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Gambling as a new tool for financial advisors

Risk Profiling and a new risk assessment tool

by

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Abstract

Financial advisors use paper-based questionnaires to retrieve the information useful to address the clients toward the right financial products and investment mix. In 2004 the European Parliament issued the MiFID (Markets in Financial Instruments Directive) that has the objective to increase competition and investor protection, and levels the playing field for market participants in investment services. Although the cardinal role played by these questionnaires and the regulators' attention, there are still issues related to the structure, phrasing, interpretation, and contents of them.

The aim of this research is to analyse and provide insights about the questionnaires, their importance, and their most debated issues. A relevant part of this research is devoted to model an empirical approach that, through a behavioural and gaming lens, tries to provide a better framework to retrieve those pieces of information needed to better understand the risk tolerance of the clients. The game approach utilized takes inspiration from the poker field due to the ample similarities of this game with the financial industry. On the basis of the results of this research, it can be concluded that, for the first time, the poker experiment was able to predict the individuals' risk tolerance emphasizing the unexploited power of this gambling field. Moreover, the research has confirmed the correlation between some socio-demographic drivers (age, education and financial experience) and the risk tolerance profile retrieved by the current questionnaires. Finally, it was defined quantitatively the magnitude of the self-judgement bias, one of the most popular and dangerous bias when assessing the clients' risk profile.

Keywords: MiFID, Risk profile, Poker, Financial advisor, Risk tolerance.

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1 Introduction

Risk profiling is a crucial stage for wealth managers and financial advisors when providing advisory for financial decisions to retail clients. It provides an overall understanding of the investment profile of the client while addressing the right investment mix and financial products in order to achieve the investor's investment goals. Nowadays, the financial industry has been able to increase the level of accuracy when obtaining information from the clients. However, there are still issues that signal considerable room for improvement in the current tools utilised by financial advisors. In fact, questionnaires are affected by serious limitations even in countries where financial advising has reached a sophisticated level. In particular, different questionnaires can show different risk profiles for the same person. The problems are related either by biases in client self-judgment or by the behavioural component when taking the questionnaire or by the questionnaire's structure. From a regulatory perspective, questionnaires have been part of the Market in Financial Instrument Directive (MiFID). This directive has the aim to identify and to provide the guidelines for retrieving crucial information needed by the financial intermediaries when these offer financial instruments to retail clients.

Part of the data retrieved by questionnaires is generally unbiased, such as socio-demographic information and current financial situation. However, some factors are biased because of the explanatory limits of the tools that measure these behavioural components, making the accurate gathering of information impossible. Factor such as risk tolerance, risk perception and attitude toward risk will be cardinal for the following research since they are extremely important in the risk profiling process although the procedure applied to retrieve them are often too naïve and not accurate. These factors are crucial to conduct a sophisticated and reliable risk profiling and misunderstanding them could lead toward a wrong composition of the client portfolio and then a decrease of the client satisfaction and trust in the institution. By neglecting such components, it is easy to compromise the investment objective of the clients while perhaps increasing the chances of moral hazard of the financial advisor which may be tempted to promote a more profitable instrument for him than a tailor-made one for the client.

After defining the basis of the research background, both empirically and theoretically, it will be shown which are the alternative solutions currently available to mitigate these problems. Using them as a starting point, it will be applied a new empirical method based on the poker statistics which has the aim to highlight the gap between the questionnaires' interpretation and the real reaction that the client would show when under pressure and when simulating a real-life investment scenario. The experiment has the purpose to highlight the risk tendency of the client and not his financial education and capacity. By putting the clients in a simulated investment scenario, it is possible to identify their decision-making structure. Therefore, being able to better understand risk tolerance, risk perception and attitude toward risk.

The purpose of this analysis is to suggest an improvement in the current interviews-questionnaire method, hopefully leading to the optimization of this process in the financial industry. The experiment is conducted by providing the sample with both tools (the current questionnaire and the poker match simulation). It also illustrates the difference in risk profiling retrieved by the game simulation and the interview, trying to understand whether some socio-demographic may affect the outcomes.

In section 2 it is described risk profiling and its main components trying to explain the connection between the theoretical field and the empirical outcomes. The analysis of the MiFID

regulation, the way this directive has been applied, and the theoretical basis of the risk profiling process are the key focus of this section.

Secondly, the new methodology based on the poker framework is presented in section 3 where the similarities between investment decisions and poker strategies are explained. Furthermore, in the same section, it is included the modelling of the experiment and the statistics utilised for conducting the research.

Finally, the result section is dedicated to reporting quantitatively the differences and commonalities of the two approaches (questionnaires and poker simulation).

2 Regulatory and theoretical review

2.1 Background of the risk profiling issues

Investor risk profiling is a key focus for wealth managers, financial advisors and any subject that has to provide financial advice or has to create an optimal investment portfolio on behalf of his clients. To ensure a suitable and effective investment strategy the advisor needs critical information that allows them to create a financial risk picture of the customers. Cardinal info such as desired profit goals, investment horizon, financial objectives, liquidity available, risk tendencies are required to address the right investment mix. In order to promote a standardized process consistent among all financial firms, in 2004 the European Union has issued the Market in Financial Instruments Directive (MiFID). The main aim is to provide the best guideline able to clarify the steps needed to assess the risk profile accurately. The main problem is rooted in the type of information needed to proceed with a well-defined risk profile process. As suggested by Brayman et al. (2017) risk profile is assumed to be a “combination of objective and subjective attributes”. Individual capacity to bear financial losses, preferred investment horizon, household income, net worth position, and financial commitments are clear examples of objective factors since they are measures quantitatively. Risk perception, risk preferences, and other behavioural components, even though they are related to the quantitative elements cited before, they are subjective components. They are typically idiosyncratic, and it is not possible to derive them through the objective attributes. Because objective components are easier to retrieve when comparing with subjective attributes, the financial industry has heavily relied on them when creating the basis to provide investment recommendations. As a result, to leverage the riskiness of the investment portfolio, after assessing the objective attributes Brayman et al. (2017) has noticed that the preferred time horizon was the determinant and solely factor used as riskiness factor. Shorter time horizon would imply a lower risk since there is less time to recover from the financial losses. It is clear that such an approach is extremely misleading.

To avoid these issues would be more conscious to analyse accurately the whole definition of the client risk tolerance. Cordell (2001) has captured the whole definition of risk dividing this into four risk components: propensity, attitude, capacity, and knowledge. Propensity and attitude are related to the behavioural framework of the client, capacity and knowledge are part of the objective attributes analysed by Brayman et al. (2017). These studies are explained more in detail further in this section. Financial advisors have known for long that emotions and attitudes drive the behaviour of the clients. Psychometric and behavioural studies have provided strong support to these thoughts by providing techniques and tools able to identify the willingness of individuals to take financial risk. The emerging of the study of subjective risk factors has not changed drastically the way to risk profile clients within the financial industry. This topic has been dealt with a naïve approach that resulted in general and not standardisable question that just partially capture the risk tendencies of investors. Brayman (2017) argued that risk researchers are sceptical about the questionnaires’ framework and the ability to measure the behavioural risk components associated with the client’s risk profile.

2.2 MiFID Regulation

The Market in Financial Instruments Directive (MiFID) has formalized the necessity of providing a transparent and suitable financial service to clients that require financial support from the financial advisory institutions. With the introduction of the MiFID, this practice has become compulsory for financial institutions that promote investment products. According to MiFID, the achievement of an appropriate and suitable product or service for the client requires a deep investigation conducted by the agent by submitting a paper-based interview. In particular, suitability is a wider concept which may be defined as: “the degree to which the product or service offered by the intermediary matches the client’s financial situation, investment objectives, level of risk tolerance, financial need, knowledge, and experience” (Lucarelli, 2010). To provide a clear and transparent service, the directive requires to assess the product suitability and appropriateness of the financial product through submitting the client with a questionnaire. According to the outcome of the client assessment, it is possible to select a certain type of financial product among the ones available to the firm product selection. Following such an approach it is crucial to model client protection, confidence, and create the basis for financial market stability.

To establish a correct implementation of the MiFID the assessment should not be just an ex-ante procedure. As mentioned by Molyneux (2011) all the steps of the contract are cardinal. He believes that the ex-ante stage is important to understand the client’s preferences and needs. Instead, when the product is owned by the investor, it is important to retrieve the information necessary to understand if any adjustment is needed. In other words, valuing constantly if it is the case to change the investment mix. He also says that the ex-post analysis is needed to understand if the outcome expected has been achieved and to determine the nature of the complaints related to the services and products advised by the financial firm. The MiFID requires financial firms to run suitability tests which focus mainly on experience and knowledge, financial situation, and risk profile.

The last element is the key focus of this research. Risk profile capture risk tolerance, financial objectives and time horizon of the investment. To clarify the implementation of the MiFID directive, the European Regulator issued general guidelines that apply to investment advice and portfolio management with the purpose of clarifying the application of certain aspects of the MiFID suitability requirements. Table 1 provides a list of the most relevant technical advice suggested by ESMA when financial firms implement the MiFID (European Securities and Market Authority, 2018), they are a selection of the most important recommendation provided by the authority.

Table 1: ESMA key guidelines

<i>Main Guidelines</i>	<i>Firm should:</i>
(Guideline 1) Reporting requirement	- Inform their clients clearly and simply about the suitability assessment and its purpose
(Guideline 2) Arrangements necessary to understand clients	- Ensure that the assessment of the information collected about their clients is done in a consistent way irrespective of the means used to collect such information. - Obtain all the elements necessary to conduct the suitability assessment such as (marital status, age, family situation, employment situation, need for liquidity)
(Guideline 3) The extent of information to be collected from	- Retrieve the right amount of specific information accordingly to the product owned and the investor type
(Guideline 4) Reliability of client information	- Find a tool which is able to detect and maintain a reliable and consistent level of information not biased by self-judgement or lack of coherency
(Guideline 5) Updating client information	- Keep track of the elements that must be reviewed constantly

The first general guideline provided by the European Securities and Market Authority (2018) describes the baseline to implement the MiFID directive transparently and consistently. It specifies that the financial firm has to inform the client about the purpose of the tool and clearly explain that the assessment is intended to act in the client's best interest. For this reason, the client needs to understand the importance of providing accurate and complete information.

