Decision-making, uncertainty, Brexit and gender in financial markets: a pluralist approach

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The candidate confirms that the work submitted is her own and that appropriate credit has been given where reference has been made to the work of others.

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Abstract

This thesis examines two aspects of financial traders' behaviour, fundamental uncertainty and the role of gender, in order to provide a better understanding of financial markets' functioning. Particularly, it aims to develop a descriptive model of financial traders' decision-making under fundamental uncertainty based on their own experience and beliefs. Financial traders' interpretations of fundamental uncertainty and its sources are explored, as are the implications of traders' understandings for their decision-making. Additionally, the Brexit vote is studied as a paradigm case of financial uncertainty**.** Furthermore, gender differences and similarities are investigated on the trading floor, as well as social norms about female underrepresentation. This research is based on two rounds of semi-structured interviews (before and after the EU referendum) with UK-based financial traders in 2016, and a 2017 online survey designed to validate the interview results.

Financial traders acknowledge the presence of fundamental uncertainty in the markets: they describe it as unquantifiable and they view the future as not entirely predictable. In the face of these knowledge limitations, traders consistently identify risk and uncertainty as separate concepts. One key result of our before-and-after Brexit-vote interviews, consistent with previous Post-Keynesian research, is that traders recognise uncertainty as a key aspect of the market context they work in. Another result of our post-referendum evidence, however, challenges the conventional wisdom that enhanced uncertainty invariably forces traders to reduce their risk-taking: after a period of time, traders increase their risk-taking, even knowing that they are trading under conditions that remain uncertain.

Previous behavioural/psychological studies show that women tend to be more risk averse than men; by implication, increasing the proportion of women in financial governance could reduce financial instability. Moreover, this research challenges stereotypical beliefs about men's and women's behavioural characteristics and provides empirical evidence suggesting that there are social and institutional reasons behind female underrepresentation on the trading floor.

Table of Contents

List of Tables

List of figures

List of Abbreviations

Capital Asset Pricing Model: CAPM

Disaster Myopia Hypothesis: DMH

Efficient Market Hypothesis: EMH

Human Abilities and Characteristics approach: HAC

International Monetary Fund: IMF

Lehman Sisters' Hypothesis: LSH

Modern Portfolio Theory: MPT

Regression Equation Specification Error: RESET

Vector Autoregression: VAR

1. Introduction

1.1 The motivation of this research and its contributions

This thesis examines two aspects of the behaviour of traders in financial markets that are centrally important in these markets' functioning, but which have received little attention in the economics literature: fundamental uncertainty and the role of gender. Both uncertainty and gender have an impact on traders' everyday decision-making. Hence, there is a need for further investigation, in order to gain a more complete and realistic view of financial markets' functioning.

This research contributes to the Keynesian and Post-Keynesian theories of fundamental uncertainty by investigating psychological and decision-making theories, as well as by applying methodologies broadly used in these disciplines, also known as the descriptive models methodology. According to the Keynesian definition of fundamental uncertainty, which we also adopt, future economic events cannot be accurately forecasted by quantitative models; therefore, individuals have to adjust their decision-making process to potential surprises and unexpected events (Keynes, 1936). Decision-making is a strand of psychology which does not accept full rationality in human behaviour, it instead aims to improve human behaviour (Baron, 2007). The descriptive models methodology is broadly used in decision-making studies and it suggests the use of mixed methods (open-ended interviews, followed by closed surveys), in order to investigate how people behave, without making presumptions of their intellectual functioning and beliefs (Morgan et al., 2002). Despite the fact that fundamental uncertainty plays a central role in Keynesian and Post-Keynesian economics, contemporary literature lacks a definitive framework and a consensus about individuals' decision-making process in an uncertain environment. This research uses the descriptive models methodology in order to cover this gap in Keynesian and Post-Keynesian economics, and to investigate financial traders' decision-making under uncertainty on the trading floor based on their own experience.

This research also contributes to the feminist economic theories of decision-making in finance, which often focus on gender differences and they overlook the gender similarities on the trading floor. According to the Lehman Sisters' Hypothesis (Van Staveren, 2014), women tend to be more risk averse than men when making decisions, and therefore higher female participation in financial governance would lead to less risk-taking and a

more stable financial environment. This thesis explores both gender differences and similarities, as well as the social reasons behind female underrepresentation on the trading floor. The descriptive models methodology is used to examine all the relevant topics around low female participation on the trading floor, based on financial traders' opinion. Hence, new concepts emerge, further than risk aversion differences, which contribute to the contemporary literature.

1.1.2 Why does financial traders' decision-making matter?

Algorithmic trading may be popular in high frequency markets, but the role of financial traders remains important. The main function of algorithmic trading, also known as high frequency trading, is to execute trades based on complex algorithms in response to new data regarding price, volume, or other variables, in a very short period of time (Oxford Dictionary, 2014). Algorithms may be able to track profit margins much faster than a financial trader, but the complexity and uncertainty of financial markets limit the predictability of algorithmic models used by financial traders (DeBondt et al., 2010). As a result, financial traders' decision-making has a central role in financial markets' functionality and it should be investigated further.

Firstly, algorithms can only process numerical market-based data, while financial traders assess qualitative data alongside with their models, such as political events, scandals, mergers and acquisitions etc. Financial uncertainty rises from both market and non-market unexpected phenomena, therefore the ability to process qualitative information and the human intuition remain crucial skills on financial trading floors. Secondly, algorithmic trading uses past market data, and builds future price scenarios based on the assumption that the markets will continue generating past price patterns. According to the non-ergodicity principle by Davidson (2011), representative samples of past data do not necessarily give sufficient information about the system as a whole, and economic outcomes cannot be forecast accurately from past data, because reality is not governed by ergodic structures, such as fixed distributions of information. In this case the human analytical ability is necessary to assess new information and to take into consideration external factors, which may not be captured in past market data. Overall, given the high number of financial traders' on a global scale –a recent estimation suggests about 13.9 million online traders (BrokerNotes, 2018) - investigating their decision-making processes

under fundamental uncertainty is crucial in understanding how financial markets operate in volatile periods.

The descriptive models methodology was chosen to investigate financial traders' decision-making, due to its usefulness in understanding how people behave, without making presumptions of their intellectual functioning. Morgan et al. (2002) suggest that experts may know very little about public beliefs, peoples' knowledge and their needs. Experts, in our case economists, often make assumptions which could be misleading about the general population, based on their prejudgments (e.g. assumptions on rationality and preferences). The descriptive models methodology suggests the use of mixed methods under the scope of gathering initially qualitative data about individuals' beliefs and opinions, through interviews. At a later stage, a follow –up survey should be released in order to increase the sample size, to provide supporting evidence for the interview findings and to test their statistical validity (Morgan et al., 2002; Baron, 2007).

This study answers two research questions: firstly, how financial traders behave in an uncertain environment; and also what the gender differences and similarities are among financial traders. To answer them we built an open-ended interview protocol, which allowed the interviewees to express their own opinions and definitions, without leading them to specific answers. We also released a follow-up survey based on the interview findings, which allowed us to test for relationships among beliefs by applying the appropriate quantitative analysis. Both analyses were informed by the Post-Keynesian definitions of uncertainty, as well as by the feminist research on gender differences and similarities in financial decision-making.

1.2 Research questions

The established literature in economics fails to capture the complexity of individuals' decision-making under uncertainty. Its limited understanding of individuals' decision-making is expressed as a mathematically developed, yet an intuitively simplistic approach of ranking preferences. Particularly, Von Neumann and Morgenstern (1944) describe decision-making based on a utility maximisation framework, with a given set of preferences with respect to behavioural axioms, such as completeness, transitivity, continuity and independence. A rich literature on human behaviour, including behaviour

in financial markets, has been developed by both psychologists and behavioural economists. The literature of mainstream or "new" behavioural economics, however, uses the rational agent model of equilibrium-based economic theory as its point of departure. For example, any behavioural deviations from the rational agent model and market anomalies, such as underreaction and overreaction, are treated as short-term deviations from the equilibrium point that would be reached in the long-term by markets' invisible hand (Fama, 1998).

On the other hand, the Keynesian and Post-Keynesian economic theories of decision-making challenge the rational agent model by incorporating into their analysis the notion of cognitive biases. Individuals' decision-making is a logical process, rather than a strict mathematical maximisation problem. Hence unquantifiable, Keynesian fundamental or true uncertainty is different from quantifiable risk. Fundamental uncertainty is embedded in a reality where actions are driven by expectations, and it cannot be avoided or eliminated (Keynes, 1936). Similarly, the non-mainstream or "old" behavioural economics, which is founded on the bounded rationality theory (Simon, 1955; 1956), challenges the rational expectations theory and shares common ground with Post-Keynesian economics. It does not aim to model or forecast human behaviour; instead it considers human limitations into decision-making processes.

We show through a pluralistic literature review that despite the embedded realism of Keynesian and Post-Keynesian economics, the field lacks a consensus about individuals' decision-making process under fundamental uncertainty. Especially in financial markets, the focus is on institutions, rather than individuals' reactions. One reason is the lack of empirical evidence, which could support the Keynesian theories of fundamental uncertainty. This gap is covered by this research, which answers the question: **How do financial traders behave in an uncertain environment?** To answer this question, we provide empirical evidence and we test the Keynesian theories of fundamental uncertainty, by interviewing and surveying financial traders, following the descriptive models methodology. Moreover, we investigate how a real-world example of fundamental uncertainty, the EU referendum as defined by the interviewees, impacted financial traders' decision-making in a follow-up analysis chapter.

While Post-Keynesian economics suggests that financial markets are unstable due to fundamental uncertainty, and also asserts that the impact of uncertainty on financial traders' expectations is crucial, it pays little attention to the role of gender on decision-making under uncertainty. This contrasts with mainstream economics which suggests that financial performance may benefit from greater gender diversity in financial governance (Francoeur et al., 2008; Campbell and Minguez-Vera, 2008). This conclusion on the part of mainstream economics remains problematic because it focuses on financial profitability rather than financial stability and gender equity. The latter gap is covered by feminist economics. Due to the fact that women's and men's decision-making under financial uncertainty differs, the Lehman Sisters' Hypothesis (Van Staveren, 2014) suggests that higher female participation in financial governance would lead to less risk-taking and greater financial stability. These gender differences, though, are often based on inconclusive empirical evidence about greater female risk aversion. Nelson (2014; 2018) suggests that researchers should focus more on gender similarities rather than differences. We adopt this approach to investigate: **What are the gender differences and similarities among financial traders?** To answer this question, we interviewed financial traders' and we asked their opinions about behavioural and institutional reasons behind the low female participation on the trading floor.

1.3 Methodology

Due to the lack of applied research in the Post-Keynesian theories of uncertainty, and to the limited data on gender differences and similarities among financial traders, there is a need for primary data collection. The descriptive models methodology allows us to investigate financial traders' beliefs without making presumptions on the topics they want to raise with regard to the questions under research. A descriptive model is derived by the two rounds of open-ended interviews with financial traders, covering questions on gender and uncertainty. A confirmatory follow-up survey was released a year later, based on the interview analyses. The survey analysis is used to update the descriptive models with the latest findings. The interview and survey analyses were informed by the Post-Keynesian definitions of uncertainty, as well as by the feminist research on gender differences and similarities in financial decision-making.

Two waves of open-ended, semi-structured, telephone interviews were conducted in 2016 covering the topics of decision-making under uncertainty, decision-making after the Brexit referendum and the role of gender in financial trading. Wave 1 interviews took place between February and May 2016, while the same group of interviewees was approached in wave 2 interviews, which took place after the Brexit referendum (June 2016), between August and October 2016. We called the interviewees from the University of Leeds, Business School phone room. These interviews allowed financial professionals to reveal their opinions for the topics under discussion, and they are used to construct appropriate descriptive models around human behaviour and social norms in finance. A follow-up online survey -wave 3- was released in June 2017 and was completed on the 28th of July 2017, answered by financial traders. The survey was based on the interview findings, and it aimed to increase the sample size, to provide supporting evidence for the interview findings and to test their statistical validity.

1.4 Outline of the dissertation

This PhD thesis is structured as follows. Chapter 2 presents a pluralistic literature review which criticises the established view on decision-making in financial markets, starting with the foundations of this research area, the rational agent model. It also presents the role of gender in the mainstream economics, and it defines and explores the psychological and decision-making studies and their methods. The second part of the chapter presents the non-mainstream, Keynesian and Post-Keynesian literature on fundamental uncertainty and decision-making, as well as the feminist economic view on female underrepresentation in finance. Moreover, this pluralistic literature review distinguishes between the mainstream, “new” behavioural economics and the non-mainstream, “old” behavioural economics, as the latter shares common theoretical foundations with the Keynesian and Post-Keynesian theories of fundamental uncertainty. The theories are discussed, compared and criticised in order to show the literature gaps that are covered by this thesis.

Chapter 3 presents the methodology employed to answer the research questions, and why this method was chosen. Chapter 4 is the first empirical chapter, which answers how financial traders behave in an uncertain environment. Particularly, it presents the interview and survey results, followed by their contributions to the literature and the

conclusions. Chapter 5 and 6, the second and third empirical chapters, answer how financial traders behaved after the announcement of the Brexit vote and what the gender differences and similarities are among financial traders, respectively. Lastly, they follow the same structure as chapter 4. Chapter 7 presents the conclusions and the contributions of this thesis, as well as the policy implications and future research suggestions.

