|-----------------|
| 1. I think I can Anticipate a stock market crash.   |              |                      |                |                         |                 |
| 2. I can anticipate fraud from a broker.  |              |                      |                |                         |                 |
| 3. My valuations are fully accurate. It is easy for me to be focused on my objectives and to reach my goals |              |                      |                |                         |                 |
| 4. Whatever happens I can handle it   |              |                      |                |                         |                 |

5. Choose the response that best describes how true each statement is for you from the following :

| Statement  | Totally true of me | Mostly true of me | Moderately true of me | Somewhat true of me | Not at all true of me |
|--|--------------------|-------------------|-----------------------|---------------------|-----------------------|
| 1. I often read books and magazines about my faith.  |                    |                   |                       |                     |                       |
| 2. I make financial contributions to my religious organization.                                |                    |                   |                       |                     |                       |
| 3. I spend time trying to grow in understanding of my faith.                                   |                    |                   |                       |                     |                       |
| 4. My religious beliefs lie behind my whole approach to life.                                  |                    |                   |                       |                     |                       |
| 5. I enjoy spending time with others of my religious affiliation.                              |                    |                   |                       |                     |                       |
| 6. Religious beliefs influence all my dealings in life   |                    |                   |                       |                     |                       |
| 7. It is important to me to spend periods of time in private religious thought and reflection. |                    |                   |                       |                     |                       |
| 8. I enjoy working in the activities of my religious affiliation.                              |                    |                   |                       |                     |                       |
| 9. I keep well informed about my local religious group and have some                           |                    |                   |                       |                     |                       |

| Statement                   | Totally true of me | Mostly true of me | Moderately true of me | Somewhat true of me | Not at all true of me |
|-----------------------------|--------------------|-------------------|-----------------------|---------------------|-----------------------|
| influence in its decisions. |                    |                   |                       |                     |                       |

6. Which of the following statements comes closest to the amount of financial risk that you are willing to take when you save or make investments:

- Take substantial financial risk expecting to earn substantial returns
- Take above average financial risk expecting to earn above average returns
- Take average financial risk expecting to earn average returns
- Not willing to take any financial risk

7. Imagine you have just received SAR 500,000. You receive the following financial offers from a reputable bank. Which offer would you accept?

- Investment (A). It is equally possible that you could lose half of the amount invested or double it
- Investment (B). Your investment will yield 3% per year (guaranteed)

8. How do you consider yourself as an investor in the stock market?

- Risk taking
- Somewhat risk taking
- Balanced
- Somewhat risk averse
- Risk averse

9. Determine the frequency of your trading in stocks and market news follow-up:

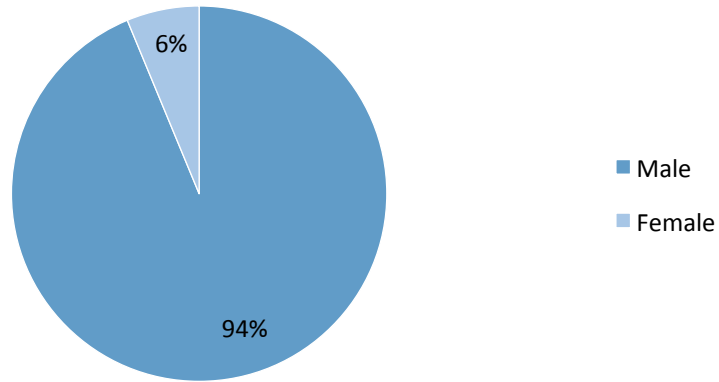
| Statement              | Daily | At least once a week | At least once a month | Few times a year | Occasionally |
|------------------------|-------|----------------------|-----------------------|------------------|--------------|
| Stock trading          |       |                      |                       |                  |              |
| Stock market follow-up |       |                      |                       |                  |              |