The second guideline express the intention of making the tool adequate to retrieve the essential information of the client optimally. To do so the answers provided by the clients must not be affected by the questionnaire phrasing or structure, but they must depend solely on the pure client' characteristics. Concerning the adequateness of the tool, firms need to pay attention to the level of clarity and comprehensibility of the questions "... avoiding misleading, confusing, imprecise, and excessively technical language" (European Securities and Market Authority, 2018). Moreover, the layout structure (font, line spacing ...) and the order in which the questions are listed needs to be accurately designed avoiding biased answer taken subconsciously. Within the second guideline is included a list of the necessary information to conduct the risk profile assessment such as marital status; family situation; age; employment situation; the need for liquidity. Probably the second guideline might be considered the most determinant since it shows the necessary items needed to conduct the assessment.

The degree of information to be collected from clients is included into the third guideline which states that the extent of necessary information depends form the type of financial instrument owned and by the type of investor.

The assessment of the reliability of the client information (guideline 4) is cardinal when making inference and conclusions from the final profile retrieved by the advisor. It is important to find a solution to detect the answers that signal a lack of coherency of the client or answers influenced by the self-judgment bias. Finally, guideline 5 suggests keeping track of some client features that need to be updated over time. It is important to understand which items need to be reviewed at which frequency and understand how the updating should be done.

However, although the clear intention of the European regulator, this assessment is not that easy and standardized as it could seem. The CONSOB discussion paper written by Linciano and Soccorso (2012) has gone through part of the obstacles that make the directive unclear and hard to standardize among all the advisory firms saying that the high degree of flexibility of the guidelines allows firms to use their own questionnaire modelled and framed as they preferred. Klement (2015) provided an overview of risk profiling stating that practitioners do not have

any standard approach and specific guideline for the clients' risk assessment, leading them to the formulation of inaccurate risk tolerance measures. The result is the creation of a myriad of biased tools with little evidence of meeting the intended functions.

2.2.1 Current Practice

As mentioned at the end of the previous section, the current regulation has had problems defining a unique tool which captures all the fundamental aspects required to create an accurate risk profile. The regulators have tried to promote a detailed guideline to address the questionnaires toward the most adequate application. However, the literature in economics and behavioural finance have selected a wider range of information that should be included within the questionnaires. The aim at this stage is to highlight the issues related to the current directive and the different blind spots that lead toward a not accurate risk profiling. Table 2 which was created by Linciano and Soccorso (2012) identifies the relevant items both for the current directive and the economic literature. The general MiFID's structure seems to go along with the economic literature, however, the degree of details suggested by the literature seems to be higher than the directive, this is shown within each macro section: experience and knowledge, financial situation and investment objectives. For the experience and knowledge part, the MiFID does not take into account any specific question which captures the financial knowledge of the investor, however, the directive retrieves the degree of knowledge solely from the previous financial experience. On the other hands, the economic literature suggests analysing the degree of knowledge through specific questions which assess the understanding of financial fundamentals such as the risk/return trade-off, credit/market/exchange rate, portfolio diversification principle, perception of probability. Furthermore, the literature suggests taking into account the overconfidence and optimism biases.

Concerning the financial situation, the MiFID and the economic literature put emphasis on the same items but the measurement of "other financial commitments" which is suggested just by the economic literature. This item includes expected changes in regular revenues and expenses, giving a higher degree of information for the financial advisor that would be more conscious about the level of safety net suitable for the specific individual.

The biggest gap in information is related to the investment objectives section. In particular, it seems that the directive treats this section with an objective lens as it has done with the other two sections, defining just risk preferences and risk profile through objective measurement. Nonetheless, the economic literature has suggested the implementation of behavioural components in order to obtain a more accurate dimension of investment objectives. These behavioural components are captured by the "emotional capacity to assume risk (subjective risk)", the "risk attitude (objective risk)", and "loss aversion". All together these elements model the risk tolerance of the investor. The risk tolerance is the cardinal elements that inspired this thesis and it is broadly analysed in the following chapters.

Table 2: MiFID and Literature compared

MiFID		Literature	
<i>Items</i>	<i>Variables</i>	<i>Items</i>	<i>Variables</i>
		<i>socio-demographic characteristics</i>	gender age marital status current and expected household composition
<i>experience and knowledge</i>	profession education nature, volume, and frequency of the client's transactions in financial instruments and the period over which they have been carried out types of service, transaction and financial instrument with which the client is familiar	<i>experience and knowledge</i>	profession education previous investment experience outcome of previous investment choice (positive/negative) knowledge of financial products knowledge of how financial markets work risk-return trade-off risk dimensions (credit/market/exchange rate) portfolio diversification principle perception of probability overconfidence and optimism
<i>financial situation</i>	investments and real property; assets, including liquid assets source and extent of regular income regular financial commitments	<i>financial situation</i>	investments and real property; assets, including liquid assets source and extent of regular income regular financial commitments other financial commitments (expected changes in regular revenues and expenses)
<i>investment objectives</i>	holding period purpose of the investment risk preferences risk profile	<i>investment objectives</i>	holding period time preferences (discount rate/degree of impatience) liquidity needs purpose of the investment amount (in relation to wealth/income) risk attitude (objective risk) emotional capacity to assume risk (subjective risk) loss aversion

Furthermore, to confirm the level of inadequateness of the current questionnaires, different institutions have carried out researches aimed to analyse the efficacy of these questionnaires. Neuroprofiler (2015), a company specialized in risk profiling services, carried out an “analysis of 504 of these risk profiling questionnaires from 50 different countries (52% from the European Union), the number of questions varies from 1 to 25. The 49% of them evaluated risk tolerance directly with the question: “What is your risk attitude?” or “Which option best describes your risk attitude?”. Only 54% took loss aversion into account. In an analysis run by the UK Financial Services Authority (FSA), 54% of questionnaires were judged unsuitable because of their failure to measure risk attitude” (Neuroprofiler, 2016). A report carried out by the Autorité des Marchés Financiers (AMF, the French stock market regulators) in 2011, declared that one-third of the audited questionnaires have an overall explanatory power of the risk tolerance between 25% and 37.6% (Palma & Picard, 2010). The conclusions have been summarized from the study ran by Palma and Picard (2010) which highlights the most recurrent issues. Firstly, the economists complained about a lack in the implementation of psychometrical and behavioural tools. Secondly, they argued that the number of sophisticated questions and simple questions is not well distributed. Furthermore, it was recorded a lack of an instrument able to measure the client consistency when answering the questionnaire. Then, they noticed that risk and loss are equally treated and defined. They argued that firms have the tendency to give the client the impression that he will decide the investment feature. Finally, they stated that the score for each question is displayed to the clients and follows an oversimplified representation.

2.2.2 Risk tolerance dimensions (RiskPACK)

As mentioned at the end of the previous section, the current regulation has problems with defining a unique tool which capture all the fundamental aspect required to create an accurate risk profile questionnaire. The aim of this research is to focus on the behavioural part of the questionnaires that happen to be the most critical to analyse since it is connected to the client behaviour and perception. The intention of this subsection is to point out which are these fundamental risk dimensions that financial advisors need to identify when trying to establish the risk tolerance of the investor.

According to Cordell (2001) "Evaluating a client's risk tolerance should be a primary task for financial planners, but few planners understand the basic issues involved in risk tolerance assessment". The framework promoted by his research points out a risk tolerance framework called RiskPACK. Such a model is based on four dimensions: propensity, attitude capacity, and knowledge.

Starting with the term risk tolerance, Cordell defines this as the maximum amount of uncertainty that a client is willing to accept when making a financial decision. High (or low) risk tolerance means that client's willingness to take risky behaviour is high (or low).

Within the definition of RiskPACK, Cordell has described risk propensity as the "client's real-life decision in financial situation", he also argues that financial advisors measure the level of risk propensity by looking at previous past decisions or current investment portfolio. However, this approach is contested by Cordell since previous actions could be misleading indicators of risk tolerance because the client might either not be aware of the intrinsic risk in a certain investment, or the assets are part of an inheritance or a change in the investor' financial standing occurred since the assets were obtained or the assets are owned for sentimental reasons or tax reasons.

Risk attitude refers to the client's willingness to incur monetary risk. This measure differs from the first one since it is a more genuine way to capture the risk preferences of the client. It is a pure analysis of the client's approach toward risk out of his personal or financial limitations. This aspect is mutable over time, therefore needs constant monitoring.

Moving away from the behavioural context, risk capacity and risk knowledge are related respectively to the financial ability and financial understanding of the client.

Valuation of risk capacity usually begins with determining the client life cycle, a younger client can accept more risk than older clients because they have more time to gain money and get rid of the financial losses. Other reasons that affect risk capacity are investment time horizons, current income, capital preservation, growth, tax minimization, competing objectives, income amount and stability, fixed expenses, balance sheet, liabilities nature, financial obligations and insurance coverage (Cordell, 2001).

Risk knowledge is a measure of client comprehension of financial instruments. There is a high correlation between this feature and risk-bearing since clients, that are aware of the market dynamics, have less tendency to panic during a market downtrend.

RiskPACK components are strongly influenced by each other. Starting with risk propensity, Cordell (2001) says that this component is a function of risk capacity and risk attitude. The high level of these two factors leads to higher risk propensity. However, risk propensity could be also explained by risk knowledge. More complex is the relationship between risk attitude and risk capacity. Wealthier people could either bear more risk since their financial situation allows so or being more conservative because they do not need to risk their capital to improve their welfare. At the other end of the spectrum, individuals with lower capacity can have a high-risk attitude because they subconsciously hope to make big wins or be very conservative because of their financial restrictions.

Cordell concludes his research arguing that “risk capacity and risk attitude are the primary components in the RiskPACK approach”. Therefore, these two factors are the components that shape risk tolerance the most. He also suggests that when capacity and attitude give conflicting signals the lower value is a constraint.