2. Literature review

2.1 Introduction

The instability of financial markets has a negative impact on the real economy and as a result on governments' economic policies. For this reason, it is important to gain a better understanding of financial markets' functionality and instability, especially when events of uncertainty occur and market vulnerability rises. We discussed in chapter 1 that despite the fact that algorithmic trading is rising, financial traders' decision-making, their investment movements and strategies drive the market's prices and psychology. While algorithmic trading models have the advantage of reacting in milliseconds to new information that enters the market, the assessment of this information is limited, compared to human traders who process this information by taking into account both the quantitative data and the qualitative information. Especially when financial uncertainty rises, the capability of understanding the causes and the potential outcomes of surprise events is vital. Also, algorithmic trading models only use market data, while financial traders incorporate the effect of non-market uncertainties in their investment strategies, for instance major political events. Hence, understanding financial traders' decision-making uncertainty is crucial for understanding how financial markets perform.

The established-mainstream view on decision-making under uncertainty in economics is described as a utility maximisation process: the rational agent model and the rational expectations literature (Von Neumann and Morgenstern, 1944). This literature is enhanced by the "new" behavioural economics, which challenges the assumptions of full rationality and well-defined preferences (Shiller, 2006), but still focuses on modelling human behaviour. Finance theory incorporates into its analysis the notion of measurable uncertainty, with the extended use of vector autoregressive models (Jurado et al., 2015). Lastly, the role of gender in financial governance is examined in relation to firms' financial performance by mainstream economists, but the empirical evidence is contradicting (Francoeur et al., 2008; Campbell and Minguez-Vera, 2008).

Behavioural economics is a subdiscipline of economics, while psychologists in decision-making studies also have addressed concerns about the rational agent model. Behavioural finance, a subdiscipline of behavioural economics examines traders' decision-making

process in financial markets, but it remains an equilibrium-focused analysis (Glaser et al., 2004). Psychological studies though, also known as decision-making studies, approach the same topic from a different perspective, using a different methodological structure. Particularly, they accept that full rationality cannot be achieved, but there are ways to improve humans' decision-making (Baron, 2007).

On the other hand, Keynesian and Post-Keynesian economic literatures reject the established view, and suggest an alternative narrative of decision-making under fundamental uncertainty, driven by animal spirits and social conventions (Keynes, 1936). While the established view in behavioural economics remains an equilibrium-focused approach, there is a strand in the field which is compatible with the pluralism of non-mainstream economics, the so-called "old" behavioural economics (Dow, 2008). The description "old" is irrelevant to the timeframe of the research, and it refers to the literature which is not theoretically and methodologically influenced by the mainstream economic analysis. Moreover, we conclude that the "old" behavioural economics examines cognitive limitations in computational capabilities, while the "new" behavioural economics focuses on modelling behavioural deviations from the rational expectations.

Despite the fact that Keynesian, Post-Keynesian and "old" behavioural economics provide a more realistic framework of individuals' and groups' decision-making process compared to the established view, these schools of thought are often gender-blind. This is a critique from another strand of non-mainstream economics, the feminist economic literature. Social structures and behavioural processes are gender influenced, based on feminist economics, due to gender inequality. Different genders face different challenges and uncertainties in their working environments, in which they are asked to make decisions, therefore their decision-making processes may deliver different outcomes (Van Staveren, 2010a).

Feminist economics can contribute to the Post-Keynesian economics by highlighting gender biases of economic processes, and decision-making under fundamental uncertainty is often suggested by feminist economist as an area of pluralistic research (Van Staveren, 2010a; Visano, 2016). "Old" behavioural economics could also benefit from feminist and Post-Keynesian economics, while the "new" behavioural economics on risk aversion differences among men and women is also criticised (Nelson, 2014; 2018).

Consequently, both the established and critical literatures and schools of thought are discussed, contrasted and criticised, with a focus on decision-making under uncertainty in financial markets.

2.2 The established view

2.2.1 Decision-making in mainstream economics: the foundations

The rational agent model, the foundations of mainstream economics, presents individuals' decision-making as a mathematically developed approach of ranking preferences. Von Neumann and Morgenstern (1944) describe individuals' decision-making as a utility maximisation process, and in the case of entrepreneurs' as a profit maximisation one. The economic agents behave on a rational basis, they depend on their knowledge and they fully understand their available paths of choice. These quantifiable relationships enable the two economists to develop a theory of economic behaviour based on "games of strategy", fully described by mathematical functions. Their theory of games builds on a given set of preferences with respect to behavioural axioms, such as completeness of preferences, transitivity, continuity and independence. This rational agent, *homo economicus*, is also a representative individual, which allows the aggregation of the individual functions of the economic participants, and therefore the shift from microeconomic to the macroeconomic analysis. The last assumption of the rational agent model ensures that a great number of agents will lead to perfect competition, because through aggregation, the influence -and power asymmetries- of each participant will become negligible.

Von Neumann and Morgenstern (1944) accept that their theory does not provide a universal system of economic theory. Their work has been criticised for the absence of the human element from its analysis, such as the psychological factors which cannot be captured by mathematical maximisation exercises. Despite the fact that they accept that modelling has been used in economics in an exaggerated manner and not always with a great success; they defend their work by comparing the use of mathematics in economics, with its use in other positive sciences, e.g. in physics, chemistry and biology. We may conclude that the fathers of rational expectations theory perceive economics as a positive science, rather than as a social one.

An extension of the rational expectations model in financial markets is the Efficient Market Hypothesis (EMH). Fama (1969) suggests that the scope of the capital market is the efficient allocation of capital stock ownership. This can be achieved under the assumption that market prices fully reflect all the available information on individuals' preferences. There are three forms of the EMH; the weak form holds when only the historical prices are available, the semi-strong form appears when prices adjust for other publicly available information such as announcements on companies' annual earnings, and the strong form rises when there is monopolistic access to any private information related to price formation. Market anomalies and behavioural deviations from the rational choice model, such as under- and over-reaction to news, are treated as short-term deviations from the equilibrium point that would be reached in the long-term by markets' invisible hand. Additionally, the long-term return anomalies may occur due to methodological mistakes, and most of them tend to disappear with reasonable changes in analytical techniques (Fama, 1998).

2.2.2 The role of risk and measurable uncertainty in finance

Financial theory describes individuals' decision-making on the trading floor as an analysis of acceptance or rejection of investment projects; under the goal of value-creation for the owners instead of profit maximisation, as the Von Neumann and Morgenstern model suggests. The most influential theories in financial literature, with regard to decision-making, are the Modern Portfolio Theory (MPT) by Markowitz (1952) and the Capital Asset Pricing Model (CAPM) by Ross (1976), which builds on the former. Both theories assume that investors are risk averse and they have homogeneous expectations, formed based on the same data about price movements and other publicly available information.

The Modern Portfolio Theory (Markowitz, 1952) suggests that the analysis of investment portfolios considers the expected return and risk of an individual asset, as well as their interrelationship as measured by correlation. Particularly, traders maximise the expected returns of a financial asset, but also the volatility of the security's return (variance of return) and they minimise the interrelationship between the individual securities (covariance and correlation of returns). According to the Capital Asset Pricing Model (Ross, 1976), financial traders have to decide the optimal combination between undertaking risk and the expected return on it, and based on these judgments they are creating a portfolio

of securities to hold. Specifically, individuals will only hold assets if their expected return compensates for their risk, to achieve an efficient portfolio, assuming that the prices clear the markets of all assets. Therefore, firms use financial derivatives to reduce the unwanted portions of risk exposure, also known as hedging. The total risk of an individual security has two components, the unsystemic risk which can be reduced through diversification, and the systemic or market risk which cannot be reduced. The systemic risk which cannot be reduced is often interpreted as "noise" in financial markets generated by inexperienced traders, which keeps prices away from their fundamental values (Fox, 2009).

As for uncertainty, it is often distinguished from risk in financial literature, it is measurable and it occurs because of external and unexpected economic shocks. The standard view on measuring uncertainty is the use of vector autoregression models. Jurado et al. (2015) provide direct econometric estimations of time-varying macroeconomic uncertainty, particularly an 11-variable monthly macro, vector autoregression (VAR) model. They define uncertainty as a function of the conditional volatility of future values' disturbance, which is unforecastable from an economic agent based on the available information, subject to constant expectations. Macroeconomic uncertainty is constructed by aggregating the individual uncertainty functions, adjusted from individuals' weights.

Quantitative, uncertainty proxies are also used broadly, to calculate macroeconomic uncertainty risk in financial literature. For example, Baker et al. (2016) develop an index of economic policy uncertainty, and they use a VAR model for 12 major economies. They use these measures to investigate the relationships between policy uncertainty and stock price volatility, investment rate and employment growth. Particularly, for the US they test the periods of presidential elections, the Gulf Wars I and II, the 9/11 attacks, the bankruptcy of the Lehman Brothers and other uncertain events. They conclude that uncertain shocks are linked with negative economic effects.

2.2.3 Gender and decision-making in finance; the established view

Homo economicus and the rational agent model are gender-blind, but gender may play an important role in decision-making in finance. There is supporting evidence that financial performance may benefit from greater gender diversity in financial governance (Francoeur et al., 2008; Campbell and Minguez-Vera, 2008). Research about the role of gender in the established literature focuses on the relationship between gender diversity

in firm governance and performance on a macro-level, as well as in gender differences in financial literacy for financial consumers. The literature suggests that greater diversity on financial governance may promote a better understanding of the financial customers' needs, and it increases innovation in leadership, such as problem-solving and decision-making (Campbell and Minguez-Vera, 2008). Financial literacy, on the other hand, is linked with high cost of borrowing, excessive exposure to debt and misjudgements about someone's debt position (Almenberg and Dreber, 2011). For the purposes of this research, which is the investigation of traders' decision-making under uncertainty on the trading floor, we focus on the role of gender in financial governance, since financial traders should suffer from financial illiteracy given their high educational background.

Francoeur et al. (2008) test whether the higher female participation on firms' boards of directors and management improves the firms' financial returns. They built their research on the mainstream literature of evaluation of risk in finance, specifically on the Fama and French valuation framework (1993), which develops further the Capital Asset Pricing Model. Their analysis focuses on the 500 largest Canadian financial firms, and they capture financial risk by firms' beta, the market-to-book ratio and the forecasts on standard deviation, as the established literature suggests. The authors conclude that higher female participation in financial firms' management and operation does generate a positive and significant impact on their stock-market returns. They also suggest that their results support policies that promote female leadership in financial governance.

Campbell and Minguez-Vera (2008) use panel data analysis to test the relationship between gender diversity on corporate boards and firms' financial performance in Spain. Changes in Spanish legislation aim to improve gender equality of opportunities, in a market with historically low female participation in the workforce. The female representation in their work is captured by a dummy variable for gender indicating one or more female directors, and by two indices of gender diversity. After testing the causality between better gender balance on financial governance and economic gains, they found a positive relationship between gender diversity on board and the firms' performance.

In contrast, other research shows that gender diversity on the board committees may not have an impact on financial firms' performance. Carter et al. (2010) examine the impact of the inclusion of women and ethnic minorities on the board of directors, on the asset

returns of a selection of US financial institutions. Their regression analysis shows that no significant relationship exists between gender and racial diversity of boards and firms' profitability, either positive or negative. They suggest though that gender and race diversity is still desirable, but for criteria other than the firms' financial performance.

Similarly, Dalton et al. (1998) provide a meta-analysis of 54 empirical studies of board composition, analysing the relationship between gender and firm performance. They test two indicators of gender diversity, related to board composition and leadership structure, while the firm's performance is evaluated by accounting and market-based indicators. They use a Pearson Product Moment Correlation analysis to identify if any relationships exist, regardless of causality. They conclude that there is no significant relationship between board composition and the firm's performance, as well as no significant relationship between board leadership structure and the firm's performance. Overall, female representation on a firm's board is not related to its financial performance.

2.2.4 Decision-making in behavioural finance

Besides gender, decision-making limitations may also have an impact on financial performance. Behavioural economics aims to provide a more realistic approach by incorporating into its analysis individuals' decision-making limitations. Behavioural finance is a subdiscipline of behavioural economics, which aims to make use of these assumptions of the fragile human capacity, in order to contribute to the field of finance. Glaser et al. (2004, p. 527) define behavioural finance as:

"A subdiscipline of behavioural economics (…), which incorporates findings from psychology and sociology into its theories. Behavioural financial models are usually developed in order to explain investor's behaviour or market anomalies, when rational models provide no sufficient explanations."

Here, we focus on behavioural finance, as this research aims to investigate decision-making on the trading floor.

According to DeBondt et al. (2010), behavioural finance investigates decision-making in financial markets and contributes by taking into account the fragile human intuition, decision-making processes and relevant personal beliefs, in order to describe how decisions are made by all kind of investors. Behavioural finance employs a range of

methods, from ethnographic research to experiments. The complexity and uncertainty of financial markets limit the predictability of algorithmic models used by financial traders, and therefore they suggest an interdisciplinary approach in teaching finance, as opposed to the Catholicism of mathematical models.

Despite the fact that Glaser et al. (2004) and DeBondt et al. (2010) promote an interdisciplinary agenda in behavioural finance, the vast majority of research undertaken in this field focuses on whether and how short-term deviations from equilibrium prices can be explained by traders' overreaction to news (Werner et al., 1985; Peteros and Maleyeff, 2013)**.** This equilibrium-focused analysis is not entirely different from finance theory, because it may not accept the condition of full rationality, but it still treats behavioural biases due to uncertainty as short-term, market anomalies. This literature, as we will further explain in section 2.3.3, is known as the "new" behavioural finance.