10. How much do you agree with the following statement?

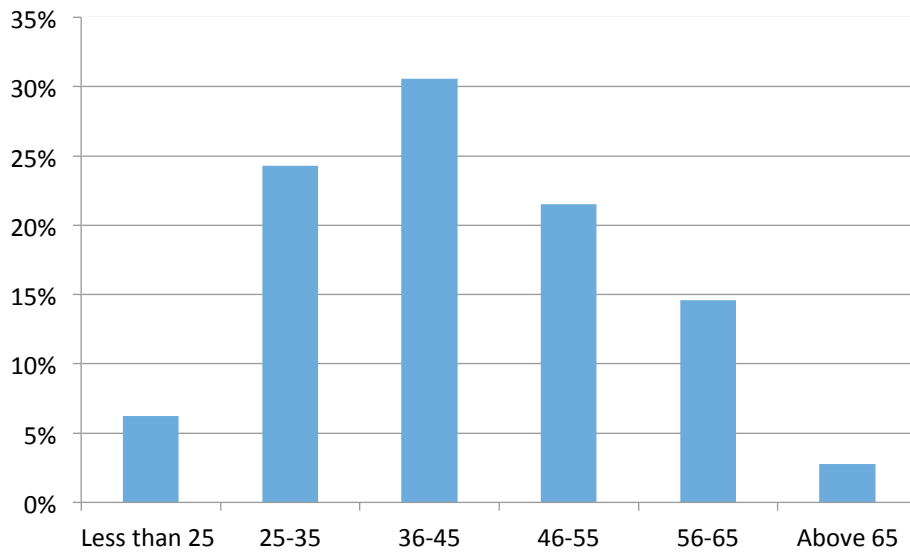
| Statement   | Agree | Somewhat agree | Neutral | Somewhat do not agree | Do not agree |
|---|-------|----------------|---------|-----------------------|--------------|
| Risky investments like short selling, trading derivatives and margin trading are the best way to invest if the investor is capable of expecting the prices of securities in the future. |       |                |         |                       |              |