2.3 Socio-demographic driver and risk tolerance

Besides the structural and content quality of the questionnaires, which need a deep review by the financial firms, there is a branch of the economic literature focused on the validity and consistency of the questionnaires’ format utilised by financial advisors. Corter and Chen (2005) verified the overall validity of the questionnaires and their explanatory power. Using three different questionnaires and the “sensation-seeking scale” created by Zuckerman (1994) they were trying to understand the difference between the real willingness on taking the risk and the risk profile identified by the 3 questionnaires. Their results showed that the 3 questionnaires were consistent among each other, however, they were not positively correlated with the sensation-seeking scale. This may raise suspicions on the validity of the questionnaires predicting power. Further researches have highlighted several problems that could arise with the use of these instruments: the failure of capturing the multidimensional components of risk, lack in the correlation between risk questions and portfolio composition, inability in predicting the changes in client behaviour when the market also changes its trend (Pan & Statman, 2010). A broad stream of study is related to the correlation between socio-demographic features and the risk tolerance of the individuals. Age, gender, marital status, education, financial knowledge, and income are the ones under the spotlight. Few of them are controversial and they do not get a wide recognition as risk tolerance driver when other socio-demographic factors are widely considered as highly correlated with risk tolerance. There is an overall consensus related to the higher risk propensity of male over female within the financial domain, this is related to the overconfidence showed by the male that is translated in a risk-seeking behaviour (Frijins et al., 2008; Hallahan et al., 2003; Barber & Odean, 2001; Grable, 2000; Riley & Chow, 1992). Concerning the age, this is considered a controversial driver. The researchers are divided into two groups when it comes to the relationship between age and risk tolerance, the first group (Frijins, et al., 2008; Grable, 2000; Wang & Hanna, 1997; Palsson, 1996) found a positive relationship where a second group (Hallahan et al., 2003, 2004; Riley & Chow, 1992; Morin & Suarez, 1983; McInish, 1982; Wallach & Kogan, 1961; Bodie, et al., 1992) recorded a negative correlation. The same ambiguity is recorded for the marital status, with the 2004 research led by Hallahan, Faff, and McKenzie who recorded a linear relationship with risk tolerance arguing that individuals with no family have a higher risk tolerance than the one with family, conversely to what argued by Grable (2000).

Financial knowledge is considered positively correlated to risk tolerance since clients with greater understanding can better process information related to risky products, bearing less fear from the unknown. The social driver income is also complicated to define as a linear driver, it is hard to describe the relationship between income and risk tolerance since wealthier people may be keener to bet money because their financial stability allows them to risk part of their wealth without compromising their overall financial situation, while people with less financial capacity may prefer to avoid further risk because of their uncertain financial status. On the other hand, wealthier people can avoid investing money since their financial standing does not require to take part to investment strategies, while individuals with minimal capacity may hope on fortunate investment results (Cordell, 2000)

3 Methodology

In order to minimize the fallacy in the current risk measures utilised by financial firms, this research suggests two different risk measurement that may be considered when assessing a client. The basic idea is to utilise a widely accepted risk assessment instrument such as the 13-item Gable and Lytton questionnaire (1999) and compare this tool with a more behavioural instrument based on a poker approach. The aim of this empirical research is to check the significance and consistency of the poker approach and understand the validity when comparing this one to the G&L instrument. Moreover, it is interesting understanding the similarities and the differences of the G&L with the poker approach. Finally, through the analysis of the socio-demographic components, it is possible to understand which are playing a determinant role when modelling the risk tolerance of a client and which are not significant.

3.1 Poker and gaming approach

In the current European regulation (MiFID), risk tolerance includes the definition of risk preferences and risk profile. The regulators refer to the first one as the objective risk, in other words, it expresses the preferences for certain financial instruments (equity, commodities, bond etc...). Instead, risk profile identifies the subjective risk also described as the emotional capacity to tolerate the risk. These definitions are not just broad, but also lack indications on how to measure these variables (Linciano, 2012).

This is the starting point for the economists who work within the financial field related to the human perception of risk and financial market. Economists have tried to come up with different solutions borrowing knowledge from different fields. Behavioural finance has covered a major role in such a topic. But also, psychology and psychometrics have provided several tools to solve such issues. For example, the “sensation-seeking scale” developed by Zuckerman (1964) is a questionnaire designed to measure how much stimulation a person requires and the extent to which he/she enjoys the excitement. It can be used to assess people’s attitudes to take risks by exploring past experiences and their intentions with respect to the future (Linciano, 2012). Another tool, originally proposed by Bechara et al. (1994), is the Iowa Gambling Task (IGT). The IGT is conducted with displaying to the participants 4 decks on a screen. They can pick one card from the decks, each deck has cards that give gains or losses (two decks have higher profit with less probability of occurring and bigger losses, while the other two have smaller gains recurring more systematically and fewer losses which are smaller than the other two decks). This approach combined with a live measurement of the somatic signals provides an unbiased profile of the risk aversion of the participant from the combination of deck choices and somatic signals (such as changes in blood pressure).

Following the same path, this research has the ambition of providing a new method to assess the risk preferences of the investors. The field utilised to carry out this new approach is related to the gambling industry. Aaron Brown (2011) took inspiration by the same topic when he was writing his book “The Poker Face of Wall Street”. One of the most analysed relations in his book is related to the relationship between finance and gambling, he stated that: “finance can

only be understood as a gambling game, and gambling games can only be understood as a form of finance”. One of the similarities highlighted in his book refers to the gambling and market framework, both of them are based on a zero-sum game. Someone must lose whatever the winner wins: “No one gets paid a lot of money to sit around worrying about what the average return on equity will be over the next 20 years; no one screams and shouts about it. People do get paid a lot of money, and scream and shout, to trade one stock versus another or buy a stock and sell it five seconds later. The average investor in the stock market gets the average return; everything else is just gambling. Anything you win comes from someone else who loses, all relative to the average return.” (Brown, 2011). The similarities spotted by Aaron Brown that led him to say such strong statements have drawn the basis of this research leading toward the analysis of a financial issue with the usage of gambling that quite often is neglected or underestimated. According to Aaron Brown (2011): “Gambling lies at the heart of economic ideas and institutions, no matter how uncomfortable many people in the financial industry are with the idea”.

From now on, this research tries to create a gambling framework that tries to explain and reshape some economic features. The game used to describe and break down some financial decisions is poker. It follows a list of similarities that help with creating the basis of the empirical experiment that will be better described in section 4. The comparison starts with some stylized facts of the financial market and compare them with poker decisions, but before beginning directly with a comparison, Chapter 3.1.1 provides a clarification of those keywords and rules necessary to understand the poker’ setting.

3.1.1 Poker jargon and basic rules

In order to clearly address the present research, it is important to clarify some basics jargons and poker rules necessary to explain the research design and interpret the further results.

There are different variants of poker, the one analysed and utilised during the experiment is the Cash Game Texas Hold’em. The number of players usually ranges from 2 to 10.

The game begins with the dealing of 2 cards, so-called hole cards (or starting hand), dealt face down to each player. The players’ turns are assigned by the position of the blinds and the dealer (the blinds are forced bets for two players). The big blind is usually twice the value of the small blind. The dealer is the last player to play. Therefore, following a clockwise direction, the cards are firstly dealt by the dealer (without taking any decision), secondly, the small blind places his forced bet, then the big blind also places his bet, finally all the other players at the table can make their decision following the clockwise direction. Then there are three stages: flop, turn and river. The flop consists of a series of three community cards, then there is the turn, where an additional community card is dealt, and, finally, the river where the final fifth community card is shown. Each player aims is to seek the best combination of five cards out of the 7 cards in possession, the two hole cards and the five community cards. The best combinations depend from the type of outcome obtained with the 7 cards. The rank of the best hands is as follows: royal flush, straight flush, four of a kind, full house, flush, straight, three of a kind, two pairs, pair and high card. Before the flop and after each stage there is a betting round where the player can decide to check, call, raise/bet or fold. Checking means to decline to bet, when no rival has bet money previously. Checking is not possible at the preflop betting round except when the player is sitting in blind position (he played already his forced bet). Fold happens when a player discards his cards. Bet occurs when a player makes the first voluntary bet. Raise is realised when there is an increase in a previous bet’ size. Call means matching a bet or a raise. All the bets placed creates the pot, which is the amount that the last player with the best combination gets. The stack is the value of the chips standing in front of the players.

3.1.2 Similarities between the poker and the financial decision framework

The purpose of this section is to draw the similarities between the general framework of the poker strategies and the decisional path taken within the financial markets.

Firstly, a key similarity is related to the discretionary process regarding the way the individual makes use of his money. Within the financial market, there is no commitment regarding the financial product that should be included in the client portfolio, it is a discretionary process that involves the agreement of both a financial advisor and retail client. Both parts need to be informed about where to put the money and there is no commitment to the type of instrument to buy. A similar approach is adopted at the poker table, it is not required to invest any money in the game (The only exception is when the player is in a blind position, however, usually this payment is not that significant to such an extent that changes the long term player strategy for cash game). Finally, what is cardinal in both fields is the importance of information. Poker is played in betting round, where those in later position acting after all the other players may have an advantage compared to those in earlier positions acting earlier. It is intuitively based on seeing how the peoples before and after you acted. In the market context, you may want to wait until more information is released (such as the decision taken by a large institution with regard to a buy or sell action). In other words, seeing what the other players have done before you take an action can give you a clue and an edge about the decision you will make.

3.1.3 Poker style and investment strategy

Investors with a high-risk tolerance can bear higher risks if compensated by a higher average return than free risk rate or market returns. This exposes them to portfolio fluctuation and higher chances to incur losses. On the other hand, investors with low risk tolerance prefer having lower volatility of their portfolio and being compensated with lower returns.

In a poker match, it is possible to adopt either a safer or riskier strategy. When following the first one, the player is betting only on his best starting hands. This will turn down the volatility of his stack, but at the same time, the return could be lower over time because the players at the table could be aware of the style followed by the tight player (the player that is following a low risk strategy) and, therefore, every time he or she is betting, people go away from the pot. Conversely, a riskier strategy could be the one adopted by a player that has a wider hand ranges and tries to hit post-flop good combinations. This player bets money more often than the player following a conservative strategy, this could increase the volatility of his stack, but could increase the average returns due to the possibility of hitting a good score since he is participating more often to the game. Moreover, other players could have the tendency of playing more betting round with him because they know that this particular player may have started participating to the betting round with a not optimal hand range.

The similarities with poker do not stop just on the magnitude of risk taken by the individual but also on the amount of action made when playing poker or investing in the stock market. Within the financial industry, we can distinguish two main investing strategies: passive versus active investing. The passive strategy would include, real estate, fixed income, value investing, growth investing which are based on the long term buy and hold mentality.