For example, Werner et al. (1985) investigate the behavioural hypothesis of traders' overreaction to earnings and the temporary movement away from fundamental values (equilibrium prices) in stock markets. They estimate 120 monthly-adjusted excess returns and they build arbitrage portfolios, analysed with Ordinary Least Squares regressions. They detect a systematic stock price reversal, when past losers significantly outperform past winners. They conclude that their results are inconsistent with the CAPM and individuals have a tendency to overreact to recent information and underweight base-rate data.

Peteros and Maleyeff (2013) also challenge the assumption of full rationality, and use historical stock market returns, the S&P 500 price index, to show the impact of traders' irrational decision-making on their performance. They build a simulation model to mimic investment periods of 5, 10, 15 and 12 years, respectively. They find that extended periods of higher or lower volatility existed and that daily price movements do not justify investment strategies driven by recent trends and short-term changes. These movements can only be explained by traders' overreaction to news. Therefore, the reason for market disequilibrium is the traders' limited capacity to assess new information, resulting in financial underperformance.

2.2.5 Psychological and decision-making studies

Decision-making is a strand of psychology, it does not accept full rationality in human behaviour, and it is distinguished from behavioural economics and behavioural finance for two reasons. Firstly, decision-making studies aim to improve human behaviour, as opposed to mainstream economics whose purpose is to model and forecast individuals' and market's behaviour. Secondly, in order to achieve the improvement of human behaviour, decision-making studies follow a specific methodological structure, a three-step protocol. This methodological structure is presented in one of the most influential books in the field, *Thinking and Deciding* by Jonathan Baron (2007). We present Baron's work for a detailed analysis of decision-making studies.

Decision-making studies are field-based projects, which aim to improve human behaviour. According to Baron (2007) they follow a three-step protocol, constructed by three models. The descriptive, the normative and the prescriptive models. The descriptive model aims into analysing individuals' behaviour as it takes place, how and why people normally think in this way. The descriptive model is constructed by observing individuals' behaviour in real circumstances, i.e. by conducting interviews and surveys. The normative model presents the ideal ways in which people should think and act, and it defines the best thinking for achieving someone's goals. The normative model is defined by experts in a field, e.g. in mainstream economics that would be the rational expectations theory. Lastly, the prescriptive models provide an analysis of how the individuals could move from the way they think towards the ideal way of thinking and deciding, and their aim is to help people make better decisions. Therefore, following the previous example, the prescriptive model would provide guidelines to individuals in order to behave in a rational way, as defined in mainstream economics. Improvement of decision-making does not only take place in the field of economics, but also in other research areas, such as consumers' behaviour, health policy evaluations etc., (Krishnamurti et al., 2012; Bruine de Bruin et al., 2007), where psychologists build a communication bridge between the experts and the non-expert population.

This thesis synthesises a descriptive model of financial traders' behaviour under circumstances of fundamental uncertainty. The use of descriptive models is useful in understanding how people behave, without making presumptions of their intellectual

functioning, namely assumptions about preferences (Baron, 2007). On the other hand, this thesis rejects the use of a normative and a prescriptive model, as this research does not imply that there is a pre-existing and ideal decision-making process for financial traders. To the contrary, it follows an open system, not a strictly mathematical analysis of fundamental uncertainty, where the future is not predetermined and therefore individuals need to adjust their decision-making process to potential surprises and unexpected events.

2.3 The critical view

2.3.1 Keynesian and Post-Keynesian theories of fundamental uncertainty

In the established view, human behaviour is always portrayed in a closed system analysis, presented through mathematically consistent models. Behavioural assumptions are set up to serve modelling closure and equilibrium of prices, rather than to describe in a realistic way individuals' decision-making process. Additionally, these literatures (mainstream economics, finance theory, and the mainstream or "new" behavioural finance) do not aim to explain the systemic and persistent inequalities between classes, genders, races etc. Psychological and decision-making studies provide a platform and a methodological structure that allows a better understanding of human behaviour, but not necessarily economic behaviour.

On the other hand, Post-Keynesian economics incorporates into its analysis the role of fundamental uncertainty in economic decision-making, and departs its macroeconomic analysis from the strictly defined microeconomic foundations, i.e. perfect knowledge and well-defined and constant preferences. Despite the fact that Post-Keynesian economics provides a macroeconomic theory explaining persistent inequalities under capitalism, it lacks an analytical framework that can explain individuals' decision-making process under fundamental uncertainty. This is especially the case for decision-making processes in financial markets; this thesis' principal contribution to Post-Keynesian economics is precisely to advance understanding of this latter topic.

Fundamental uncertainty in Keynesian economics is defined as the unforeseen future events, which cannot be forecasted by mathematical models, it is unmeasurable and different from risk. Therefore, the dominance of quantitative models to predict the

market movements is of limited usefulness. On the contrary, decisions under fundamental uncertainty are not the outcome of multiplying a weighted average of utilities by probabilities in quantitative terms. They are driven by animal spirits which make up for the lack of knowledge and confidence in the knowledge (Keynes, 1936, p. 161).

In *The General Theory* it is discussed how economic agents perceive fundamental uncertainty and form expectations, which play a key role in their behaviour (Keynes, 1936, ch.12). Specifically, it is the entrepreneurs' short-term expectations about their expected profit that dictate their decisions about production levels; while they also form long-term expectations about the general economic environment. The long-term expectations depend both on the forecasts about future events and economic agents' confidence. Confidence is defined as "how highly we rate our likelihood for our best forecast turning out wrong" (p.148), and it depends on agents' existing knowledge, which might be insufficient for accurately calculating mathematical expectations. Subsequently, future is uncertain and it cannot be perfectly predicted. Additionally, the time gap between the moment of decision-making and the outcome of the choice is a source of uncertainty, due to the unforeseen changes which might occur in the meantime.

Dymski (1993) underlines the theoretical differences between Keynesian uncertainty and asymmetric information, in order to distinguish unmeasurable uncertainty from measurable risk. In the mainstream economic theory, the world is governed by stochastic processes with known and stable probability distributions, which are independent by individuals' actions. Therefore, these risks can be diminished by aggregations across homogeneous and rational agents or by repeated draws over time. On the contrary, Keynesian uncertainty is distinguished from any probabilistic concept, because real-world phenomena are not governed by stable probability distributions. To start with, there is a lack of costless information about the "true" state of economic activities –a key assumption of the rational agent model. Simultaneously, although agents' decisions have an impact on the final outcomes, yet they cannot be fully aware of its extent. Furthermore, systemic risk cannot be entirely eliminated, as finance theory suggests, because the economy does not have specific and well-defined parameters. Hence, uncertainty cannot be quantified or modelled, as opposed to risk.

Dow (2004) raises her concerns about modelling financial uncertainty and its role in monetary policy making, under the scope of price stability. She accepts the definition of unquantifiable, Keynesian uncertainty and she distinguishes it by the three following types of modelling uncertainty. Firstly, the additive uncertainty can be measured by the variance of the error terms, and it stands for the randomness in nature and the availability of information. When the sample is representative and random, we may assume that additive uncertainty is reduced, as long as the mean of the error terms is as close as possible to zero and without serial correlation among them. Secondly, the multiplicative or parametric uncertainty is measured by the variance of the parameters, and it rises due to structural changes, for example changes in financial structure. Thirdly, the model uncertainty is measured by the spectral density of the non-random error term, and it is the uncertainty about whether the right model is used in monetary policy. The fourth type is the Keynesian uncertainty or model uncertainty, which is the unmeasurable and fundamental uncertainty. Given that there is a variety of model-uncertainties, the author concludes that monetary policy should not be dictated by a single model. On the contrary, there is a need for methodological pluralism and involvement of human judgment.

Shackle (1972) also rejects the use of probabilistic measurements in entrepreneurial decision-making. According to him the list of potential outcomes, as a result of the entrepreneur's choices, cannot be complete in principle. The entrepreneur's decision will shape the future state of the world, hence he/she cannot hold this knowledge in advance. Particularly he describes economic decisions as unique experiments, whose circumstances will differ once they take place (1949, p.6). Therefore, decision-making is non-replicable, because of the continuous changing environment in which individuals take actions.

In *Expectations in Economics,* Shackle (1949) describes expectations as the anticipation of an imagined future situation, which individuals treat as equivalent to an actual future event, although it may not occur. This prediction has two basic characteristics; it is treated as if it is happening, and it depends on the degree of someone's belief that it will happen. This description of expectations develops into a focus-on-values conception, in which individuals make decisions based on judgments about future gains and losses. Individuals' focus on future gains reveals their desirability of the expected outcome, while their focus on loss possibilities is linked with their potential surprise. In the meantime, there is a range

of possible choices between these two marginal points of gains and losses. These alternative choices are weighted by individuals' degree of potential surprise, rather than mathematical probabilities. The investor might use specific mathematical or numerical probabilities, but he/she can also classify his/her choices as "practically impossible", "unbelievable in prospect" or "perfectly possible", although he/she may not have made a final decision (Shackle, 1979). This raises the infinite regress problem, which paralyses the investor and prevents him/her from making a decision. Uncertainty, for example, can be taken as a paralysing force and can lead individuals into holding greater liquidity.

According to the non-ergodicity principle by Davidson (2011), representative samples of past data do not necessarily give sufficient information about the system as a whole, and economic outcomes cannot be forecast accurately from past data, because reality is not governed by ergodic structures, such as fixed distributions of information. Mainstream economics assumes that future outcomes of economic processes can be forecasted by suitable calculations, using available data from the recent past. In contrast, the Post-Keynesian theory suggests that economic outcomes cannot be forecasted accurately from past data, because reality is not governed by ergodic structures, such as fixed distributions of information. Forecasting economic variables based on an analysis of past data, even if these samples are extended enough to be characterised as representative, implies a hidden assumption; that the real variables, and as a result the reality, follow a specific probability distribution. The non-ergodicity principle rejects this assumption and therefore individuals are incapable of optimising intertemporal rational choices.

On the other hand, O'Donnell (2015) criticises the non-ergodicity axiom for not allowing agents to obtain knowledge of the relevant states and for interpreting probabilities as knowledge. Based on the Human Abilities and Characteristics approach, human knowledge is limited, the future is unknown and there is only incomplete information about the past and the present. Decision-making though is independent of the non-ergodicity principle, because even under fundamental uncertainty, individuals still adopt strategies to cope with the uncertain future and they seek for as much rationality as the situation allows.

Overall, we may conclude that the mainstream economic theory on individuals' behaviour can be interpreted as a special case of decision-making when there exists a well-defined

probability distribution, with a known and complete set of possible future outcomes, but it is not the general case.

2.3.2 Decision-making under fundamental uncertainty

Once fundamental uncertainty is defined, it is also important to investigate decision-making in financial markets and how it is influenced by the unforeseen future. Financial markets are highly uncertain and unstable due to the fast movements of capital flows, which lead to unexpected price fluctuations. Financial fragility has a negative impact on real economic activity as well. Therefore, financial decision-making under fundamental uncertainty needs to be investigated further. In Post-Keynesian economics it is examined from a macroeconomic point of view, with a focus on market sentiments. Despite the rich theoretical framework, this analysis is missing a focus on individuals' perceptions of uncertainty and their reactions to it, on the trading floor, which is the contribution of this thesis.

In the Post-Keynesian tradition, the environment in which the individuals act and make decisions also has an impact on their behaviour. For Keynes (1936, p. 161) decisions are not the outcome of multiplying a weighted average of utilities by probabilities in quantitative terms, but they are driven by animal spirits which make up for the lack of knowledge and confidence in individuals' knowledge. Animal spirits are defined as the spontaneous urge to action under surprise, rather than inaction. They should be considered as a social and cultural macro-phenomenon, with respect to fluctuations in spontaneous optimism and uncertainty perceptions (Dow, 2014). For example, decision-making in financial markets is heavily influenced by the changing degrees of optimism/pessimism and individuals' perception of uncertainty.

When individuals shape their expectations, they do not make choices only based on their personal beliefs. They incorporate the average opinion of the final outcome into their decisions, in an attempt to make the right guess about the future. In stock markets, for instance, traders do not only depend on their opinion about future prices; they also need to incorporate into their analysis other traders' expectations on future values, because the latter influence the market's movements. This psychological phenomenon is known as the beauty contest paradigm (Keynes, 1936, ch.13).

In this unpredictable world, individuals follow the pre-existing social norms to cope with uncertainty and to be able to make choices. When economic processes span over a long period of calendar time, individuals deal with uncertainty by following social conventions, binding nominal contractual commitments and social contracts, which are learned by participating in social practice (Keynes, 1930; 1936). People tend to trust conventional judgements rather than themselves, because they prefer to follow the better-informed masses. For example, money is a contractual mean of exchanges and a mean to store value in an uncertain world. Therefore, fundamental uncertainty leads people to hold more liquidity as a mean of security, also known as liquidity preference (Keynes, 1936). Social conventions can also be misleading. An example of social conventions as a way to cope with uncertainty is financial inclusion of racial minorities, where race is treated as a signal of potential lack of lenders' creditworthiness (Dymski, 1993).