## Sample Description

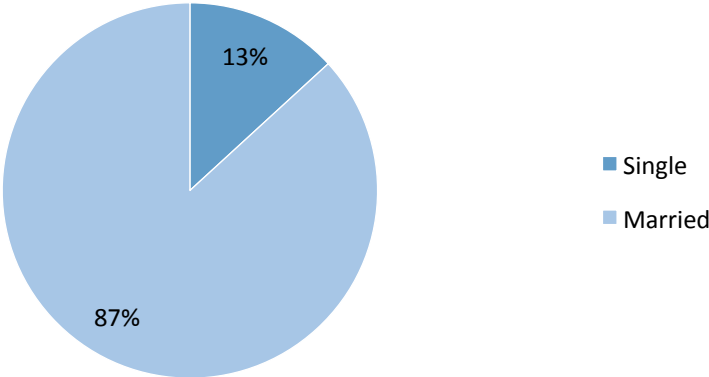
### 1. Gender



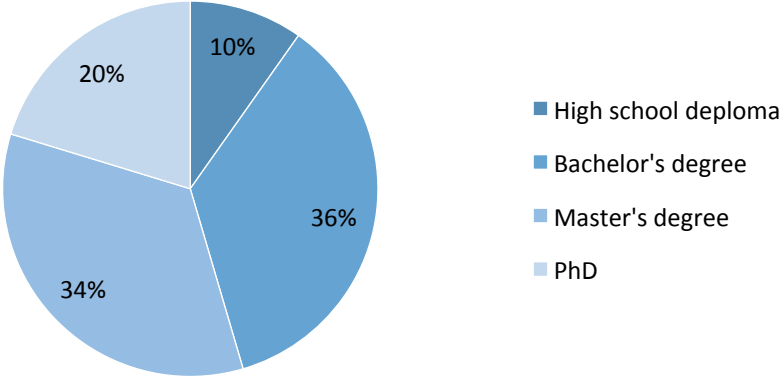
### 2. Age



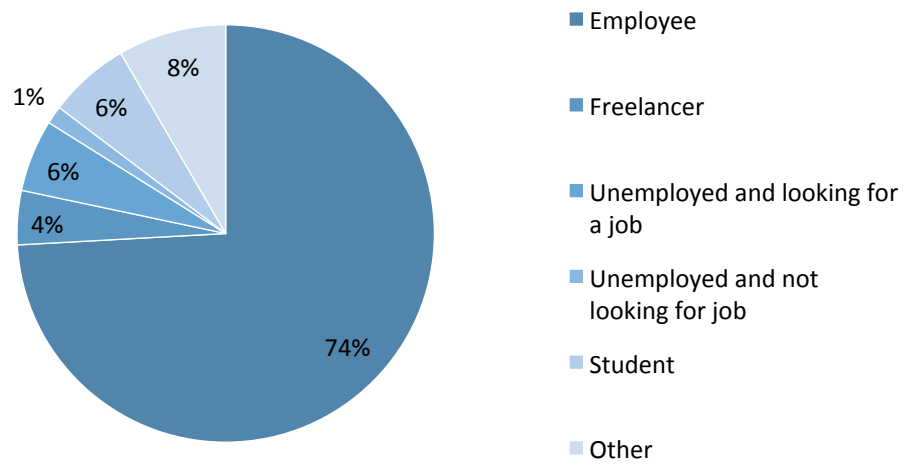
**3. Martial Status**



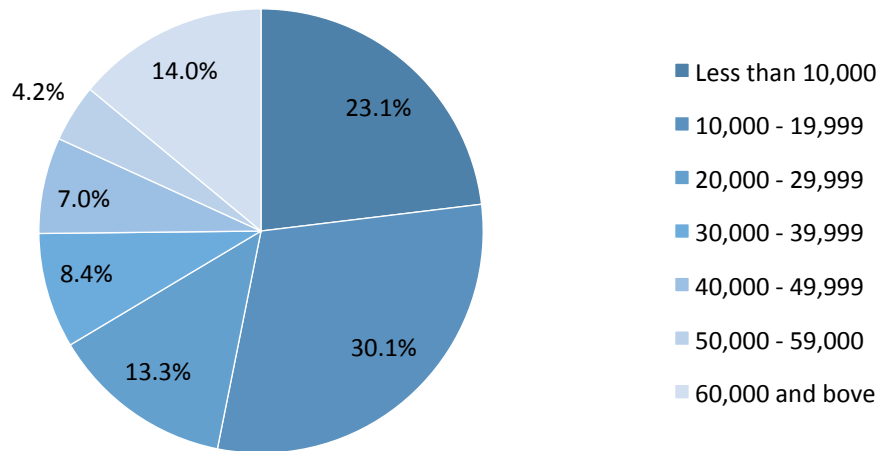