Within the active, it would be included all the investment based on the short-term fluctuations (such as momentum investing, day trading, stock picking...).

Basically, which investment strategy a client would adopt depends on his time horizon, risk tolerance and financial goals. In poker terms, an active player could be seen as the one playing aggressively: this player raises often when he has the occasion, this increases the value of the pot (potential gain), at the same time it increases the money under risk, this combination brings

toward high volatility of the player stack. Conversely, passive players are the ones that are not raising or re-raising often, they prefer that other people take action first and then decides what to do, this may be seen as a safer strategy because the player may prefer to avoid risking money and try to get more information by the other people action.

3.1.4 Poker and financial behavioural traits

Emotional control is a key factor for both financial planners and retail clients. Even though the financial decisions are based on well-structured financial analysis and strong economic ideas the financial market has a component of randomness which could lead toward undesired swing of the assets' value. This could happen quite often since the market is extremely hard to predict. However, although these undesired changes, if the decision made was done carefully, in the long term it is likely to expect a change in the direction of the assets' value toward the expected predicted outcome. Nonetheless, the undesired changes of assets value in the short run can make investors doubtful about the strategy, calculation and assumption. Leading toward a weak state of mind that could create the base of bad decisions: selling the discounted assets to minimize the losses, reviewing the decision process, making not thoughtful decisions.

Poker players also suffer the changes in the expected outcomes mentioned above, even if they are playing their best hands in the best table positions, they also suffer undesired swings in their stacks because of the randomness of the game. Nevertheless, as in the financial market, the long run will reward the thoughtful strategy applied. Other features such as overconfidence (the tendency to hold a false and misleading assessment of our skills, intellect, or talent) increase the "portfolio" of behavioural factors that affect the individual decision making. In short, it's an egotistic belief that makes people think that they better than they actually are (Pallier et al., 2002; Grinblatt & Keloharju, 2009). Another popular bias is the optimism described as the tendency to perceive an event or action as more likely to end up with a more fortunate result (Heaton, 2002, Sharot, 2011). Finally, one more bias that it is present in both financial and poker field is the status quo bias (the emotional bias that leads toward a preference for the current state of affairs). In finance could be described as sticking on past decisions because they are perceived safer and easier to value, this is due to informational and cognitive limitations, the so-called bounded rationality (Simon, 1982).

3.2 The Grable & Lytton scale

The Grable and Lytton's article was among the first to provide published risk scale reliability and validity estimates (Kuzniak et al., 2015). The Grable and Lytton instrument has 13 questions, the so-called items. The maximum score is 47 and the minimum score is 13. An individual that gets a value below 18 has a low-risk tolerance, between 19 and 22 a below-average risk tolerance, 23 to 28 is an average/moderate risk tolerance, from 29 to 32 is above average risk tolerance, and 33 or above is usually considered as an investor with a high-risk tolerance. The scale was created to assess several dimensions of risk tolerance and to be

comprehensive of all the factors that shape the risk tolerance profile of an investor. The dimensions analysed are: a) guaranteed versus probable gambles, b) choice between sure loss and sure gain, c) risk as experience and knowledge, d) risk as a level of comfort, e) speculative risk, f) prospect theory and g) investment risk. The two economists argued that individually the questions were not accurate when measuring the investor' risk tolerance, however, the combination of the questions provided a reliable measure of a client's financial risk tolerance. Every item/question includes one or more risk tolerance dimension, Table 3 summarizes the dimension captured by each question. Every item/question is shown in Appendix A.

Table 3: Risk tolerance dimensions for each question/item

	Guaranteed versus probable gambles	Choice between sure loss and sure gain	Risk as experience and knowledge	Risk as a level of comfort	Speculative risk	Prospect theory	Investment risk
Item 1			X	X			
Item 2	X				X		
Item 3				X			
Item 4			X				X
Item 5			X	X			X
Item 6			X	X			X
Item 7			X		X		X
Item 8	X	X			X		
Item 9						X	
Item 10						X	
Item 11			X				X
Item 12				X		X	
Item 13	X				X		

Item 2, 8 and 13 capture the risk attitude through deciding between guaranteed and probable games, this usually requires making risk calculation. Generally, choosing a probable gain over a guaranteed profit is considered as a more risk-tolerant option.

The sure loss and sure gain can be measured effectively by framing questions that require respondents to choose among alternatives without complete information. To include the sure loss and sure gain dimension the 8th question is based on the fact that making money from an action based on incomplete information makes an individual feel more satisfied (Malkiel, 1994; Pring, 1993; Rowland, 1996). On the other hand, preferring an inheritance to avoid dealing with incomplete information is considered as a less risk-tolerant decision. Since different studies have shown the correlation between financial experience and knowledge with the individual risk tolerance it was necessary to include this dimension into the G&L instrument. Therefore, question 1,4,5,6,7, and 11 capture this dimension through more complex questions related to financial products and investment decisions. Usually, people with higher financial experience

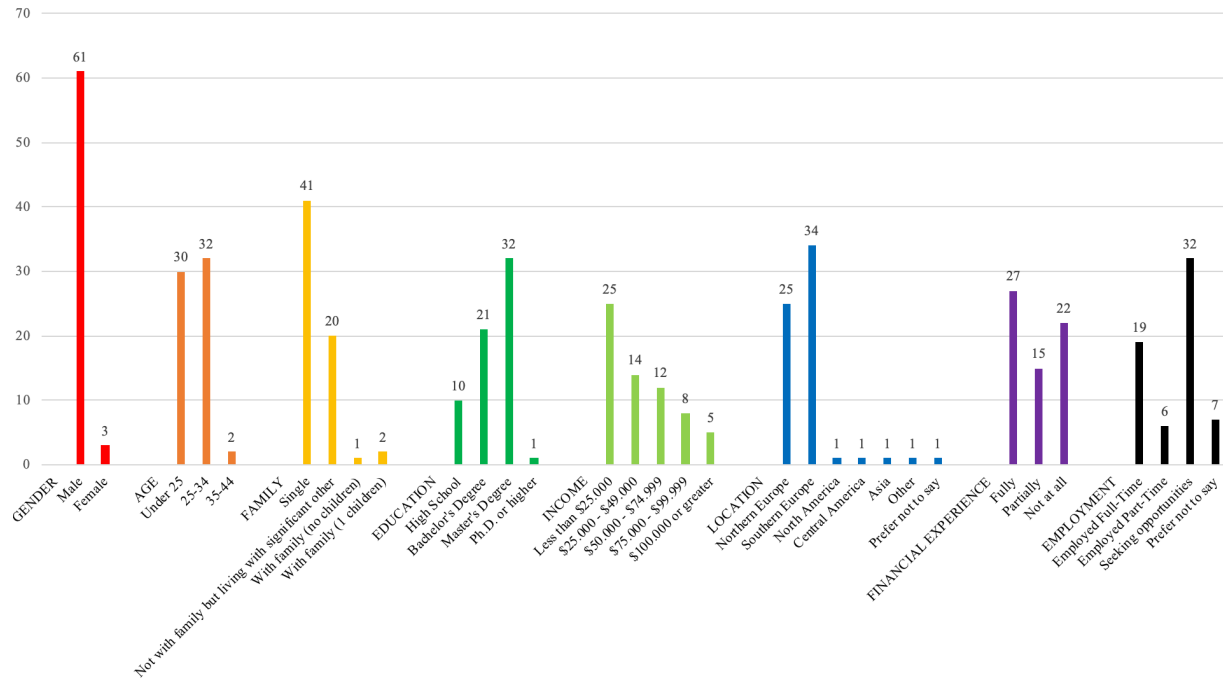
and knowledge would answer more aggressively than people that are less familiar with this type of investment, making the first more risk-tolerant than the second (Goldberg, 1995; Grable and Joo, 1997). Highly correlated to the financial experience there is the risk expressed as the level of comfort illustrated on the items 1,3,5,6, and 12. Through this characteristic it is possible to understand the natural attitude of a person toward risk and losses, usually, this feature is located in our inner behaviour and is a trait of individual psychology (Carducci and Wong, 1998). Item 2, 7, 8 and 13 put the individual in a scenario where he could either seize the opportunity generated by a certain potential favourable situation or take a safer path toward lower return rate and higher stability. A more speculative approach is typical of people with lower risk tolerance and vice versa (Malkiel,1994; Mehrabian, 1991). Item 9, 10, 12 recall the concept of prospect theory. As suggested by Tversky and Kahneman in their 1979 article, investors evaluate their choice in terms of potential gains and losses relative to some reference point, challenging the idea of the expected utility theory (Tversky, Kahneman 1979). The item 9 and 10 rephrased the prospect theory concept in terms of sure gain/loss and 50% chance gain/loss choice with an identical expected cashflow. However, people acting coherently with the risk aversion theory will choose the sure outcome for both gain and losses scenario. Conversely, individuals choosing the unsure pay-out will be the one with higher risk tolerance and risk-seeking attitude. Empirically the average individual chooses the sure gain and the unsure loss. The last dimension is captured by item 4, 5, 6, 7, and 10 which ask directly the investment preferences signalling the financial knowledge and overall risk tendency of an individual. Both knowledge and propensity as analysed previously in the RiskPACK chapter are determinant when retrieving the individual risk profile. Generally, would be not surprising to find equity, commodities or just everything with a certain magnitude of volatility into the portfolio selection of a risk-tolerant client.

3.3 Sample characteristics

The research is based on a web survey personally created submitted to a broad sample that has to fill three different sections. The first includes the G&L 13 item risk measure, the second is dedicated to the poker simulation, the third one is related to the socio-demographic drivers. The data of this research are personally collected from a web survey created on Google Forms. The survey recorded 64 valid participants. The number of male participants was much higher than female (94.1% of participants were male). The sample age is divided mainly into two groups: under 25 (47.1% of the sample) and 25-34 (48.5% of the sample). This could be partially justified by the channel used to promote the survey (mainly LinkedIn and Facebook) and the personal network. More than one-third of the sample has had or has experience within the financial industry (38.5%), whereas 35.4% and 26.2% have partial or no experience respectively. Concerning the income, the sample capture all the 5 different ranges created. However, the sample income is skewed toward the range “Less than \$25.000”, this is due to the typical income life cycle which is lower when younger and increasing over time. Since the respondents in the empirical distribution captured a younger audience, is not surprising that the range “Less than \$25.000” was the most popular. Another social variable that is affected by the young average age of the sample is the marital status: the majority of the survey participants were either “Single” (63.2%) or “Not with family but living with significant other” (30.9%). The highest level of education completed was a Master’s degree (49.2%) followed by a Bachelor’s degree (32.3%) and High School (15.4%). The majority of the individuals that have participated in the survey were from Europe (Southern Europe 53.8% and 38.5% Northern

Europe). Table 4 displays the socio-demographic distribution when Appendix D. provides a more detailed illustration of the socio-demographic descriptive statistics.