Another influential theory about decision-making in finance is Minsky's Financial Instability Hypothesis (1992) about endogenous fragility of financial markets, according to which the creation of financial bubbles is related to forming expectations under uncertainty. Over long periods of economic prosperity, financial institutions shift from stable financial relations to instability, by overexposing themselves to excess risk. During these periods of economic expansion, investors' growing tendency to reduce their expectations of risk paradoxically leads them to higher exposure to it. Their expectations are driven by overconfidence, which creates a sense of euphoria in the market. At this stage, investors' excitement quickly becomes mania around increasing asset prices, which reinforces their propensity to engage in speculative investments. In this inflationary state, and while asset prices diverge from their real value, regulatory authorities may choose a contractionary monetary policy to meet their inflation targets. As a result, speculative investments could turn into Ponzi units, as their initial net value starts to decrease. Finally, mania gradually turns into anxiety, investors start selling their assets, which pressures the prices further down, and may result in a collapse of asset values.

On the trading floor, Earl (1990) describes speculators as the traders who do not use long-term information about demand and supply conditions, as financial theory suggests, but as the ones who predict better the behaviour of the rest of the investors and the average opinion. They buy assets whose price is rapidly rising and they decide to sell them when

they believe another asset can play this role. Price instability driven by speculative movements makes it difficult for long-term investors to value financial assets based on their performances, and it can become a threat to the genuine enterprise. Speculators' investment movements influence market psychology and perception of future prices, and as a result, self-fulfilling expectations are promoted by their herd behaviour. In this case, the best decision-making strategy is to have a list of possible future outcomes, given that the market may be surprised by unanticipated events.

2.3.3 "Old" versus "New" behavioural economics

Keynesian economic theory relies heavily on psychological insights, and it has defensible behavioural foundations on agents' behaviour and their judgments in the real and uncertain world. Paul Davidson claims that behavioural economics can potentially benefit from the pluralism and realism of the Keynesian and Post-Keynesian literatures (2011). Similarly, Jefferson and King (2010) support that Post-Keynesian economics could benefit from behavioural economics' methodological aspects in the following three ways. Firstly, behavioural economics could enhance the realism of the Post-Keynesian theory by providing supporting evidence to their fundamentals. Secondly, behavioural economics could enhance the microeconomic foundations of the Post-Keynesian theory. Lastly, Post-Keynesian empirical research could adopt some of the research methods usually applied by behavioural economists at a micro-level (individual-level) and meso-level (institutional-level) analysis.

On the other hand, some scholars raise objections to a potential engagement between Post-Keynesian and behavioural economics. Especially, in the research area of behavioural finance, some of the topics under discussion are often criticised and rejected by the Post-Keynesians. For example, Barberis and Thaler (2002) examine why individuals fail to rationally incorporate new information and to make consistent rational choices. Particularly, under the scheme of maximising their excepted utility, they search individuals' cognitive errors that affect market prices and exhibit inefficiency. These psychological biases are treated as behavioural deviations from the rational expectations theory. Given that utility maximisation is rejected by Keynesian theory, Barberis' and Thaler's work would be of limited use for an interdisciplinary attempt.

To overcome this criticism, Post-Keynesians distinguish between "old" and "new" behavioural economics (Dow, 2008). "Old", or non-mainstream, behavioural economics builds on Herbert Simons' bounded rationality theory (1955; 1956), which challenges the rational expectations model, as well as on other theories that diverge from the equilibrium-focused analysis of the mainstream economics. "Old" behavioural economics is the recommended area for pluralistic research with Post-Keynesian economics, because of their fundamental similarities. Both traditions are open system analyses, unconstrained by unrealistic behavioural assumptions. Post-Keynesian economics underlines the importance of fundamental uncertainty in decision-making, while "old" behavioural economics emphasises individuals' cognitive limitations in the same process. Both theories aim to understand human behaviour, rather than to model it and forecast the future.

"New", or mainstream, behavioural economics develops the rational expectation theory of mainstream economics, while "new" behavioural finance is described by Shiller (2006) as "not wholly different from neoclassical finance". The "new" tradition shares the same foundations with the established view on decision-making in economics. It is a closed system analysis and it focuses on how decision-making deviates from the rational expectations model. "New" behavioural economics relaxes the strict, microeconomic assumptions about preferences and perfect knowledge, but it remains an equilibrium-focused and utility maximisation theory. These mainstream foundations of the "new" behavioural economics are incompatible with the open system analysis of the Post-Keynesian economics, therefore a potential collaboration between the two is not suggested.

"Old", non-mainstream, behavioural economics

"Old" behavioural economics is founded on the bounded rationality theory by Simon (1955; 1956) which challenges the rational expectations theory and shares common ground with the Post-Keynesian economics. It does not aim to model or forecast human behaviour. Instead, it considers human limitations into decision-making. Another influential theory is the Disaster Myopia Hypothesis, by Guttentag and Herring (1986), which expands the "old", non-mainstream behavioural analysis on financial markets.

By assuming utility maximisation, mainstream economic theory intends to predict someone's choices, but it does not consider individuals' limited cognitive capacity. Bounded rationality theory, on the other hand, takes into account agents' knowledge or its absence about the environment where they belong to, and their ability to process this knowledge in order to make a decision and cope with uncertainty (Simon, 2000).

According to Simon (1972; 1957), individuals' limited cognitive capacity may rise from the uncertainty linked to the consequences that follow each alternative choice, the incomplete information about the alternatives and the complexity of the cognitive functions used by individuals. That discourages them from calculating the best course of action and constraints their computational capacity. Individuals deal with their limited cognitive capacity by downsizing the alternative choices and by using rules of thumb, such as conventional numerical values. Another popular decision-making process is the use of the satisficing criteria, when individuals stop searching for alternatives, as long as they find a choice that satisfies their aspiration level criterion. The drawback of bounded rationality theory is that although it introduces imperfect information, it still assumes perfect knowledge of the distribution of the random variables. Therefore, it concludes that the difficulty in decision-making is driven by its own complexity, and not necessarily by fundamental uncertainty.

The distinction between uncertainty and risk is also investigated in the "old" behavioural tradition. Huettel et al. (2006) recognise three types of choices, depending on the level of uncertainty regarding the outcomes. The first choice is the certain one, when there is only one possible outcome. The risky choice takes place when there are multiple outcomes with known probabilities. The ambiguous or uncertain choice occurs when multiple outcomes with unknown or not well-defined probabilities exist. They suggest that different levels of available information, not only define the type of uncertainty with which individuals deal, but also have a different impact on their brain functioning in relation to their decision-making. Overall, uncertainty rises from the existence of multiple outcomes, whose probabilities are unknown or not well-defined.

In the "old" behavioural finance, Guttentag and Herring (1986) distinguish risk from uncertainty, as well as their impact on decision-making. Risk refers to the calculation of the probability of an event that might occur in the future, while uncertainty indicates our

inability to perfectly foresee the future and any unexpected events that might occur. Hence, when individuals' confidence in estimation is high they refer to risk, while when their confidence is low they refer to uncertainty. During the upturn of the business cycles, when financial markets are driven by unrealistic optimism about asset prices, investors systematically underestimate shock probabilities and the presence of uncertainty, due to the time gap since the last economic shock that took place. This phenomenon is known as the Disaster Myopia in financial markets.

Disaster Myopia Hypothesis is the systematic tendency to underestimate shock probabilities, which increases as time passes since the last economic shock took place (Guttentag and Herring, 1986). It occurs when investors are overconfident about their trading abilities, and it is driven by two behavioural heuristics; the availability bias and the threshold heuristic. Heuristics are mental shortcuts, used in dealing with limited cognitive capacity and problem-solving. Although they save time in decision-making, they can introduce systematic errors in probability judgements. The availability heuristic refers to the estimation of the probability of a shock, which is based on the available information associated with the event and what individuals can bring first in their minds. The threshold heuristic rises when a probability reaches such a critically low level, which is treated as if the probability was equal to zero. When market participants underestimate the probability of a potential crisis due to its low frequency, then the markets and the economy become vulnerable.

"New", mainstream, behavioural economics

We use the term "new" behavioural economics to describe the research that examines why individuals' decision-making deviates from the rational expectations model, it builds on the established view of the rational and representative agent, and it follows a closed system analysis. Despite the fact that behavioural assumptions about preferences, risk aversion, knowledge of probability distribution etc. are relaxed compared to the rational expectations model, "new" behavioural economics remains an equilibrium-focused and utility maximisation analysis. For these reasons, the "new" behavioural economics literature is incompatible with the pluralist approach of Post-Keynesian economics. Additionally, the role of gender in the "new" behavioural finance literature is inadequately

incorporated by investigating gender differences in preferences in financial decision-making.

Prospect theory, by Kahneman and Tversky (1979), is one of the most influential theories in the "new" behavioural economics literature. The two authors criticise the rational choice model and provide an alternative model of decision-making under risk. Individuals tend to underestimate outcomes that are merely probable, compared to certain outcomes, also known as the certainty effect. Despite the fact that choices should depend only on the outcome itself and not on the way they are described, there is a tendency to change preferences when the same choice is presented in different ways. The latter is known as the isolation or framing effect. These two empirically observed, psychological effects are inconsistent with the strict assumptions of the rational choice model. In prospect theory, utility is replaced by a value function, assigned to gains and losses, and probabilities are replaced by decision weights, calculated as changes from a reference point. Additionally, changing risk preferences and ambiguity aversion are incorporated into a mathematically expressed model of decision-making. This model is subject to behavioural assumptions, for example, the value function is concave with respect to gains and convex for losses, while it overweights the lower decision-weights and underweights the higher ones. These assumptions ensure individuals' risk and loss aversion.

Camerer and Weber (1992) define ambiguity as the uncertainty about probabilities and they suggest a model of changing preferences, which reflects the several degrees of ambiguity aversion. Certainty occurs when potential outcomes and their corresponding probabilities are known, while risk rises when the probability distribution is known, but there is no definitive list of potential outcomes. They build their work on the Von Neumann and Morgenstern (1944) rational agent model, by relaxing its assumptions of perfect knowledge of the probabilities of future outcomes. They also review a series of utility-based and probabilistic models of ambiguity, by using a nonlinear weighting of expected probabilities or models of non-additive probabilities. Overall, despite their attempt to provide a more realistic analysis of the decision-making process, their work remains a utility maximisation exercise.

Gender is often examined in the "new" behavioural finance literature, but its analysis is limited down to gender differences in risk aversion. Powel and Ansic (1997) design a

computer-based, laboratory experiment to test whether gender differences in risk preferences and decision-making strategies in financial markets are a general characteristic or context-specific. Specifically, they run two experiments; the first tests differences for different levels of familiarity with financial decision-making and different frames of the choices, while the second one tests differences on the basis of missing information and costs of re-entering the market. They conclude that women are undertaking less risk than men, regardless of levels of familiarity, framing, costs and uncertainty. Also, there are gender differences in financial decision-making strategies, but there are no significant gender differences in performance. Lastly, because the financial decision-making strategies are easier observed than their outcomes, these differences in decision-making fuel the gender stereotypes in financial management. For example, it may seem that women tend to undertake lees risk in their decision-making, but it is not easy to quantify whether this characteristic leads to lower risk in their portfolios' performance.

2.3.4 Gender and decision-making under uncertainty in finance; the critical view

While Post-Keynesian economics suggests that financial markets are unstable due to fundamental uncertainty and its impact on financial traders' expectations is crucial, it pays little attention to the role of gender on decision-making under uncertainty. On the other hand, the established literature, while it incorporates into its analysis the role of gender and gender differences, it focuses on differences in preferences, on women's greater risk aversion and lastly on differences on financial strategies. The scope of its analysis is financial performance, rather than gender equity. Feminist economics, on the other hand, places gender inequality that the centre of its analysis. Low female participation on the trading floor is criticised by feminist economics, but this argument is often based on empirical evidence on gender differences and women's' greater risk aversion. Little attention is paid on gender similarities in financial decision-making under uncertainty, and the gender norms on the trading floor that lead to low female participation. This gap in the literature is covered by this thesis.

The top decision-making positions in the US and EU financial governance institutions, intergovernmental, private and global regulatory institutions, and regulatory reform organisations are almost exclusively occupied by male professionals (Schuberth and

Young, 2011). Same holds for the EU National Central Banks, Ministries of Finance and other professional networks (Young, 2014). Higher participation of female professionals in financial governance is suggested by the feminist economic literature, in order to improve decision-making by avoiding groupthinking and gender biases in policy making.

According to Young (2014), higher female participation in top positions of financial institutions would not have prevented the 2008 financial crisis, but it would have prevented a narrow groupthinking in financial decision-making. This groupthinking was the result of decision-making positions occupied by a narrow social group, which shared common objectives and was driven by herd behaviour. On the contrary, a better-distributed labour representation between male and female market professionals in financial governance would lead to greater diversity in decision-making and improvement in the quality of investment and financial decisions. It would also question gender neutrality of macroeconomic analysis and policy. Specifically, macroeconomic policies often ignore the unpaid economy that produces goods and services crucial for social reproduction, which is mostly supported by female unpaid labour. Therefore, higher participation of women in policy making could bring in their experience of these gender biases and lead to more democratic policies.

Van Staveren (2014) synthesises a rich literature review based on psychological and neurological studies; and she concludes that due to gender differences in risk aversion and response to uncertainty, in ethics and moral attitudes, and lastly in leadership, higher female participation in financial decision-making would lead to more sustainable financial markets. This is also known as the Lehman Sisters' Hypothesis (LSH). The psychological evidence reviewed by the author, belongs in the "new" behavioural finance literature, which focuses on financial performance and profitability, as well as on gender differences in risk preferences. The neuroscience research reviewed focuses on differences in hormones between men and women and how they affect individuals' decision-making.