**4. Education**



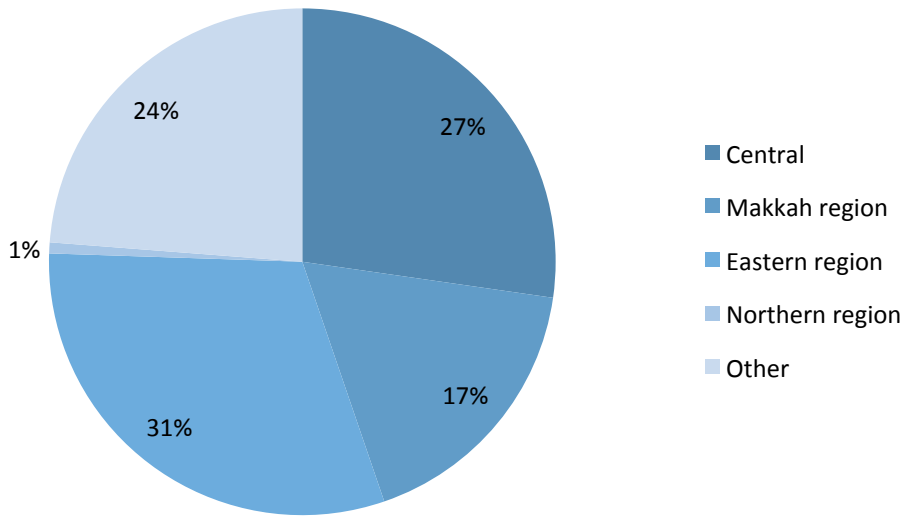
## 5. Employment



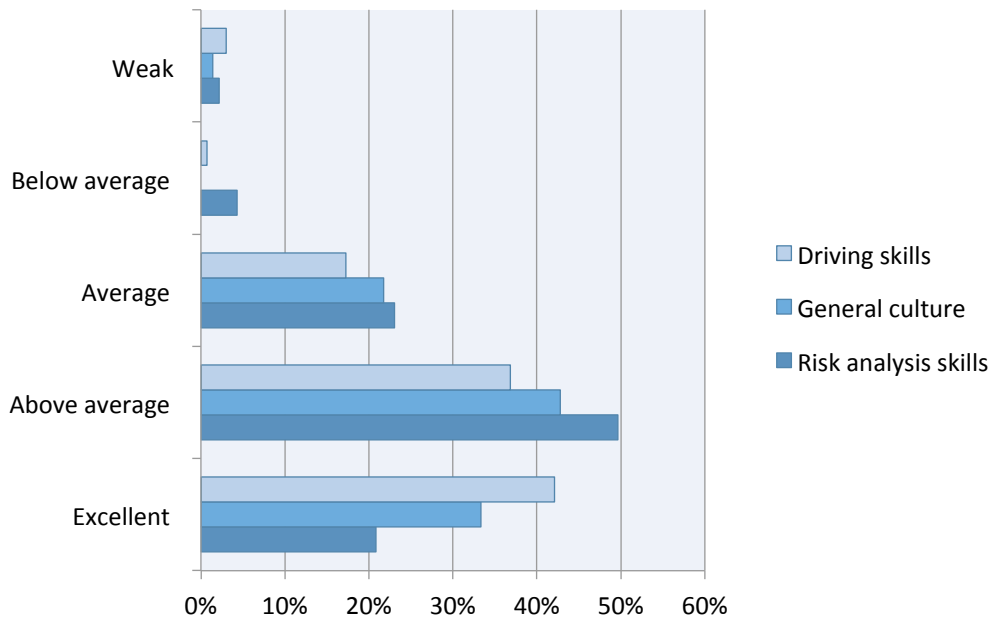
## 6. Monthly Income



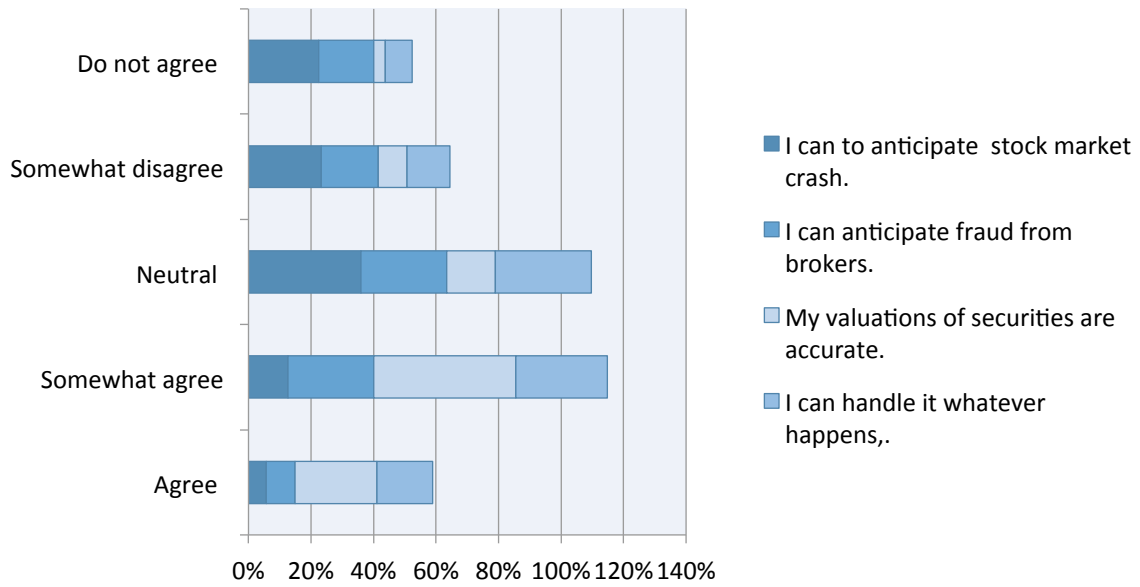
### 7. Place of Residence



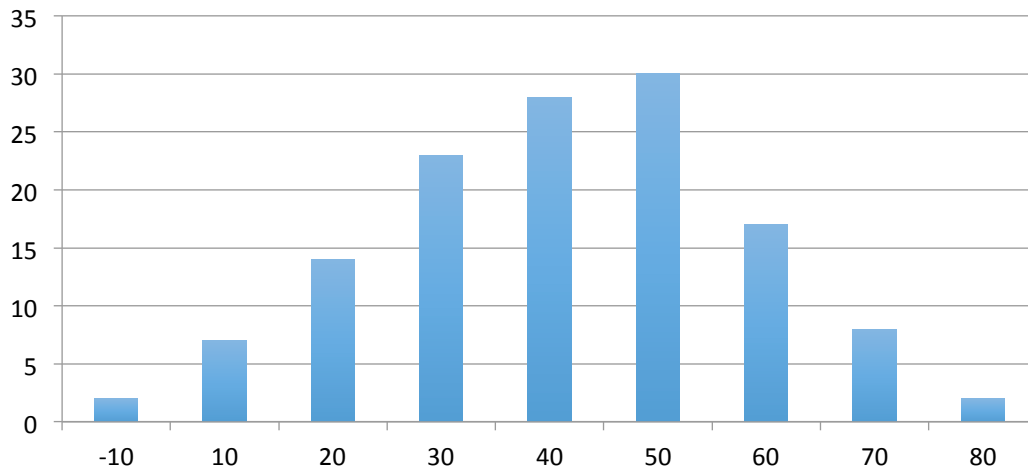
### Q1.How do you rate the following:



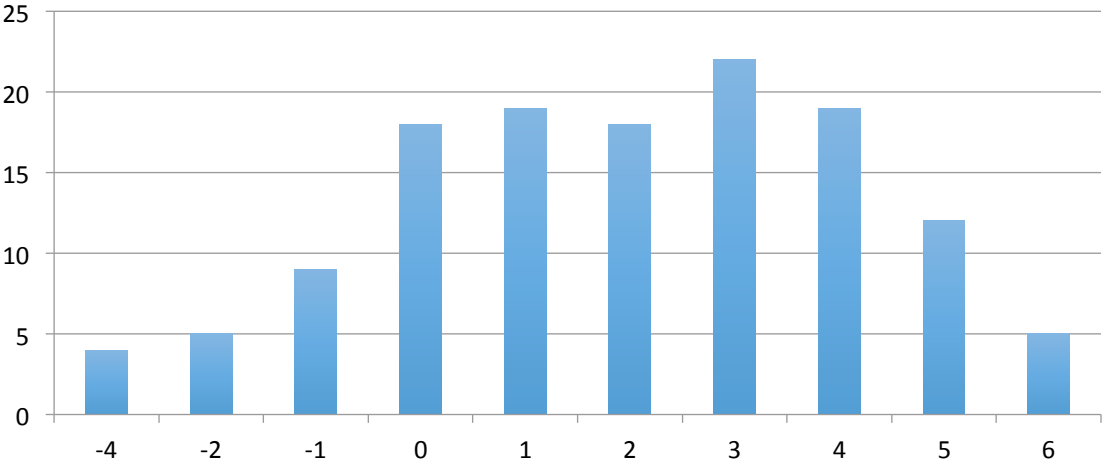
**Q2. How much do you agree with each of the following statements:**