Table 4: Socio-demographic distribution



3.4 The Survey

Appendix A, Appendix B and Appendix C illustrate the 51 questions asked on the survey. The survey can be accessed at <https://forms.gle/URUCNAVGMMyMrvh89>. The first 13 questions are taken by the G&L tool, the following 30 questions are the simulated poker hands and the last 8 are the socio-demographic questions.

The maximum score for the G&L tool section is 47 whereas the minimum score is 13. A higher score is representative of a client with a high level of risk tolerance (aggressive investor), a lower score represents a low-risk tolerance (conservative investor). The score is obtained by the sum of the points linked to every answer (See Appendix A.).

The poker simulation is composed of 30 simulated hands, alike the G&L questions, these are the same for all participants (See Appendix B). These hands have been appositely created in order to cover the whole poker hand range. This means that 3 hands that represent the best initial 10% combination (77+, A9s+, KT+s+, QJs+, AJo+, KQo+), other 3 hands that represent the best initial 20% combination excluding the previous 10% best hands (55+, A3s+, K7s+, Q8s+, J9s+, T9s, A9o+, KTo+, QJo). “s” and “o” at the end of the poker hands mean suited (same suits) and off suit (different suits). Following this scheme, until the worst 10% combination it is possible to simulate 30 hands that cover the whole hand range. This procedure leads to minimizing the bias of picking too valuable hands or too weak hands. This is necessary in order to retrieve unbiased poker statistics. Without taking this into account the respondents would follow the same pattern if providing them with too strong or too weak hands. This means that when providing to a sample a really good combination or a really bad combination it is

likely that they are going to behave the same way even though their overall style and risk perception are different. In other words, black and white are the same for all the player, what makes the difference are the shades of grey in the middle.

The socio-demographic questions are 8 and refer to the gender, age, employment status, marital status, level of education, working financial experience, annual income and location. They were decided by looking at the literature and the MiFID indications which suggests some socio-demographic features as drivers of risk tolerance (See Appendix C for the socio-demographic questions).

3.5 The poker statistics

The first statistic analysed in the second part of the survey is the VPIP (voluntary put in the pot). This statistic measure how many times the player has decided to put money in the game voluntarily, in other words, the number of times a player call or raise over the total number of hands he has played.

$$VPIP = \frac{\#CALLS + \#RAISES}{\#HANDS - \#WALKS}$$

Where walks are the situation where every player fold at the table and the person sitting at the big blind position wins the pot without taking any action. In this empirical research, this situation never appears, thus, it is possible to consider VPIP just as written previously but considering the walks equal to zero.

In the long run players with a high VPIP are classified as “Loose players”. A loose player usually exhibits a higher level of trust on his hands since he is playing many hands even when his starting combination is not the most valuable. Not only he relies on his hands, he is also risking money, betting part of his stack wishing for good combination during the different poker phases. In conclusion, he is keen to bet money relying on fortunate combination even though he does not start as a favourite. This type of style can cost lots of money in the long run, however, sometimes this player can hit fortunate combination and attract players in the pot because these players are aware of the loose style of the player.

Conversely, low VPIP means betting just when the player has the best initial combination. When translating in financial terms, this sounds more similar to a low volatility mentality where the investor tries to increase the portfolio worth in the long run.

At this point may sound clearer the correlation between poker statistic and financial preferences. However, there is one more statistic that can help out with shaping the risk tolerance of an investor when using a poker perspective. This statistic is the PFR (preflop raise) expressed as the sum of total bets or raises before the flop over the total hands played:

$$PFR = \frac{\#RAISES}{\#HANDS}$$

In poker terms, this suggests the propensity of making an aggressive action pre-flop. Instead, financially, it could be seen as the magnitude of the active or passive strategy adopted by the investor and also his risk tolerance. Somehow could describe the way an investor put his money under risks. Day trading and continues portfolio rebalancing could be seen as the natural

twin of a high poker PFR. On the other hands, buy and hold strategies and long-term value investing could be compared to a low PFR.

In order to maintain a certain level of simplicity and validity, the poker simulation is created following a certain structure that makes the simulation less biased and easier to analyse: the game is a cash game Poker Texas Hold'em; 6 players are playing at the table; the player's stack should be 5% of the player annual income expressed as 100 chips in the game, the possible choices are fold, check, call, raise.

3.6 The indicators normalization

To conduct a side by side analysis, it is required to make the indicators metrically comparable using a scale from 0 to 1. To retrieve this value, it is necessary to normalize using a feature scaling. In other words, to make a scale from 1 to 0 for both G&L score and poker score was used the following formula:

$$x' = \frac{x - \min(x)}{\max(x) - \min(x)}$$

Where x' is the score obtained by the single individual, $\min(x)$ is the minimum score of a certain indicator and $\max(x)$ is the maximum score of a certain indicator.

4 Results

4.1 Descriptive statistic of the two poker benchmarks

The poker simulation provided the number of calls, folds, checks, raises for each individual (See Table 5).

Table 5: Descriptive statistics for the sample poker decisions

	<i>CALL</i>	<i>FOLD</i>	<i>CHECK</i>	<i>RAISE</i>
Mean	10,64	Mean 12,25	Mean 0,81	Mean 6,27
Standard Error	0,69	Standard Error 0,64	Standard Error 0,07	Standard Error 0,45
Median	10	Median 12	Median 1	Median 6
Mode	10	Mode 10	Mode 1	Mode 5
Standard Deviation	5,52	Standard Deviation 5,09	Standard Deviation 0,56	Standard Deviation 3,58
Sample Variance	30,52	Sample Variance 25,90	Sample Variance 0,31	Sample Variance 12,80
Kurtosis	-0,10	Kurtosis 0,42	Kurtosis -0,06	Kurtosis 0,66
Skewness	0,49	Skewness 0,20	Skewness -0,04	Skewness 0,65

The average number of calls, folds, checks and raises for each individual is 10,64; 12,25; 0,81; 6,27 respectively. The calls, folds, and raises distributions are skewed to the right, when the check distribution is skewed to the left. The calls and checks show a slightly platykurtic distribution (excess kurtosis of -0,10 and -0,06 respectively) whereas the folds and raises distribution are leptokurtic (excess kurtosis of 0,42 and 0,66 respectively). Similar standard deviation is recorded for number of calls (5,52) and folds (5,09). The standard deviation recorded for the number of raises and checks was 3,58 and 0,56 respectively.

Analysing the number of calls, folds, checks, and raises made by each individual allow retrieving VPIP and PFR (see Table 6).

Table 6: Descriptive statistics for VPIP and PFR

<i>VPIP</i>		<i>PFR</i>	
Mean	0,564	Mean	0,209
Standard Error	0,021	Standard Error	0,015
Median	0,567	Median	0,2
Mode	0,5	Mode	0,167
Standard Deviation	0,166	Standard Deviation	0,119
Sample Variance	0,028	Sample Variance	0,014
Kurtosis	0,217	Kurtosis	0,666
Skewness	-0,099	Skewness	0,650
Range	0,8	Range	0,533
Minimum	0,167	Minimum	0
Maximum	0,967	Maximum	0,533

These statistics brought to an average VPIP of 56,4% and an average PFR of 20,9%. In other words, the average player decided to put money in the pot (sum of calls and raises) before the flop more than half of the time he could while the same average player raises, in the same betting round, one-fifth of the time. Both empirical distributions showed a positive excess kurtosis. The VPIP is slightly skewed to the left when the PFR is skewed to the right.

For the readers that are more familiar with these statistics, it is noticeable a quite high average value either for VPIP or PFR, this is partially justified by the number of hands which are just 30 when for retrieving a more reliable index for VPIP and PFR it is required a higher number of hands (at least 100 hands played). One more reason that justifies the high percentage of VPIP and PFR is the fact that the whole sample is playing with no money, therefore, this leads toward a more aggressive overall game strategy. From a poker perspective this could look like a biased number, however, the fact that every individual in the sample played the same game and the normalization with a value between 1 and 0 make the simulation standardized and the number retrieved not too biased for the scope of the research.

To illustrate the variety of the choices made by the respondents it is useful to report the two extreme value for VPIP and PFR: the maximum and the minimum VPIP of the empirical distribution is 96,67% and 16,67% respectively when the PFR recorded a maximum of 53,33% and a minimum of 0%. These statistics summarize the two extreme strategies that the sample adopted, the individual that recorded a 96,67% of VPIP made 21 calls, 1 check 8 raises, this denotes an extremely loose player which loves to see the preflop, however, he is not that aggressive comparing to the number of time he sees the preflop, he raised just 26,7% of the time he could.

The individual with lowest VPIP made 5 raises and 25 folds, this signals a quite tight player that is not scared to bet money on the pot when he has good hands, indeed he has a PFR equal to his VPIP. The individual with the highest PFR made 16 raises, 12 folds and two calls. This is typical of a loose and aggressive player, which has no fear to bet money even with weak combination, this could be seen as a quite risk-tolerant strategy.

To make the VPIP and PFR metrically comparable with the G&L score, it is necessary to normalise as explained on Chapter 3.6. Therefore, was possible to retrieve the VPIP benchmark and PFR benchmark for each player. Summing these benchmarks and normalising again it was obtained a poker index metrically comparable with the G&L score which has the ambition to capture the behavioural dimension of the respondent (See Table 7 for the poker score descriptive statistics).

Table 7: Normalised Poker score descriptive statistics

<i>Poker score</i>	
Mean	0,41
Standard Error	0,02
Median	0,43
Mode	0,44
Standard Deviation	0,19
Sample Variance	0,04
Kurtosis	0,61
Skewness	0,35

With regard to the final poker benchmark the player that recorded the lowest score, thus, the least risk tolerant had a VPIP of 20% and PFR of 7% when the individual with the highest score had a VPIP of 90% and PFR of 53%.