Empirical evidence from the US and India, for the periods 2000-2007 and 2000-2009 respectively, suggests that female fund managers outperformed their male colleagues (Chang, 2010; Azmi, 2008). There is also strong empirical evidence that women respond differently to financial uncertainty and price volatility. Specifically, research shows that women fund managers rate financial discipline higher compared to their male colleagues,

based on a UK survey by a major British investment bank with an international portfolio of 2.000 clients (Barclays Wealth, 2011). The female survey participants suggest that they respond to market volatility with patience and self-restraint. Similarly, empirical evidence from the US shows that despite the fact that gender differences in the mutual funds industry are not statistically significant, female managers adopt more stable investment strategies and show higher performance resistance (Niessen and Ruenzi, 2005).

Van Staveren (2014) also presents evidence of gender differences in risk aversion levels, which suggests that women tend to be more risk averse than men. Higher risk-taking leads to more volatile and uncertain financial markets, therefore female greater risk aversion could lead to less financial uncertainty. But there is no conclusive evidence on gender differences in risk aversion levels, in the grounds of psychological research and neuroscience though. Particularly, there are several studies that present contradictory results, therefore we cannot reach safe conclusions. Additionally, the studies used by the author to support the Lehman Sisters' Hypothesis often derive their sample population from non-financial professionals, therefore the assumption that women are more risk averse than men may not hold in financial markets. Burns (1985) argues there are differences between financial professionals' and non-professionals' behaviour due to training, reputation and other factors. This hypothesis is also challenged by Van Staveren due to self-selection bias, i.e. the women who join financial markets are self-selected in a highly competitive and risk-driven working environment.

The other two dimensions of financial decision-making that Van Staveren (2014) suggests are moral attitudes and leadership, which are not supported by an extensive literature. The author argues that there are gender differences in the ethics of care and justice. In moral dilemmas, women tend to focus on the care values, while men weight more the justice-oriented values, due to stereotyping gender roles. Women's care orientation could benefit financial markets by recognising responsibility towards the firms' clients, and by changing the reward system for financial professionals, who often engage into riskier investment behaviour under the promise of higher bonuses. Lastly, the author suggests that gender stereotypes about power and leadership constrain women from achieving managerial positions in banking. Low female representation in financial leadership further fuels into the predominant masculine culture in finance. Once more, diversity in

leadership may lead to better decision-making, but empirical evidence is inconclusive. “New” behavioural economic studies show that higher female representation in financial governance may or may not have a positive impact on firm’s financial performance, besides that there is no evidence suggesting that gender diversity in leadership may have a negative impact on business performance.

Bliss and Potter (2003) examine the decision-making process of mutual fund managers in the US, and how it is influenced by gender diversity and teamwork. They test three hypotheses; whether women are more risk averse than men, if men are more overconfident than women and lastly, whether groups make more extreme decisions than individuals due to groupthinking. The hypotheses are tested with a sample of 3000 domestic and international equity funds, for data ending September 2000. Depending on the type of the fund, female participation in managerial positions varies between 11% and 19%. Firstly, women fund managers are not found more risk averse than men. In equity-based mutual funds, women managers take on more risks, while in bond funds women take on less risk than their male colleagues. Therefore, the results are inconclusive. Secondly, in domestic equity funds women managers outperform men -they are more diversified and more tax efficient-, while in international equity funds women perform worse in almost all categories. In the case of bond funds, women perform better in the taxable bond category, but marginally worse than men in the municipal bond category. Once more the outcomes about women’s and men’s performance in managerial positions of mutual funds are not consistent or conclusive. Thirdly, men are not found more overconfident than women in all categories, which is measured by their trading frequency. Lastly, individually managed mutual funds perform better than the team-managed ones, but they adopt riskier investment strategies. A possible explanation is that the groupthinking mentality, which is criticised by Young (2014), led to errors that outweighed the benefits of teamwork.

According to Bliss and Potter (2003), women managers of mutual funds are not found consistently more or less risk averse than their male colleagues, they do perform better though on a risk-adjusted basis in the domestic funds, and there is strong evidence for groupthinking errors. Bliss’ and Potter’s research is an example of empirical research used

to support the Lehman Sisters' Hypothesis, but often the conclusions are rival, especially the evidence about women's greater risk aversion.

2.3.5 Feminist critiques of Post-Keynesian, "old" and "new" behavioural economics

Feminist critiques of Post-Keynesian economics

In Post-Keynesian economics the role of gender is limited, and linked with economic growth driven by consumption. Gender equality is promoted as a core element of macroeconomic growth, rather than as an argument for social justice. For example, Onaran (2015) analyses a macroeconomic path through which greater gender equality in the labour market would increase economic growth and employment. She suggests the construction of a gendered demand-led growth model, and she concludes that due to women's higher consumption propensity, a better representation of women in the labour market would lead to a wage-led/equality-led recovery of economic development.

Visano (2016) argues that given the open system analysis of Post-Keynesian economics, a gendered theory of financial crises would be compatible and it would benefit the former. She argues that Post-Keynesian economics address income and class inequality, but its analysis is incomplete if it does not incorporate intergroup inequality as well, i.e. gender inequality within the same class. Gender is often invisible in markets due to the increased burden on women as unpaid caregivers. Household reproduction is much dependent on women's unpaid work within it, a fact that is often neglected by policymakers. The nonmarket sphere of economic activity is a research area often forgotten by Post-Keynesian economists. Another gender-blind spot in economics is the absence of data disaggregation by gender. Theoretical outcomes, such as output, unemployment and others perpetuate the invisibility of women. For the research of financial markets, the author suggests three areas of potential collaboration between Post-Keynesian and feminist economics. Firstly, the presence of gender differences in response to risk and uncertainty. Secondly, gender differences in the use of credit that accommodates and supports speculation. Lastly, a link between credit and production, which includes the nonmarket activities, thus it will include gender differences in labour.

Van Staveren (2010a) identifies three key concepts both in the Post-Keynesian and feminist economics that need further investigation. Gender, household and unpaid work

are at the centre of feminist economics, while uncertainty, market power and endogenous dynamics are core ideas in Post-Keynesian economics. Despite the fact that the Post-Keynesian economics challenges the long tradition of dualisms in economics, e.g. closed systems versus open systems, exogenous versus endogenous dynamics, and perfect versus imperfect competition, it misses the dualism of gender, and as a result it fails to recognise the different and often unequal positions men and women have in the economy. For example, in a demand-driven economic system it is important to count for the asymmetric bargaining power of men and women within their households. Also, the gender dualism of the labour market, the "masculine" and better-paid position versus the "feminine" position of caring sector, in which employees receive lower wages, should be considered in a system driven by consumption. Secondly, the author suggests that gender plays a role in decision-making under uncertainty due to differences in risk aversion. Men and women may also face different uncertainties about the future, depending on their vulnerability within the economy, and as a result they may end up shaping different expectations. Hence, uncertainty and the forming of expectations is another area of Post-Keynesian economics that should take into account the role of gender. Lastly, the endogenous variable in Post-Keynesian economics, the labour demand should be analysed side-by-side with the endogeneity of labour supply in feminist economics. Specifically, labour supply is a key concept in feminist economics due to women's unpaid labour, which supports household reproduction. Moreover, labour market dynamics is the third area of potential collaboration among the two economic traditions.

Post-Keynesian economics examines persistent income and class inequalities of the economic systems, its analysis though remains incomplete because it does not consider the role of gender. The reason is that gender and racial inequalities exist across and within the social classes. Hence, feminist economics could contribute to the rich Post-Keynesian literature. Specifically, in the case of financial markets insights from feminist and the "old" behavioural economics, could shape a better-informed narrative of decision-making under fundamental uncertainty.

Feminist critiques of "old" behavioural economics

There is not an extended feminist economic literature criticising the "old" behavioural economics. One reason is that the distinction between the "old" and the "new"

behavioural economics is commonly used among Post-Keynesians, but it is not widely used in other non-mainstream economic literatures. Old", or non-mainstream, behavioural economics builds on Herbert Simons' bounded rationality theory, which challenges the rational expectations model, as well as other theories that diverge from the equilibrium-focused analysis of the mainstream economics.

Austen and Jefferson (2008) review Daniel Kahneman's 2002 Nobel lecture "Maps of Bounded Rationality: Psychology for Behavioural Economics", which builds on H., Simon's bounded rationality theory. Kahneman argues that the emphasis on rational and emotion-free decision-making models in economic science is unrealistic, because it lacks an understanding of intuitive thought, which depends on emotions and the context. Austen and Jefferson criticise his work because it lacks a gender dimension. They suggest that an analysis of emotions and context of decision-making needs to take into account the observed gender differences in economic behaviour and inequality in economic outcomes. On this basis, they suggest a dialogue between feminist and behavioural economics.

The two authors identify four research areas of Kahneman's work that need a gender dimension. Firstly, the analysis of the affective valence -our judgment of what is good or bad, and our tendency to be drawn towards good objects or feelings and avoid the bad ones- contains a gender dimension. In western cultures, women are encultured to neglect or resist more strongly to options that are effectively labelled as selfish or driven by self-interest, compared to men. That would lead to gender differences in decision-making. Secondly, Kahneman suggests that we use social categories and the information we have about them to simplify decisions or judgements. In this context, norms and stereotypes have a key role in decision-making because they are used as mental short-cuts. For example, gender norms and stereotypes may have a significant impact on employment selection decisions, depending on what tasks are viewed as particularly feminine or masculine. The third research area of potential engagement between feminist and behavioural economics is the uncertainty in decision-making. According to Kahneman, when uncertainty is suppressed, decision-making tends to be intuitive, while once individuals recognise the presence of uncertainty, they will doubt their interpretations of reality and they will be forced to make a deliberate decision. Men and women may face

different uncertainties depending on the context. For instance, perceiving and addressing inequitable wages may depend on whether a woman works in a male-dominated and better-paid workplace or in a highly feminised industry, which offers low wages to everyone. Moreover, the perception of ambiguity about employer's payment structure changes in the two cases, as well as the doubt about receiving an appropriate wage level. The last category focuses on emotions and their role in decision-making. We associate actions with positive or negative emotions and we tend to block other information that is relevant in finalising a decision. Gender stereotypes influence the weight or the importance that men and women give to different emotions, for example to empathy or competitiveness. Hence, in order to understand gender differences in preferences, we need to incorporate gender differences in emotions as well.

The feminist and the "old" behavioural economics share the same open system analyses and the same goal to provide a more realistic perception of the economy, while departing from an equilibrium-focused analysis. Both theories can contribute to each other, and along with the Post-Keynesian economics, they could potentially shape a better understanding of the ways people make decisions. Particularly, the topic of uncertainty in decision-making is often suggested as a common area of interest between the three schools of thought.

Feminist critiques of "new" behavioural economics

The "new" behavioural economics relaxes the strict, microeconomic assumptions about preferences and perfect knowledge, but it remains an equilibrium-focused and utility maximisation theory. Gender is often examined in the "new" behavioural finance literature, but its analysis is limited down to gender differences in risk aversion.

Nelson (2014; 2018) challenges the "new" behavioural economics literature on risk aversion and gender differences, and suggests that researchers should focus more on gender similarities rather than differences. She suggests a tool for measuring similarity, the index of similarity, which calculates the degree of overlap between the two distributions, e.g. the distributions of risk aversion levels between men and women. The drawback of the index of similarity is that it requires equal-sized groups. Additionally, differences in sample means should also be tested for their statistical significance, as well as their substantive size, also known as Cohen's d (Cohen, 1988). These two measures are

often neglected by the "new" behavioural finance research, when they test for gender differences in risk aversion levels.

Nelson (2014) tests whether economists are prone to stereotyping, by oversimplifying beliefs about groups and their extension on individuals, and prone to confirmation bias, the tendency to seek information that confirms pre-existing beliefs. Nelson uses a sample of published articles on gender and risk aversion to test if the hypothesis of women's greater risk aversion is a robust scientific outcome, or the result of the scientists' stereotypical, confirmation bias. She calculates the Cohen's d and the index for similarity for 35 studies on gender and risk preferences or risk perceptions, in economics, finance and psychology. She finds that women's greater risk aversion is far less empirically supported than has been claimed in the literature. This debatable evidence may be the result of low-quality research and researchers' confirmation bias. This happens due to the misleading citation of stereotype-confirming literature, the overemphasis on gender differences within each study's results, along with the fact that stereotyping findings are more likely to be published. Moreover, researchers often fail to consider complementary factors that may influence gender differences, e.g. educational background, income differences etc. Lastly, there is a narrow range of risks examined in the "new" behavioural finance literature with lottery, gambling and investment scenarios.

Despite the fact that feminist economists often make use of empirical evidence from the "new" behavioural economic literature to support higher female participation in the male-dominated financial markets, it often neglects the impact of stereotyping and confirmation bias. This thesis examines both gender differences and similarities in decision-making under fundamental uncertainty as suggested by Julie Nelson (2014; 2018). We do not only focus on gender differences, but also on their statistical significance, as well as on the sizes of these differences.

2.5 Conclusions and research gaps

2.5.1 Critiques of the established literature

Decision-making in mainstream economics is fully presented by mathematical models, which aim to forecast the market movements and human behaviour, but they are disconnected by the fundamentally uncertain real world and unforeseen future. The

Rational Expectations Theory and the Efficient Market Hypothesis (Fama, 1969; Von Neumann and Morgenstern, 1944) are built on unrealistic assumptions about human nature. For instance, individuals' known and constant preferences are taken as given, which later translate to known and constant behavioural functions of maximising utility or profits. These assumptions are necessary in the mainstream literature, as they set up the conditions that lead to a stable, long-term economic equilibrium. The established view in economics, does not allow any role for government intervention, because it is constructed in a way that does not provide an efficient explanation of inequalities, in terms of wealth and income, gender and race. This effort of transforming economics from a social science into a positive one, reflects the values of the mainstream economics, which does not aim to describe capitalist economies and societies and to explain their crises and flaws, but only to model them in a technical way. This technical modelling promotes the dominance of financial markets and profit accumulation, which fuel further the abovementioned inequalities and instability.