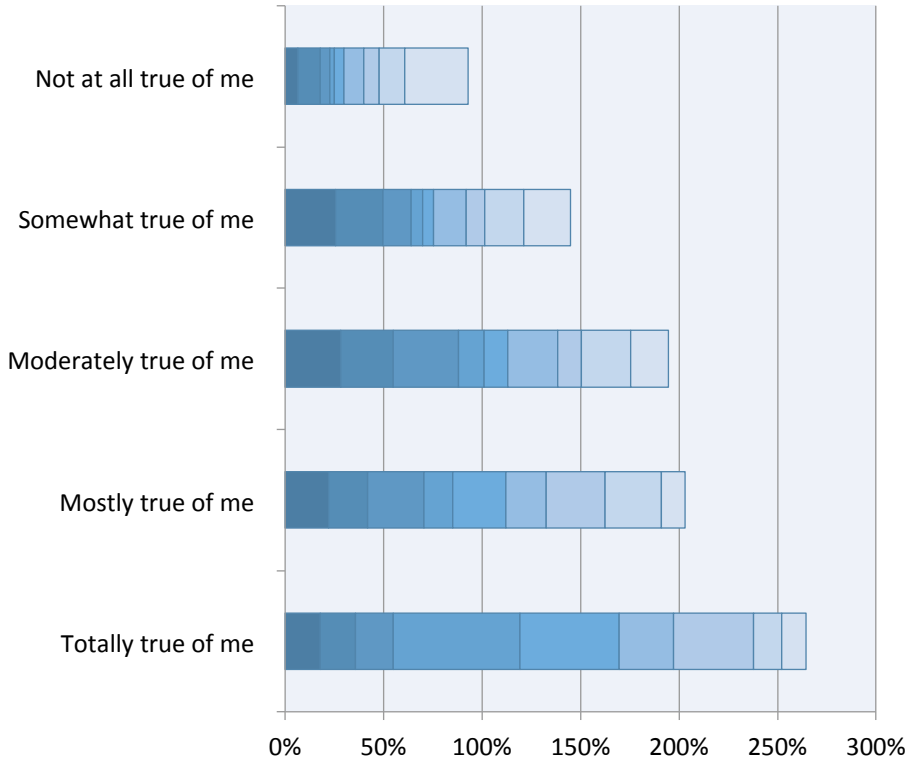
**Q3. Miscalibration**



**Q4. Retrospective miscalibration**



**Q5. choose the response that best describes how true each statement is for you from the following**

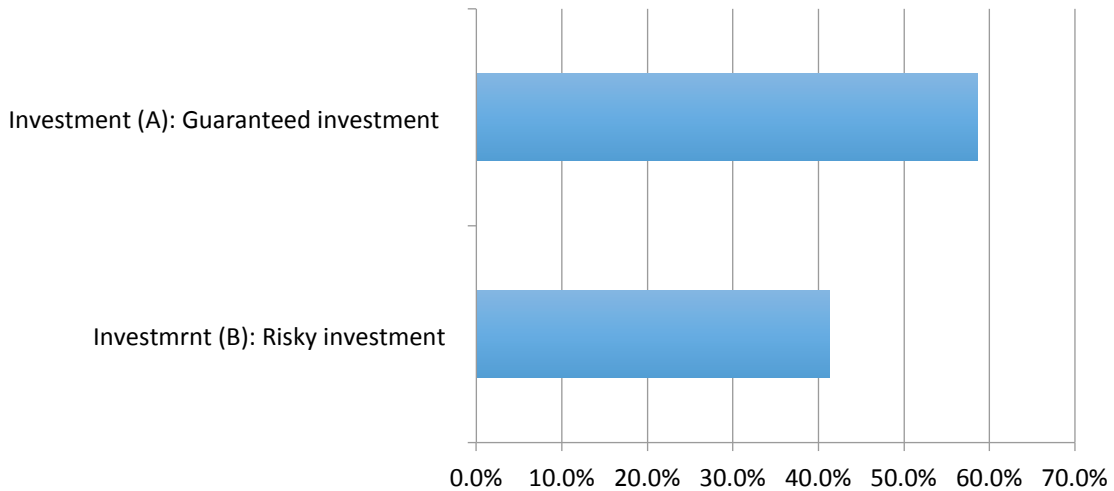


- I often read books and magazines about my faith.
- I make financial contributions to my religious organization.
- I spend time trying to grow in understanding of my faith.
- Religion is especially important to me because it answers many questions about the meaning of life.
- My religious beliefs lie behind my whole approach to life.
- I enjoy spending time with others of my religious affiliation.
- Religious beliefs influence all my dealings in life.
- It is important to me to spend periods of time in private religious thought and reflection.
- I keep well informed about my local religious group and have some influence in its decisions.

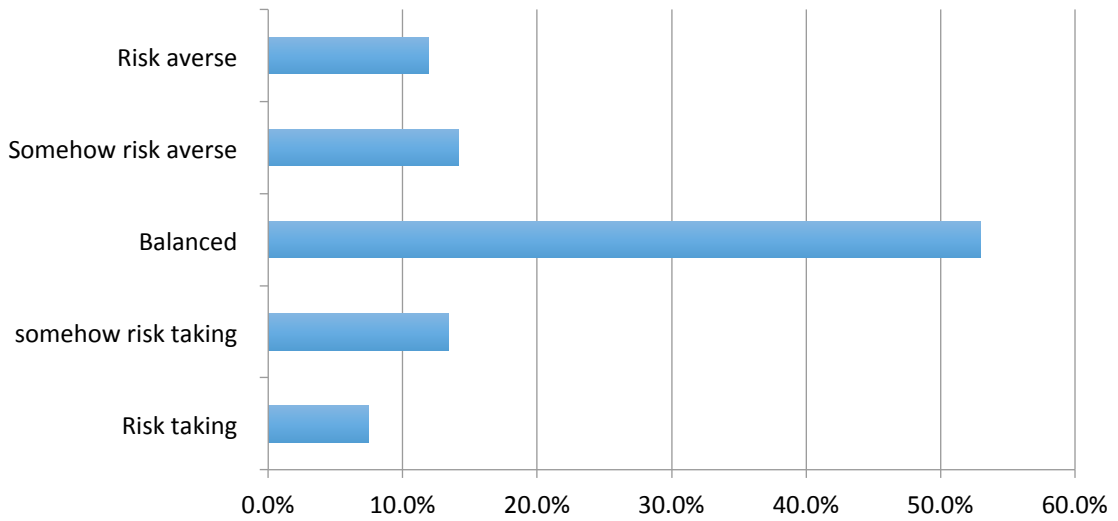
**Q6. Which of the following statements comes closest to the amount of financial risk that you are willing to take when you save or make investments:**



**Q7. Imagine you have just received SAR 500,000. You receive the following financial offers from a reputable bank. Which offer would you accept ?**



**Q8. How do you consider yourself as an investor in the stock market**



**Q9. Determine the frequency of your trading in stocks and market news follow-up**