4.2 Univariate regression

To understand whether the poker score is a reliable estimate for the G&L score a univariate regression was utilised (See Table 8 and Figure 1). Using the poker score as the explanatory variable and the G&L score as explained variable showed that the poker benchmark is statistically significant (p-value less than 0,1%). This is the first key finding for this research. The confirmation of the validity of the poker instrument is something new and surprising.

Table 8: Result of the univariate regression of poker score with G&L score

Regression Statistics		Coefficients	Standard Error	t Stat	P-value	
Multiple R	0,561465049	Intercept	0,1304758	0,0411610	3,1698899	0,0023546
R Square	0,315243001	Poker Score	0,6056792	0,1124651	5,3854843	0,0000011
Adjusted R Square	0,304373843					
Standard Error	0,14506468					
Observations	65					

The model describes the dependent variable with a Multiple R of 0,5614 and R square of 0,3152, this could be interpreted as a sufficient result since the model is based on empirical results retrieved by behavioural studies and with limited sample size. Therefore, these results are considered relevant to confirm the consistency of the poker tool.

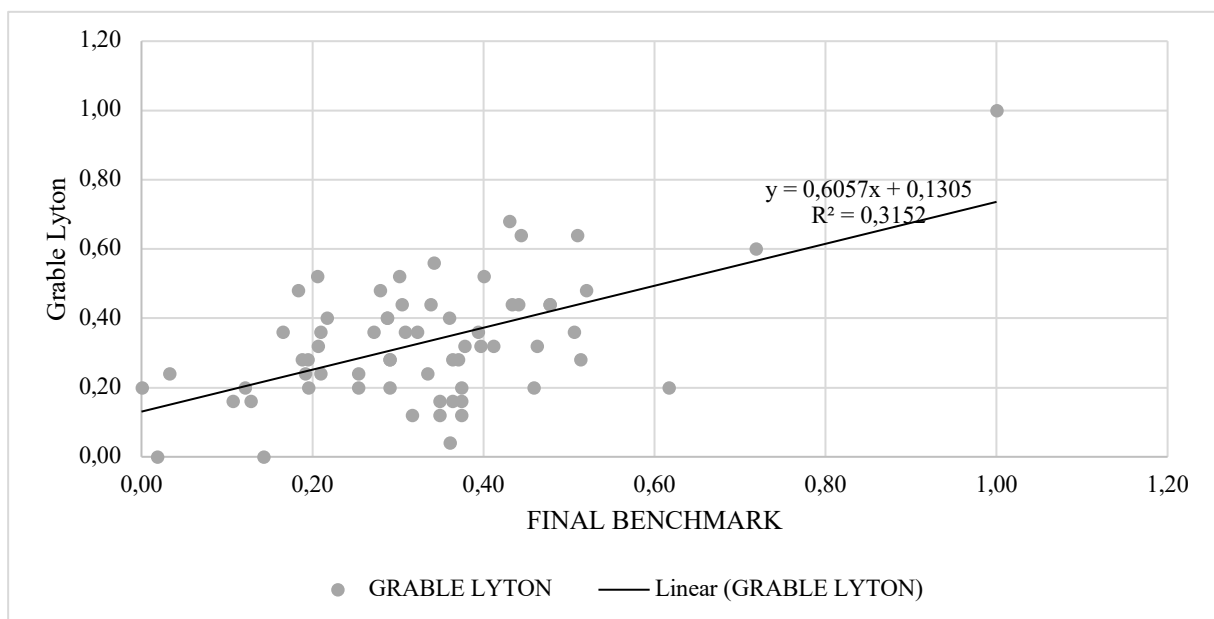


Figure 1: Poker score line Fit Plot

Furthermore, it is interesting to test the significance of the two preliminary indexes utilised to create the poker score, VPIP benchmark (see Table 9) and PFR benchmark (see Table 10). Both of them were statistically significant with a p-value of 0,00121 for VPIP and p-value of 1,7027E-06 for PFR.

Table 9: Result of the univariate regression of VPIP score with G&L score

<i>Regression Statistics</i>		<i>Coefficients</i>				
Multiple R	0,3926949	Intercept	0,1696971	0,051310255	3,3072739	0,0015593
R Square	0,1542093	VPIP benchmark	0,3175049	0,093682042	3,3891758	0,0012138
Adjusted R Square	0,140784					
Standard Error	0,1612222					
Observations	65					

Table 10: Result of the univariate regression of PFR score with G&L score

<i>Regression Statistics</i>		<i>Coefficients</i>				
Multiple R	0,55385182	Intercept	0,189221969	0,032204785	5,87558548	1,72589E-07
R Square	0,30675183	PFR benchmark	0,616358326	0,11673841	5,27982458	1,70273E-06
Adjusted R Squ	0,29574789					
Standard Error	0,14596133					
Observations	65					

4.3 The socioeconomic drivers for G&L and poker

The empirical distribution obtained has shown a G&L mean value of 29.24 with median 29. Therefore, the value is slightly above the average investor, this could be the result of the sample characteristics. For this reason, it was conducted a multivariate analysis of the socio-demographic drivers (gender, age, family, education, income, location, financial experience, employment status) to understand which factor may explain the risk tolerance expressed by the G&L scale. The code of the socio-demographic variable utilised in the regression are illustrated in Table 11.

Table 11: Socio-demographic variables regression codes

GENDER		AGE		FAMILY		EDUCATION	
Male	1	Under 25	7	Single	6	Some High School	1
Female	0	25-34	6	Not with family but living with significant other	5	High School	2
		35-44	5	With family (no children)	4	Bachelor's Degree	3
		45-54	4	With family (1 children)	3	Master's Degree	4
		55-64	3	With family (2 children)	2	Ph.D. or higher	5
		65-74	2	With family (3+ children)	1		
		75 and over	1				

INCOME		LOCATION		FINANCIAL EXP.		EMPLOYMENT	
Less than \$25.000	1	Northern Europe	1	Fully	3	Employed Full-Time	4
\$25.000 - \$49.000	2	Southern Europe	0	Partially	2	Employed Part-Time	3
\$50.000 - \$74.999	3			Not at all	1	Seeking opportunities	2
\$75.000 - \$99.999	4					Retired	1
\$100.000 or greater	5					Prefer not to say	

To make the variable Location significant it was necessary to adjust the sample distribution removing 5 people outside from Europe since the other 60 participants were all Southern or Northern European. The result of the multivariate regression illustrates a statistical significance for the following variables: age (p-value 0,020), education (p-value 0,038), and financial experience (p-value 0,003). Age is a quite controversial socio-demographic driver, generally, financial planner suggests investing in the riskier financial product when younger because the financial lifecycle is favourable for younger people than older since the first one has more time to cover the possible losses (Modigliani, 1975). Even though this popular statement may lead to the conclusion that there is a positive correlation between the increase of the age and the risk tolerance of individuals, different studies have shown the opposite (Wallach and Kogan, 1961; Mc Inish, 1982; Morin and Suarez, 1983; Riley, Chow, 1992; Hallahan, Faff, McKenzie, 2003, 2004). As shown in Table 12, the empirical result of the multivariate regression confirms what argued by the researchers that support the negative relationship between age increases and risk tolerance (coefficient of -0,097). The same non-linear relationship appears in the variable education (coefficient of -0,082). However, unlike the variable age which follows the common consensus of the economic literature, the negative correlation with the variable education doesn't follow the general idea specified in previous studies (Riley, Chow 1992; Grable, 2000; Hallahan, Faff, Mc Kenzie, 2004).

With regard to financial experience, it was recorded a positive correlation with the risk tolerance retrieved by the G&L instrument (coefficient of 0,093), which is aligned with previous studies which confirm the positive correlation between financial experience and risk tolerance (Frijns et al., 2008; Grable, 2000). The client with a greater understanding of risk may provide more positive responses to risk attitude questions because they can process the information better and their knowledge gives them less reason to fear the unknown (Cordell, 2001).

Table 12: Significance of the socio-demographic drivers for G&L

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Regression Statistics</i>	
Intercept	1,1394	0,2155	5,286	0	Multiple R	0,623933
Gender	0,0682	0,1022	0,6668	0,5079	R Square	0,389292
Age	-0,0972	0,0406	-2,3957	0,0203	Adjusted R Square	0,293495
Family	-0,0328	0,032	-1,0263	0,3096	Standard Error	0,149422
Education	-0,0827	0,039	-2,1228	0,0386	Observations	60
Income	0,0051	0,0176	0,287	0,7753		
Location	0,0104	0,0405	0,2568	0,7984		
Fin. Exp	0,0935	0,0305	3,0672	0,0035		
Employment	0,0001	0,0187	0,0055	0,9957		

As suggested by previous studies, the empirical distribution obtained from the G&L instrument confirmed the correlation with some socio-demographic variables such age, education and financial experience (See Figure 2, Figure 3, Figure 4).