Finance theory, on the other hand, does not follow the profit maximisation rationale. It focuses on creating value, and specifically, on increasing the stock markets returns for firms' stockholders. It builds on the rational expectations model, assuming that prices reflect information about firms' performance and individuals' preferences. Despite the fact that it challenges the assumption about perfect information with the different forms of the Efficient Market Hypothesis (weak, semi-strong and strong axioms), it still fails to capture the inherent instability and uncertainty of financial markets. The Modern Portfolio Theory offers a tool case of brokerage techniques, taught in universities for the future (and current) financial traders. But from a macroeconomic point of view, this approach is not realistic, because it does not incorporate human interaction in decision-making, institutional constraints, emotions, the impact of uncertainty or gender on decision-making, in order to create a more complete understanding of markets and their functions. Especially the vector autoregression models, which are extensively used in risk evaluation (Jurado at al. 2015) are constructed in order to incorporate into their analysis the notion of measurable uncertainty risen from external shocks, whilst they perform under conditions of unmeasurable uncertainty.

The established view on the role of gender in finance is linked with the firms' financial performance (Francoeur et al., 2008; Campbell and Minguez-Vera, 2008). There is a rich literature on whether gender and race diversity on financial governance could lead to higher financial returns, due to a better understanding of customers' needs and pluralism in decision-making. There is empirical evidence both for and against this argument. From a methodological point of view, differences in preferences based on gender and their impact on behaviour and decision-making, presuppose a utility maximisation framework and a trade-off between risk and returns. From a theoretical point of view, the mainstream literature on gender focuses on financial firms' performance, instead of gender equality. This position is problematic because it is missing a discussion on gender equality on opportunities, regardless profitability. This absence of concerns about social equality reflects the main thread within the mainstream literature; treating economics as a positive science rather than a social one.

Behavioural finance, a subdiscipline of behavioural economics, incorporates into its analysis the notion of behavioural biases and deviations from the rational agent model, into financial decision-making. Behavioural finance questions the rationality assumption of the Modern Portfolio Theory and the Capital Asset Pricing Model (Markowitz, (1952; Ross, 1976), but it uses them as the starting point of its analysis. It is suggested that psychological and sociological findings could enhance finance theory (Glaser et al., 2004), yet the "new" behavioural finance focuses on traders' overreaction to new information and external shock events. This analysis is limited by an equilibrium-focused framework. Indeed, researchers do not focus on exploring behavioural biases in financial trading, but they study price deviations from the estimated fundamental value or equilibrium prices, which are interpreted as limitations in traders' rationality. So instead of challenging the mainstream finance theory, they use behavioural insights to explain why the MPT and the CAPM do not hold in financial markets, because of human mistakes. This literature is defined as the "new" behavioural finance and it is part of the established view.

The rational agent model, finance theory, behavioural finance and mainstream studies on gender share a common ground; they describe and assess agents' behaviour without studying directly their decision-making. They study agents' behaviour by tracking either price movements or financial performance. These theories miss a direct dialogue with the

individuals under investigation, in this case they would be financial traders. This gap is covered by field-based psychological studies, also known as decision-making studies.

Decision-making studies offer a methodological structure that brings together the experts' and the general population's opinions, as an attempt to improve human behaviour. They suggest a three-model protocol, in order to inform the experts about how the general population makes decisions. Later, they use this information to provide a framework which will help the non-expert population to correct their decision-making process. For the purpose of this thesis, we adopt the use of a descriptive model of financial traders' behaviour under fundamental uncertainty. We focus on financial traders' behaviour because despite the extensive use of algorithmic trading, traders' decision-making still has a crucial impact on market psychology. We do not assume that there is an experts' model (normative model) of the ideal decision-making on the trading floor, and hence we do not propose a prescriptive model which would improve traders' decision-making. We suggest the combination of interviews and surveys to track financial traders' decision-making process under uncertainty, as well as their opinion about the role of gender in financial markets.

2.5.2 Critiques and the gaps in the critical literature

We adopt the Keynesian definition of fundamental uncertainty, according to which future economic events cannot be accurately forecasted by quantitative models, therefore individuals have to adjust their decision-making process to potential surprises and unexpected events (Keynes, 1936). Fundamental uncertainty is unmeasurable; hence it cannot be modelled, and future events cannot be predicted based on economic forecasts. The study of fundamental uncertainty though remains crucial due to its impact on individuals' decision-making. Keynesian and Post-Keynesian economics does not attempt to predict human behaviour, their goal is to understand it by allowing insights from psychology and other social sciences. This open system analysis of Keynesian and Post-Keynesian theories, not only offers a platform for theoretical and methodological pluralism, but it also offers realistic explanations of the persistent inequalities of capitalism. Table 1 summarises the different types of Keynesian uncertainty and their corresponding decision-making processes based on four criteria; the two most common descriptions of Keynesian uncertainty in the literature (radical and institutional

uncertainty) and the two most commonly reported reactions to Keynesian uncertainty (panic and searching for rationality).

Table 1. Types of Keynesian uncertainty and their corresponding decision-making processes

	Types of decision-making processes	
Types of Keynesian uncertainty	**Panic**	**Seeking for as much rationality the circumstances allow**
Radical definitions of uncertainty	Non-ergodicity principle: Reality does not follow a specific probability distribution/ Individuals are incapable of optimising intertemporal, rational choices (Davidson, 2011) A continuously changing environment does not allow prior knowledge of the future state of the world / The infinite regress problem paralyses the investor and prevents him/her from making a decision (Shackle, 1979)	Fundamental uncertainty: Future events are unforeseen and cannot be predicted by economic forecasting/ Individuals follow animal spirits and the beauty contest paradigm. They also change their liquidity preference (Keynes, 1936) A continuously changing environment does not allow prior knowledge of the future state of the world/ Individuals make decisions based on judgments about future gains and losses (Shackle, 1949) Human knowledge is limited, the future is unknown, incomplete information about the past and the future/ Individuals adopt strategies to cope with uncertainty (O'Donnell, 2015)

Table 1. continued

	Types of decision-making processes	
Types of Keynesian uncertainty	**Panic**	**Seeking for as much rationality the circumstances allow**
Institutional definitions of uncertainty	Financial Instability Hypothesis: During periods of economic expansion, the increasing asset prices turn financial institutions into Ponzi units. Speculative investment is the source of financial uncertainty/ Financial institutions join a stage of overexposure to risk, followed by panic once the bubble bursts (Minsky, 1992)	Unmeasurable uncertainty is linked with monetary policy, the latter should not be dictated by a single model/ There is a need for methodological pluralism and involvement of human judgment (Dow, 2004) Price instability reflects financial uncertainty/ Speculative traders try to predict the behaviour of the rest of the investors and the average opinion. They also have a list of possible future outcomes (Earl, 1990)

Radical definitions describe uncertainty as fundamentally embedded in economic systems, they describe future as unforeseen and they underline the limited usefulness of forecasting models. While, institutional definitions of uncertainty focus on financial uncertainty and the role of financial institutions, either in policy making or in speculative investment. Simultaneously, there are identified two main reactions to Keynesian uncertainty. Firstly, some theories suggest that individuals or institutions react with panic after Keynesian uncertainty occurs, often not knowing what to do, while other theories describe decision-making under uncertainty as a not well-defined process, in which individuals and institutions are looking for as much rationality as the situation allows.

We may conclude that Post-Keynesian economics lacks a definitive framework and a consensus about individuals' decision-making process under fundamental uncertainty. Especially in financial markets, the focus is on institutions, rather than individuals' reactions. One reason is the lack of empirical evidence, which could support the Keynesian theories of fundamental uncertainty. This gap is covered by this research which answers;

How do financial traders behave in an uncertain environment? To answer this question, we provide empirical evidence and we test the Keynesian theories of fundamental uncertainty, by interviewing and surveying financial traders. Additionally, this study does not only search for definitions of fundamental uncertainty on the trading floor and traders' reactions, but also for the sources of fundamental uncertainty. Lastly, the empirical outcomes of this research contribute to the Post-Keynesian literature by enhancing it with new descriptions of uncertainty and by showing their relationship with a number of decision-making processes.

Uncertainty is a topic of research, not only in the Keynesian and the Post-Keynesian economics, but also in other literatures. Table 2 summarises the definitions of risk and uncertainty in the established and critical theories, as well as the corresponding decision-making processes. Particularly, the notion of measurable uncertainty, also known as risk, plays a central role in mainstream economics, finance theory, the "new" behavioural economics and "new" behavioural finance. In these theories, the analyses of decision-making focus on behavioural deviations from an equilibrium point. On the other hand, unmeasurable uncertainty is researched in the Keynesian and Post-Keynesian economics, the "old" behavioural economics and "old" finance, and feminist economics. This research synthesises a pluralistic analysis of the latter theories in order to provide a comprehensive narrative of traders' decision-making under fundamental uncertainty on the trading floor.

Table 2. The types of uncertainty in the established and the critical literatures

Literature	Types of uncertainty	Decision-making
Mainstream economics	Perfect foresight of future events, perfect information	Rational expectations Maximisation of utility/ profit functions
	Measurable uncertainty, short-term deviations/long-term equilibrium	Use of uncertainty functions, given constant expectations (use of VAR models)
Finance theory	Measurable Risk	A trade-off between risk and return, Portfolio diversification
	Unmeasurable risk/ "noise"	-

Table 2. continued

Literature	Types of uncertainty	Decision-making
"New" behavioural finance	No role for uncertainty Focus on behavioural biases	Overreaction to new information, deviations from equilibrium prices
Decision-making/psychology	Depends on empirical observations; a field-based approach	It does not accept full rationality, but it suggests improvement of human behaviour depending on the expert model
Keynesian/Post-Keynesian economics	Fundamental and unmeasurable uncertainty Future is not entirely predictable Real world cannot be described by mathematical models	Following animal spirits Using social conventions and contracts Beauty contest paradigm Liquidity preference Inability to shape well-defined probabilities for future events
"Old" behavioural economics	Both risk and uncertainty, depending on the level of the available information and individuals' computational capacity	Simplifying decision-making; limit the alternative choices, use of rules of thumb, choose a satisfying, rather than an optimal outcome
"Old" behavioural finance	Uncertainty rises from our inability to perfectly foresee the future	Disaster Myopia Hypothesis Under uncertainty: Low confidence in estimation During a boom period: systematic underestimation of shock probabilities and uncertainty
"New" behavioural economics	Unknown probabilities of future events	Risk and loss aversion Behavioural heuristics and mental short-cuts Deviations from equilibrium prices Utility maximisation framework
Feminist economics	Market volatility as a measurement of financial uncertainty	Need for more gender diversity in decision-making to avoid groupthinking biases

Despite the fact that the Keynesian and Post-Keynesian theories place fundamental uncertainty in the centre of their analysis, they do not pay enough attention to the human limitations of economic agents. As shown in table 2, the “old” behavioural economics takes into account the individuals’ bounded rationality, as well as their cognitive limitations on processing information and on computational skills, which lead to simplifying decision-making by using rules of thumb and by limiting the alternative choices. We focus on the “old” behavioural finance, given that we research financial traders’ behaviour, and we test the Disaster Myopia Hypothesis, the systematic tendency to underestimate shock probabilities, which increases as time passes since the last economic shock took place (Guttentag and Herring, 1986). Specifically, the announcement of Brexit is a case of fundamental uncertainty on the trading floor, and it allows us to investigate the changes in financial traders’ opinion and decision-making over time; a few months before the Brexit vote, immediately after the EU referendum, and a year later. This real-time uncertain event in financial markets allows financial traders to reveal their true decision-making process under financial uncertainty and their beliefs about its future impact on the British economy. The specific case of Brexit referendum is presented as a follow-up, analysis chapter and a focused example of financial decision-making under fundamental uncertainty.

The literature of the “new” behavioural economics and finance is incompatible with the purpose of this thesis. As shown in table 2, uncertainty is defined in the “new” behavioural economics as the unknown probabilities of future events, while in the “new” behavioural finance there is no role for uncertainty at all. Both theories aim to explain behavioural deviations from the rational agent model. Particularly, the “new” behavioural finance is an equilibrium-focused analysis, and the majority of research topics focus on traders’ psychological biases that explain short-term deviations from equilibrium prices, i.e. traders’ overreaction. Therefore, the “new” behavioural economics and finance theories are incompatible with the open system analysis of the Keynesian and Post-Keynesian theories of fundamental uncertainty.

Despite the fact that fundamental uncertainty plays a central role in the Keynesian theory, little attention is paid on the impact of gender on decision-making in financial markets. In Post-Keynesian economics, gender is incorporated in differences in propensities to

consume, rather than in decision-making in finance. In mainstream economics, economic agents are gender-neutral, often referred as *homo economicus*, while in finance theory and the "new" behavioural finance there is a role which focuses on gender differences in preferences, risk aversion and financial strategies and how they relate to the firms' performance. Financial literature explores the role of gender under the scope of maximising financial firms' profitability, rather than questioning gender inequality in financial markets. In psychological studies, the role of gender is not central, but it depends on the hypotheses under test. The "old" and "new" behavioural economics are often gender-neutral, as gender is mostly studied in finance. Lastly, the feminist economic literature focuses on the role of gender in decision-making, either by investigating gender differences or similarities. Table 3 summarises the role of gender in the established and critical literatures.