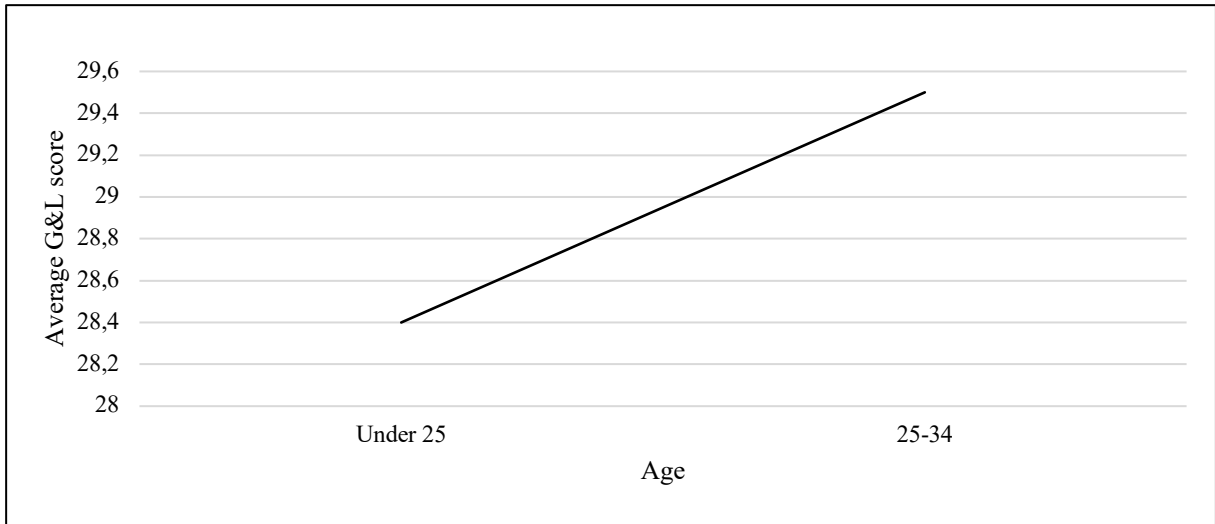


Figure 2: G&L score by age

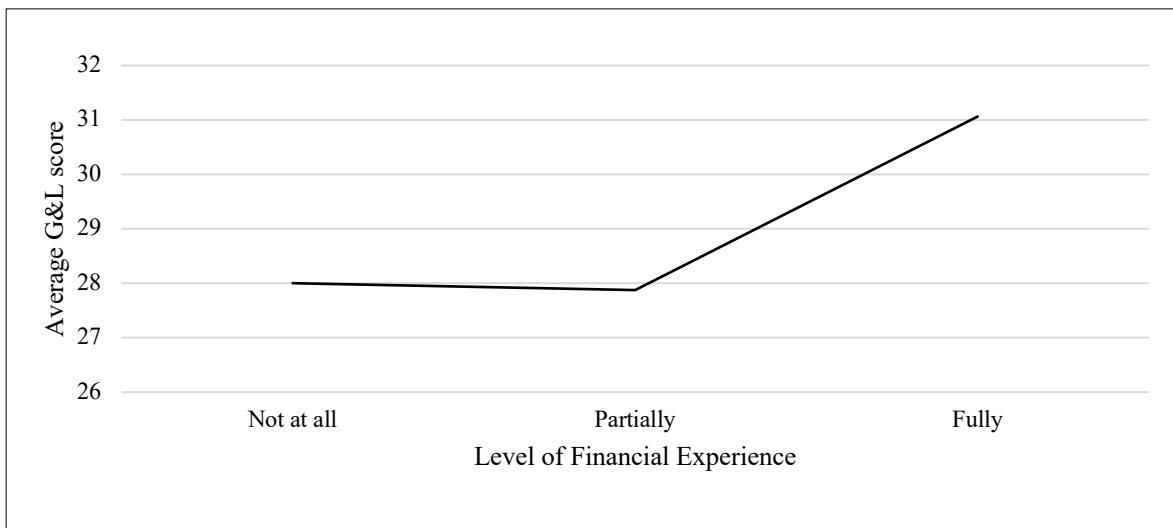


Figure 3: G&L by financial experience

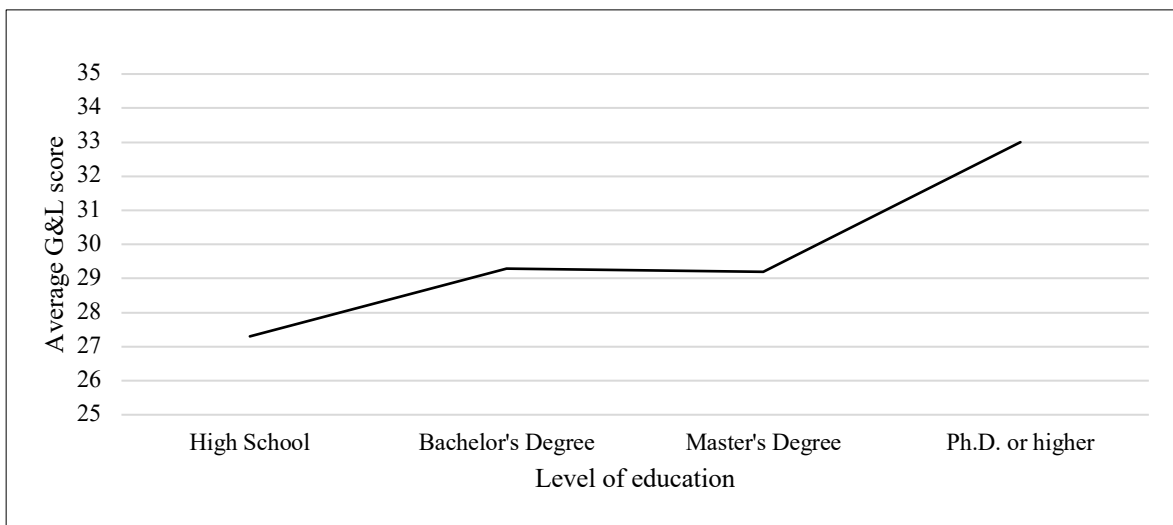


Figure 4: G&L score by level of education

The same statistical analysis was made for the poker score which did not record any significant variable among the socio-demographic driver. In other words, the socio-demographic drivers did not have any explanatory power when trying to predict the poker score as Table 13 shows.

Table 13: Significance of the socio-demographic drivers for poker score

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	1,08873301	0,20863536	5,21835338	3,3328E-06
Gender	-0,0572517	0,0989606	-0,5785305	0,56545222
Age	-0,0729403	0,03926171	-1,8577964	0,06897544
Family	-0,0140352	0,03093556	-0,4536921	0,65197519
Education	-0,0611216	0,03770439	-1,6210727	0,11116923
Income	-0,0017736	0,01707361	-0,1038786	0,91767315
Location	0,04469088	0,03919311	1,14027381	0,25949903
Fin. Exp	0,03639512	0,02951359	1,23316457	0,22316816
Employment	-0,0141295	0,01805847	-0,7824285	0,43758068

4.4 Self-judgment bias measurement

One of the key findings of this thesis is the empirical confirmation of self-judgement bias. Indeed, 75% of the sample believe to be “Willing to take risks after completing adequate research”, this could be interpreted as a moderate/average risk-tolerant individual, which, accordingly to the G&L score just 34,38% shows this profile. Moreover, when 9,38% of the sample defines itself as gamblers, 17,19% of the sample got a G&L score comparable to a risk-seeking individual. This finding is crucial when defining self-judgement bias, people believe to have a higher risk tolerance when they actually do not meet certain requirement to bear financial risks or vice versa they are more risk-tolerant than they believe. Indeed, 43,75% of the sample is considered a cautious investor from the G&L scale, where the self-assessment would include just 15,63% of the participants, resulting in a high percentage of people that believe to be willing to take the risk or even gambler when actually they should consider their self as a more cautious investor. Concerning risk-avoiding investor, 4,69% of the sample got a G&L score that shows a low-risk tolerance where no one self-defined itself as risk avoider. Therefore, people can barely understand their real risk profile when they try to predict their behaviour.

To retrieve the percentage of people considered to be of the gambler type, willing to take the risk, cautious and risk avoider it was used the benchmarks suggested by Grable and Lytton which consider highly risk-tolerant an individual with a higher score of 33, a score between 29 and 32 signals an average/moderate risk-tolerant person, between 23 and 28 is a person with a risk tolerance below average, and less than 22 shows a risk avoider investor profile.

Concerning the poker distribution, was used the quartiles to divide the distribution into 4 equally sized bins. Therefore, with the division imposed was possible to understand the percentage of individuals within each risk profile group (See Table 14).

Alike the G&L scale, the poker score illustrated that the individuals overestimated their risk tolerance either when they define their self as gamblers or willing to take risks. In fact, just 21,88% of the poker distribution could be described as willing to take the risk, conversely to what was illustrated by the self-assessment that says that two-third of the sample is willing to

take the risk. The same is for the Gambler profile, which just 4,69% of the sample is included in this group when using the poker scale against the 9,38% of the people that believe to show a gambling attitude.

When comparing the sample distribution, we notice that the poker score and the G&L are consistent with clustering the individual profile, this is not the same for the divisions made by the self-assessment.

Table 14: Clustering of the client profile according to the instrument

	<i>G&L</i>	<i>Poker</i>	<i>Self Assessment</i>
<i>Gambler</i>	17,19%	4,69%	9,38%
<i>Willing to take risk</i>	34,38%	21,88%	75,00%
<i>Cautious</i>	43,75%	53,13%	15,63%
<i>Risk Avider</i>	4,69%	20,31%	0,00%

4.5 Limitations

The present study is heavily based on the empirical answers retrieved from the web survey and the analysis of the data obtained by these individual responses. The major limitations are related to the methodology adopted and the inference made by the results.

With regard to the method utilised, the web survey is based on a sample of 65 respondents. Even though it is possible to retrieve a general trend about the topic analysed, the number of participants may be considered too low to make this research widely accepted and statistically significant for a wider population. This main issue is also emphasized by the low number of females in the sample (4 respondents were female), low number of individuals older than 34 years old (only 3 respondents), low number of people with family (4 answers obtained by people with family). This sample composition may be misleading when making inference from the socio-demographic drivers.

Furthermore, it was indicated to play the poker simulation pretending to bet a stack equal to 5% of the individual annual income. It may be ambitious to argue that people behaved as they actually would in their real world. This probably skewed the results toward a more aggressive poker style since the sample is not betting real money. This was partially considered when making the normalization of the sample as indicated in Chapter 3.6.

Another issue is related to individuals that might have answered randomly. Concerning this problem, it was decided to eliminate 1 respondent from the sample which took always the same action throughout the survey, however it wasn't detected any other outlier.

For simplicity, the poker simulation was based just on a betting round, this could bias the final poker score especially for players that may prefer to play aggressively at the first betting round or vice versa. Therefore, the use of VPIP and PFR could oversimplify the interpretation of risk even if there is a really high correlation with the popular Grable and Lytton instrument. However, to offset the issue of an oversimplified version of a poker match in future researches could be possible to include other poker statistics such as aggression frequency, continuation bets, and others.

Finally, not every individual is familiar with poker, this creates a tool accessible to a smaller population.

5 Conclusion

The present study investigates the different dimensions of risk tolerance attempting to suggest the adoption of more accurate risk assessment tools which would be able to capture both the objective and subjective component of the retail client risk profile.

The study has shown, for the first time, the positive correlation of the experimental approach based on the poker framework comparing to the respectable Grable and Lytton 13-item scale.

The outcomes from the poker methodology have a solid explanatory power for the G&L score. However, it is surprising that while the G&L score presents correlation with some socio-demographic drivers such age, financial experience and level of education (as supported by the consensus), the poker score does not show correspondence with any socio-demographic driver. This research, aligned with many studies, detected and quantified the self-judgment bias of individuals, showing how dangerous and misleading it can be relying solely on the perception that people have of their own risk profile.

Although this research raised doubts on the implementation of the questionnaires, they are still considered an optimal method to retrieve the client risk tolerance when well constructed such as the Grable & Lytton 13-item scale. Indeed, these questionnaires need to be revisited because they often lack a well-defined structure and could provide biased outcomes because of the presence of not accurate contents and questions. Moreover, the questionnaire's format does not permit to accurately measure the risk tolerance component related to the subjective dimension of the individual. Due to these ambiguities, it was analysed a different tool able to mitigate the issues that raise with the questionnaires approach. Using the poker framework would be possible to offset several mental and structural constraints that emerge in the questionnaires approach. This does not mean that the poker experiment should substitute the current approach, however, weighting the adoption of the poker experiment and the use of a well-structured questionnaire (such as the Grable & Lytton 13-item scale), it would be possible to have a less biased tool, providing clients with an accurate risk profile. Modelling an appropriate risk profile allows to address the client toward the suitable investment mix and can increase the customer satisfaction achieving safely the goals set by the client leading to an overall improvement of the wealth management services.

Further studies can establish the relevance of the poker approach extending the research on a wider sample and using more poker statistics including all betting rounds and not just preflop as done in this thesis.

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Appendix A. 13 item Grable and Lytton (1999)

1. In general, how would your best friend describe you as a risk taker?
 - a. A real gambler
 - b. Willing to take risks after completing adequate research
 - c. Cautious
 - d. A real risk avoider
2. You are on a TV game show and can choose one of the following, which would you take?
 - a. \$1,000 in cash
 - b. A 50% chance at winning \$5,000
 - c. A 25% chance at winning \$10,000
 - d. A 5% chance at winning \$100,000
3. You have just finished saving for a “once-in-a-lifetime” vacation. Three weeks before you plan to leave, you lose your job. You would:
 - a. Cancel the vacation
 - b. Take a much more modest vacation
 - c. Go as scheduled, reasoning that you need the time to prepare for a job search
 - d. Extend your vacation, because this might be your last chance to go first-class
4. If you unexpectedly received \$20,000 to invest, what would you do?
 - a. Deposit it in a bank account, money market account, or an insured CD
 - b. Invest it in safe high quality bonds or bond mutual funds
 - c. Invest it in stocks or stock mutual funds
5. In terms of experience, how comfortable are you investing in stocks or stock mutual funds?
 - a. Not at all comfortable
 - b. Somewhat comfortable
 - c. Very comfortable
6. When you think of the word “risk,” which of the following words comes to mind first?
 - a. Loss
 - b. Uncertainty
 - c. Opportunity
 - d. Thrill
7. Some experts are predicting prices of assets such as gold, jewels, collectibles, and real estate (hard assets) to increase in value; bond prices may fall, however, experts tend to agree that government bonds are relatively safe. Most of your investment assets are now in high interest government bonds. What would you do?
 - a. Hold the bonds
 - b. Sell the bonds, put half the proceeds into money market accounts, and the other half into hard assets
 - c. Sell the bonds and put the total proceeds into hard assets
 - d. Sell the bonds, put all the money into hard assets, and borrow additional money to buy more
8. Given the best and worst case returns of the four investment choices below, which would you prefer?
 - a. \$200 gain best case; \$0 gain/loss worst case
 - b. \$800 gain best case; \$200 loss worst case
 - c. \$2,600 gain best case; \$800 loss worst case
 - d. \$4,800 gain best case; \$2,400 loss worst case

9. In addition to whatever you own, you have been given \$1,000. You are now asked to choose between:
 - a. A sure gain of \$500
 - b. A 50% chance to gain \$1,000 and a 50% chance to gain nothing
10. In addition to whatever you own, you have been given \$2,000. You are now asked to choose between:
 - a. A sure loss of \$500
 - b. A 50% chance to lose \$1,000 and a 50% chance to lose nothing
11. Suppose a relative left you an inheritance of \$100,000, stipulating in the will that you invest ALL the money in ONE of the following choices. Which one would you select?
 - a. A savings account or money market mutual fund
 - b. A mutual fund that owns stocks and bonds
 - c. A portfolio of 15 common stocks
 - d. Commodities like gold, silver, and oil
12. If you had to invest \$20,000, which of the following investment choices would you find most appealing?
 - a. 60% in low-risk investments, 30% in medium-risk investments, 10% in high-risk investments
 - b. 30% in low-risk investments, 40% in medium-risk investments, 30% in high-risk investments
 - c. 10% in low-risk investments, 40% in medium-risk investments, 50% in high-risk investments
13. Your trusted friend and neighbour, an experienced geologist, is putting together a group of investors to fund an exploratory gold mining venture. The venture could pay back 50 to 100 times the investment if successful. If the mine is a bust, the entire investment is worthless. Your friend estimates the chance of success is only 20%. If you had the money, how much would you invest?
 - a. Nothing
 - b. One month's salary
 - c. Three month's salary
 - d. Six month's salary

Scoring:

1. a = 4; b = 3; c = 2; d = 1
2. a = 1; b = 2; c = 3; d = 4
3. a = 1; b = 2; c = 3; d = 4
4. a = 1; b = 2; c = 3
5. a = 1; b = 2; c = 3
6. a = 1; b = 2; c = 3; d = 4
7. a = 1; b = 2; c = 3; d = 4
8. a = 1; b = 2; c = 3; d = 4
9. a = 1; b = 3
10. a = 1; b = 3
11. a = 1; b = 2; c = 3; d = 4
12. a = 1; b = 2; c = 3
13. a = 1; b = 2; c = 3; d = 4

(Grable & Lytton, 1999)

Appendix B. Poker simulation

<i>hand</i>	<i>position</i>	<i>a</i>	<i>b</i>	<i>c</i>
73o	D	FOLD	CALL	RAISE
JTo	CO	FOLD	CALL	RAISE
J8o	MP	FOLD	CALL	RAISE
A2o	UG	FOLD	CALL	RAISE
K5o	BB	FOLD	CALL	RAISE
T6o	SB	FOLD	CALL	RAISE
96o	D	FOLD	CALL	RAISE
K7o	CO	FOLD	CALL	RAISE
42s	MP	FOLD	CALL	RAISE
Q5o	UG	FOLD	CALL	RAISE
T6s	BB	FOLD	CHECK	RAISE
K9s	SB	FOLD	CALL	RAISE
84o	D	FOLD	CALL	RAISE
Q9s	CO	FOLD	CALL	RAISE
T5o	MP	FOLD	CALL	RAISE
95s	UG	FOLD	CALL	RAISE
Q9s	BB	FOLD	CALL	RAISE
QTo	SB	FOLD	CALL	RAISE
T8o	D	FOLD	CALL	RAISE
55	CO	FOLD	CALL	RAISE
94o	MP	FOLD	CALL	RAISE
T8s	UG	FOLD	CALL	RAISE
KTo	BB	FOLD	CALL	RAISE
AJo	SB	FOLD	CALL	RAISE
J5o	D	FOLD	CALL	RAISE
82o	CO	FOLD	CALL	RAISE
Q3o	MP	FOLD	CALL	RAISE
53o	UG	FOLD	CALL	RAISE
AQo	BB	CHECK	RAISE	
53s	SB	FOLD	CALL	RAISE

Position:

D= DEALER

CO= CUT OFF

MP= MIDDLE POSITION

UG= UNDER THE GUN

BB= BIG BLIND

SB= SMALL BLIND

Appendix C. Socio-demographic questions

1. What is your gender?

Male

Female

Other

Prefer not to say

2. What is your current age in years?

Under 25

25-34

35-44

45-54

55-64

65-74

75 and over

3. What is your current employment status?

Employed Full-Time

Employed Part-Time

Seeking opportunities

Retired

Prefer not to say

4. What is your marital status?

Single

Not with family but living with significant other

With family (no children)

With family (1 children)

With family (2 children)

With family (3+ children)

5. What is the highest level of education you have completed?

Some High School

High School

Bachelor's Degree

Master's Degree

Ph.D. or higher

Trade School

Prefer not to say

6. Is your current or previous profession related to financial services?

Fully

Partially

Not at all

7. What is your household's approximate annual gross income before taxes?

Less than \$25.000
\$25.000 - \$49.000
\$50.000 - \$74.999
\$75.000 - \$99.999
\$100.000 or greater

8. Where is your home located?

Northern Europe
Southern Europe
North America
Central America
South America
Africa
Asia
Australia
Pacific Islands
Caribbean Islands
Other
Prefer not to say

Appendix D. Sample demographic

	<i>Frequency</i>	<i>Percent</i>
<i>GENDER</i>		
Male	61	0,938
Female	4	0,062
<i>AGE</i>		
Under 25	30	0,462
25-34	32	0,492
35-44	2	0,031
55-64	1	0,015
<i>FAMILY</i>		
Single	41	0,631
Not with family but living with significant other	20	0,308
With family (no children)	1	0,015
With family (1 children)	2	0,031
With family (3+ children)	1	0,015
<i>EDUCATION</i>		
Some High School	1	0,015
High School	10	0,154
Bachelor's Degree	21	0,323
Master's Degree	32	0,492
Ph.D. or higher	1	0,015
<i>INCOME</i>		
Less than \$25.000	26	0,400
\$25.000 - \$49.000	14	0,215
\$50.000 - \$74.999	12	0,185
\$75.000 - \$99.999	8	0,123
\$100.000 or greater	5	0,077
<i>LOCATION</i>		
Northern Europe	25	0,385
Southern Europe	35	0,538
North America	1	0,015
Central America	1	0,015
Asia	1	0,015
Other	1	0,015
Prefer not to say	1	0,015
<i>FIN. EXP</i>		
Fully	27	0,415
Partially	15	0,231
Not at all	23	0,354
<i>EMPOYMENT</i>		
Employed Full-Time	19	0,292
Employed Part-Time	6	0,092
Seeking opportunities	32	0,492
Retired	1	0,015
Prefer not to say	7	0,108