Table 3. The role of gender in the established and critical literatures

Literature	Role for gender	Gender differences
Mainstream economics	No	Gender-neutral representative agents, *homo economicus*
Finance theory	Yes	Gender diversity on financial governance related to firm's performance
"New" behavioural finance	Yes	Gender differences in preferences, risk aversion and financial strategies
Decision-making studies/psychology	Limited	It depends on the expert model
Post-Keynesian economics	Limited	Gendered, demand-driven macroeconomic models, higher female participation to labour market would lead to economic growth, due to women's higher propensity to consume
"Old" behavioural economics/finance	No	Gender-neutral individual
"New" behavioural economics	No	Gender-neutral individual
Feminist economics	Yes	Low female representation in financial governance, lack of equity Differences in risk aversion, morals, ethics and leadership - the Lehman Sisters' Hypothesis Focus on gender similarities

Women's and men's decision-making under financial uncertainty differs. According to the Lehman Sisters' Hypothesis (Van Staveren, 2014), women tend to be more risk averse than men when making decisions, and therefore higher female participation in financial governance would lead to less risk-taking and a more stable financial environment, as risk is linked with uncertainty. The empirical evidence from psychological and neurological studies on risk aversion differences is inconclusive, and they often derive conclusions from non-financial professional populations. There may be a self-selection bias of female professionals who are not as risk averse as the non-professional female population. Additionally, the author suggests that higher female participation in financial leadership would add value in financial profitability, and it would have a positive impact on the firms' value, which agrees with the established view about the role of gender in finance. There is supportive evidence, but inconclusive. Some studies show an increase in firms' stocks prices and return, and others suggest that there is no statically significant difference when the number of women in financial firms' boards increases. There is no supportive evidence for the opposite though, that more equal distribution of powers would have a negative impact on firms' profitability.

The "new" behavioural finance literature focuses on financial performance, rather than gender equality, which is problematic because it puts the company's profitability in the centre of its analysis, rather than the equity among its employees. Often the "new" behavioural finance studies which test either risk aversion differences or differences in financial performances among men and women are not reliable, because of misleading citation of stereotype-confirming literature, the overemphasis on gender differences, along with the fact that stereotyping findings are more likely to be published (Nelson, 2014). Hence, there is a need for studying not only gender differences, but also similarities in financial decision-making, as well as to derive a sample from financial professionals only. This gap is covered by this research which answers; **What are the gender differences and similarities among financial traders?** To answer this question, we interviewed financial traders' and we asked their opinions about behavioural and institutional reasons behind the low female participation on the trading floor. We contribute to the feminist literature by studying both gender differences and similarities, in terms of trading characteristics. We also constructed a gender-neutral survey, which we later analysed for

gender differences, to understand whether the reported gender differences and similarities are the result of gender stereotypes in finance, or not.

Overall, this thesis allows insights from the Post-Keynesian, feminist and "old" behavioural economics to investigate decision-making under fundamental uncertainty on the trading floor. Feminist critiques support such a pluralistic framework. Particularly, the literature suggests that feminist economics could contribute to the rich Post-Keynesian literature, by examining gender inequalities within the same social groups, such as financial traders. Additionally, feminist and "old" behavioural economics could shape a better-informed narrative of decision-making under fundamental uncertainty in financial markets. The three schools of thought share the same open system analyses and the same goal to provide a more realistic perception of the economy, while departing from an equilibrium-focused analysis.

2.6 Conceptual map

Figure 1. How do the different literatures link with each other, and around uncertainty gender and decision-making in finance?

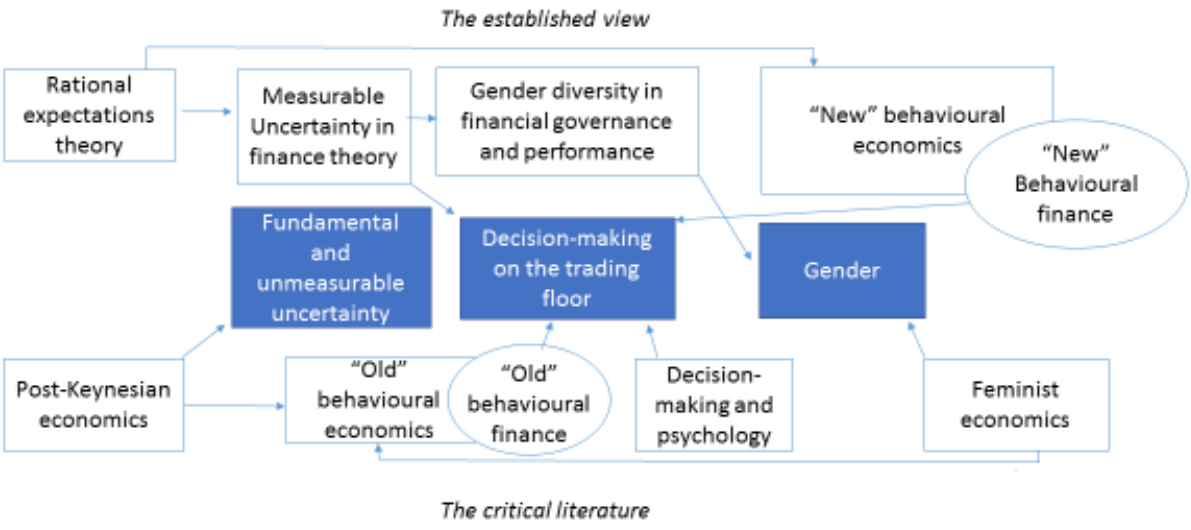

Figure 1 illustrates the links between the different schools of thought. In the established literature, the rational expectation theory is the foundation of finance theory, which takes into account measurable uncertainty, also known as risk. Finance theory also examines the role of gender in financial markets, and how it may influence the firms' financial performance. The "new" behavioural economics, and its subdiscipline the "new"

behavioural finance, also build on the rational expectations theory, and they use psychological terms, such as heuristics, in order to explain why individuals do not behave in an optimum, rational way as the finance theory suggests.

On the other hand, in the critical literature the Post-Keynesian economics, the "old" behavioural economics, and its subdiscipline the "old" behavioural finance, as well as feminist economics share the same goal of providing a realistic description of economic systems, which depart from the mainstream equilibrium-focused models; while they examine different aspects of decision-making. The Post-Keynesian economics focuses on the role of fundamental and unmeasurable uncertainty, feminist economics on gender biases and the "old" behavioural economics on decision-making and cognitive limitations. Decision-making is also examined by psychological studies, also known as decision-making studies.

Despite the fact that decision-making studies are presented under the established view, as they are often adopted by mainstream economists, we make use of its suggested methodology to approach financial traders and obtain their true opinions and feelings. Specifically, we build a descriptive model of financial traders' behaviour under fundamental uncertainty. We focus on financial traders' behaviour because despite the extensive use of algorithmic trading, traders' decision-making still drives the market psychology. For this purpose, we conducted two rounds of interviews and we released an online survey to track financial traders' decision-making process under uncertainty, as well as their opinion about the role of gender in financial markets.

3. Methodology

3.1 Introduction

In the Post-Keynesian literature, financial traders' expectations and emotions under uncertainty are the driving force for market instability, while in the "old" behavioural economics the humans' cognitive limitations constrain them from acting rationally. In the feminist literature, gender inequalities and differences either in risk aversion or in experiences have an impact on traders' decision-making as well. All three literatures put the individuals' behaviour into the centre of their analyses. Algorithmic trading may be popular in high frequency markets, but the role of financial traders remains important. Algorithms may process information faster than humans, but they can only process market, numerical data, while financial traders assess qualitative data alongside with their models, such as political events, mergers and acquisitions etc. Financial uncertainty rises from both market and non-market unexpected phenomena, therefore the ability to process qualitative information remains a crucial skill on financial trading floors. Another limitation of algorithmic trading is the fact that it uses past market data, and builds future price scenarios based on the assumption that the markets will continue generating past price patterns. As already discussed, the Post-Keynesian theories of fundamental uncertainty suggest that reality does not follow predetermined probability distributions, or else it does not repeat past price patterns. In this case the human analytical ability is necessary to assess new information and to take into consideration external factors, which may not be captured in past market data. Given the high number of financial traders' on a global scale - a recent estimation suggests about 13.9 million online traders (BrokerNotes, 2018)- it is important to investigate their decision-making under fundamental uncertainty, in order to understand how financial markets operate in volatile periods.

We suggest the synthesis of a descriptive model of financial traders' behaviour under uncertainty, due to its usefulness in understanding how people behave, without making presumptions of their intellectual functioning, namely assumptions about preferences. Hence, it enables us to reveal new dimensions of decision-making under uncertainty and the role of gender in finance, which are not covered by the contemporary literature. Descriptive models, also called mental models, are commonly used in

psychological/decision-making studies. We use one of the most influential sources in the field, Morgan et al. (2002), to explain and justify the rationale for a "mixed method" approach in investigating financial traders' decision-making. We use the term descriptive models to be consistent with the literature review, as defined by Baron (2007), but in the broader literature they are also referred as mental models. Both terms describe the same methodology.

3.2 Descriptive models

Morgan et al. (2002) suggest that experts may know very little about public beliefs, peoples' knowledge and their needs. Experts, in our case economists, often make assumptions which are often misleading about the general population, based on their prejudgments. Therefore, there is a need for a systematic approach of gathering data about individuals' beliefs and opinions. The authors suggest a five-step protocol, including the use of open-ended interviews, followed by a confirmatory survey, based on the interview results.

The first step is to derive a normative model, which presents the ideal ways in which people should think and act. This step corresponds to the literature review, which shapes and informs the methods' design. The second step is the construction of a descriptive model, which is derived from open-ended interviews. Open-ended interviews aim to collect peoples' beliefs on a topic, expressed in their own terms, without interference of experts' prejudgments. The interview questions should cover all relevant topics, while allowing the participants to express their opinions, whether they are right or wrong. The third step is to conduct a confirmatory survey, which should be based on the responses derived from the initial interviews, so it covers all the relevant topics of concern. The follow-up survey will capture a larger sample that should be appropriately selected from the intended audience, and it will estimate the popularity of these beliefs across the population. Based on these findings, a descriptive model can be formed to reveal individuals' behaviour as it takes place, how and why people think in this way. Lastly, the interview and the survey findings can be used to identify knowledge gaps between experts and non-experts and to shape communications between them. The latter is not the purpose of this research as we do not suggest that there exists an ideal way of thinking and deciding for financial traders.

According to Bruine de Bruin and Bostrom (2013) the use of conducting interviews in research offers the advantage that interviewees may raise topics about which the researcher may not be aware of in advance, and it should reveal the wording that individuals use to describe the relevant issues. While the advantage of using surveys is that they can be distributed to a larger number of respondents compared to the number of interviewees, which makes them time and cost-efficient. Also, surveys allow for the transformation of the qualitative beliefs into quantitative data, which can be tested for their statistical validity.

Overall, this thesis follows the five-step protocol of descriptive models. The literature review plays the role of the normative model, which represents the theory behind financial traders' decision-making. A descriptive model was derived by the two rounds of open-ended interviews, where the financial traders answered relevant questions on gender and uncertainty. A confirmatory survey was released a year later, based on the interview analyses. The survey analysis was used to update the descriptive models with the latest findings. The last step, identifying knowledge gaps among the population under research and the scientific community in order to improve financial traders' decision-making was skipped, as we do not adopt the approach that there is an ideal way of thinking and behaving on the trading floor. Instead, we compare the normative and the descriptive models to identify the contributions to the contemporary scientific literature. Lastly, following the five-step protocol ensures that we conduct research in a systematic way, free from prejudgments and assumptions about financial traders' behaviour. Therefore it allows us to reveal new dimensions of decision-making under uncertainty and the role of gender in finance, which are not covered by the existing literature.

3.3 Study design and procedure

3.3.1 The overall study

This study answers two research questions. Firstly, how do financial traders behave in an uncertain environment; and also what are the gender differences and similarities among financial traders. To answer them we built an open-ended interview protocol, which allowed the interviewees to express their own opinions and definitions, without leading them to specific answers. We also released a follow-up survey based on the interview findings. Their analyses were informed by the Post-Keynesian definitions of uncertainty,

as well as by the feminist research on gender differences and similarities in financial decision-making.

Financial traders' opinions on fundamental uncertainty and the role of gender were examined in different points of time, also called waves. Two waves of open-ended, semi-structured, telephone interviews were conducted in 2016, covering the topics of decision-making under uncertainty, decision-making after the Brexit referendum and the role of gender in financial trading. Wave 1 took place between February and May 2016, while the same group of interviewees was approached in wave 2, which took place after the Brexit referendum (June 2016), between August and October 2016. We called the interviewees from University of Leeds, Business School phone room. These interviews allowed financial professionals to reveal their opinions for the topics under discussion, and they were used to construct appropriate descriptive models around human behaviour and social norms in finance. A follow-up online survey - wave 3 - was released in June 2017 and was completed on the 28th of July 2017, answered by financial traders. The survey was based on the interview findings, and it aimed to increase the sample size, to provide supporting evidence for the interview findings, and to test the statistical validity of the interview results. Table 4 presents the three waves of data collection.

Table 4. Waves of data collection[1]

Waves	Data collection method	Time period	Sample size
Wave 1	Phone interviews	February-May 2016 (Pre-Brexit referendum)	13 participants
Wave 2	Phone interviews	August-October 2016 (Post-Brexit referendum)	10 participants
Wave 3	Online survey	June-July 2017	210 participants

Financial traders-the statistics

Despite the central role of traders' decision-making in financial markets, there is little information available on the number of financial market traders, as they do not register

[1] The Brexit referendum took place on 23 June 2016.

with a professional body. Also, the existence of numerous online trading platforms makes it easier than ever to access financial markets. According to a recent report (BrokerNotes, 2018), the number of online, retail, traders is estimated to be 13.9 million, while 2.7 million of them are female traders. Retail traders are individual traders who buy or sell securities for their personal accounts. The UK has the highest participation of retail traders in Europe, with more than 730,000 online traders. Since 2014, the percentage of traders between 25 and 34 years old has increased, as opposed to the percentage of traders over the age of 45, due to lower barriers to entry and the rise of the cryptocurrency markets. The average income of retail traders in the UK is 35,742 British pounds per year.

Institutional traders, on the other hand, buy or sell securities for financial institutions, e.g. banks, hedge funds, asset management firms and insurance companies. In July 2008 the US hedge fund industry was estimated of 3 trillion US dollar value in total assets, while only 3% of these assets were managed by female traders and only 10% of mutual fund managers were women (NCRW, 2009). Additionally, based on the 2016 Gender Diversity Index, in financial sector, and specifically, in the biggest 120 financial companies in the US according to the Fortune1000 list, 21.5% of the board members were women. Yet there were no available data about the percentage of female financial traders.

For the purpose of our research, we contacted institutional, financial traders with working experience on financial institutions' trading floors. Firstly, because institutional traders are dealing with high volumes of trades, as opposed to individual, independent traders, hence their investment movements have a greater impact on market prices. Secondly, because they work on trading floors, they get influenced by the reactions of their colleagues and the market sentiments, which is part of the Keynesian theory of fundamental uncertainty and it informs our research design. Lastly, their working experience from the trading floor is necessary to contribute to the research of gender norms in finance.

3.3.2 Interviews' design and procedure

Wave 1 interviews

The goal of interviews is to allow people to talk as much as possible about how their opinions and experiences, while imposing as little as possible of others' ideas, perspectives and terminology (Morgan et al., 2002). For this reason, the wave 1 interviews started with a simple and open-ended question, such as "Could you please describe a situation of

uncertainty on the trading floor?". Then the interviewees answered to a few follow-up questions, more focused that would provide greater details. The Post-Keynesian definition of fundamental and unmeasurable uncertainty informed the interview design, therefore to avoid confusion with risks, uncertainty was also described as "unknown risks" in a follow-up question. Other topics covered by the interview questions were the sources of fundamental uncertainty, which are often overlooked by the Post-Keynesian literature, the traders' reaction to uncertainty, as well as other individuals' reactions, and lastly questions about regulators' reactions to uncertainty.

As for the gender-focused interview questions, we first asked the interviewees' opinion about female participation, to test whether their experience agrees with the feminist literature of female underrepresentation. Then we asked the interviewees' opinion both for gender similarities and gender differences, as suggested in the feminist literature (Nelson, 2014; 2018). A pilot interview was conducted in advance with non-professionals to control for its quality, to ensure that the use of jargon was avoided and to calculate the time length of it. Table 5 presents the interview questions of wave 1.

Table 5. Wave 1 interview questions

Main questions	Which theory informed the interview questions?
Could you please describe a situation of uncertainty on the trading floor? **Follow-up questions:** Could you please describe a situation of unknown risks on the trading floor? Can you describe what made that situation uncertain? How did you respond to this uncertain event? How did others respond? How would regulators react? How should regulators react? Does uncertainty play a role when investing in shadow banking? Is there a link between uncertainty and regulation, or the absence of it?	Keynesian and Post-Keynesian theories of fundamental uncertainty
In your experience, how common is it for women to participate on the trading floor? What are the similarities you can think of between male and female traders? What are the differences you can think of between male and female traders?	Feminist theories focusing on both gender similarities and differences

Wave 1 interviews took place between February 2016 and May 2016. They were all phone interviews, and the calls were made from Leeds University's facilities. The selection of the participants was based on snowball sampling due to the difficulty of recruiting interviewees. Despite our efforts to contact Leeds University alumni, through the university's alumni office, and by contacting directly financial institutions in the UK, we did not get enough positive responses. Therefore, the first interviewee was contacted initially by Professor G. Dymski, and the rest were approached through snowball sampling, i.e. interview participants directed us to other participants who also fit the research criteria, through their network. Each of them was awarded an Amazon voucher of £100 value (two participants kindly refused it) and on average each interview lasted about an hour or less.

The sample population of the wave 1 interviews, consists of fourteen participants (one interview is not included in the analysis due to low sound quality). The number of participants is considered to be a sufficient sample for qualitative research (Bruine de Bruin and Bostrom, 2013). In order to participate, they had to be over 18, to be recruited from the UK and other EU countries, to have at least one year of experience on the trading floor, to be familiar with trading financial securities in secondary markets (not necessarily having working experience), and lastly they had to sign a consent guide which was distributed in advance.

Out of the thirteen participants, seven were men and six were women. Their average age was 34.7 years, and their average working experience was 10.15 years. One did not hold any degrees, one held only bachelor's degrees, eight had Master's degrees and three had PhD diplomas.

The research project had the approval by the Chair of the ESSL, Environment and LUBS (Ethics reference AREA 14-139) Faculty Research Ethics Committee. The data about the companies where the interviewees' worked or the type of their trading deals were not collected, but we were able to gain further information about the working environment for eleven out of the thirteen interviewees by matching all publicly available information (CVs, LinkedIn profiles) with their personal data. Information for the remaining two participants was unavailable. Also, we tracked further information in our transcripts. In

this section, we present all the available information about our participants' background unanimously.

The interviewees' working background

Financial markets are distinguished into the buy and the sell sides (wave 1, interviews). Our participants held positions in the sell-side, the so-called trading floors in investment banks. Some of them -at least two- had working experience from both sides. The sell-side provides services to investors (the buy-side) by structuring and selling financial products, by providing market execution services, as well as research for particular companies and stocks. For example, structuring and trading derivatives and securities are part of the sell-side. On the other hand, the buy-side consists of institutions or individuals that invest in the markets with some rate of return regularly (monthly, yearly, etc.), and they buy financial services provided from the sell-side. In our analysis they are referred as investors or clients.

The interviewees' roles often overlapped, because participants held more than one roles. Four interviewees had working experience as equity traders, i.e. buying and selling companies' stock shares in the equity market. Six participants had trading experience in fixed income markets, i.e. with a special focus on long-term investment strategies such as treasury and certificate bonds. Seven participants also had experience with trading derivatives and securities, i.e. financial products whose value depends on the underlying assets. Such groups of assets may consist of stocks, bonds, commodities, currencies, interest rates and market indexes. Lastly, risk and portfolio management were two keywords often used to describe their working qualifications. These markets are highly volatile and uncertain, especially the equity, derivatives and securities markets, therefore the selected interviewees had the appropriate experience with dealing with financial uncertainty. For example, one of the equity traders described a case of uncertainty while trading the stock shares of a company, due to the fact that one of its subsidiaries was involved in a scandal. The scandal led to the failure of a merge, and the trader was not sure how it would influence his deal.

The interview participants also had working experience from leading financial intuitions. Particularly, ten participants had current or past working experience in six out of the top 10 investment banks globally (Investopedia, 2018a). These institutions provide a broad

spectrum of financial services. For example, on the official site of one of these institutions it was stated that the company offered financial activities in listed futures markets, over-the-counter swaps, options and other derivatives referencing, interest rates, currencies, investment grade and non-investment grade corporate credits, sovereign securities, market bonds and loans, credit indices, asset-backed security indices, property indices, mortgage-related and other asset-backed securities, and real estate loan products. Another company was one of the largest asset and wealth managers in the world as of December 31, 2017, for individuals, advisors and institutions. And a third one achieved the second-highest revenues of any investment bank worldwide in 2010, with a global market share of 6.8%. The information provided is public and the companies' titles are not included to protect interviewees' anonymity. We matched information taken directly from the companies' sites and from the Financial Data Research Platform (accessed on Aug. 8, 2018). The big market size of these companies ensured that our interviewees had the appropriate knowledge of how international institutions and markets are functioning and they provided relevant answers to our questions. Table 6 summarises the financial activities of these institutions, their market size as per market capitalisation, and the number of interviewees with working experience in these institutions.

Table 6. Interviewees' working environment

Type of institution (in the top 10 investment banks globally) Investment activities	**Size of financial institution (market capitalisation)**	**Number of interviewees with working experience in this institution**
Institution 1: investment, mergers and acquisitions, equity and debt capital markets, lending, trading, risk management, research, and liquidity and payments management	The company's market capitalisation was 316.83 billion USD as of Aug. 8, 2018.	4
Institution 2: retail banking and wealth management, commercial banking, global banking and markets, and global private banking	The company's market capitalisation was 187.90 billion USD as of Aug. 8, 2018.	1

Table 6. continued

Type of institution (in the top 10 investment banks globally) Investment activities	Size of financial institution (market capitalisation)	Number of interviewees with working experience in this institution
Institution 3: investment banking, institutional client services, investing & lending and investment management	The company's market capitalisation was 89.85 billion USD as of Aug. 8, 2018.	1
Institution 4: institutional securities, investment management and wealth management	The company's market capitalisation was 87.47 billion USD as of Aug. 8, 2018.	2
Institution 5: wealth management, retail & corporate, global asset management, investment banking and corporate centre	The company's market capitalisation was 60.04 billion USD as of Aug. 8, 2018.	2
Institution 6: private banking, wealth management and investment banking, debt and equity underwriting, mergers and acquisitions, sales and trading, and investment research	The company's market capitalisation was 40.29 billion USD as of Aug. 8, 2018.	3

Sources: Financial institutions' official sites; Investopedia (2018a), Financial Data Research Platform (2018)
Note: The number of the participants does not add up to eleven, due to the fact that some had working experience in more than one of the listed companies

Wave 2 interviews

The second wave of interviews was informed by the Disaster Myopia Hypothesis (DMH), the systematic tendency to underestimate shock probabilities, which increases as time passes since the last economic shock took place (Guttentag and Herring, 1986). In order to test the DMH we needed to interview people before and after an economic shock and compare how their opinions may change over time. The Brexit referendum was chosen to test the DMH, because despite the fact during wave 1 interviews took place a few months before the EU referendum, none of the interviewees referred to it as a potential case of uncertainty. Therefore, the Brexit vote fits the Post-Keynesian definition of fundamental uncertainty, according to which future economic events cannot be accurately forecasted

by quantitative models. As a result, individuals have to adjust their decision-making process to potential surprises and unexpected events, and our intention was to capture this change in their behaviour. Additionally, to test the DMH, the same set of interview questions was repeated purposefully to the same interviewees in wave 2, in order to avoid confirmation bias in their answers. We wanted to test whether our participants would agree with our hypothesis about the Brexit vote -that it was an unforeseen event that influenced their decision-making- rather than defining it as an uncertain event from the beginning of the interviews. This is why we did not ask directly the interviewees' about the referendum, in order to avoid leading them into a specific answer and to allow them unveil their own opinions. This practice agrees with the descriptive models approach, which aims to gather data free from the scientists' prejudgments.

We started the wave 2 interviews again with an open-ended question about uncertainty "Could you please describe a situation of uncertainty on the trading floor?" because we did not want to lead them to a specific answer, such as to define the Brexit vote as a case of fundamental uncertainty. Instead we wanted to test this hypothesis. Given that all of the participants in wave 2 referred to the announcement of Brexit as a case of uncertainty, we adjusted the follow-up questions to the topic, covering once more the sources of uncertainty, the traders' reaction to it, as well as others individuals' reactions and lastly, the regulators' decision-making. We also asked them to reveal their true decision-making process around uncertain future events, by asking them "What do you think is going to be the future impact of Brexit on the British economy and financial markets?". Table 7 presents the interview questions of wave 2.

Table 7. Wave 2 interview questions

Main questions	Which theory informed the interview questions?
Could you please describe a situation of uncertainty on the trading floor? **Follow-up questions** Can you describe what made that situation uncertain? How did you respond to the announcement of Brexit? How did others respond? How did regulators react? How should regulators react?	Keynesian and Post-Keynesian theories of fundamental uncertainty Disaster Myopia Hypothesis, "old" behavioural economics
What do you think is going to be the future impact of Brexit on the British economy and financial markets?	Keynesian and Post-Keynesian theories on expectations and unforeseen future

The second wave of interviews took place between August 2016 and October 2016. They were all phone interviews, and the calls were made from Leeds University's facilities. The same group of participants was asked to repeat the interview and ten out of thirteen replied positively. The number of participants is considered to be a sufficient sample for qualitative research (Bruine de Bruin and Bostrom, 2013). They did not sign a second consent guide, and they did not receive a payment. Each interview lasted on average twenty to thirty minutes.

3.3.3 Survey's design and procedure

Based on the descriptive models methodology, once the interview transcriptions are complete, they need to be analysed both for the intrinsic value of qualitative data, but also to be developed forward to a structured survey (Morgan et al., 2002). There are several advantages of conducting a survey, which is designed based on the outcomes of the interview analysis. Firstly, a closed-ended survey can be more efficiently shared to a larger number of participants both in terms of cost and time, compared to conducting interviews. Specifically, internet surveys allow overcoming geographic boundaries and it allows the participants to answer when it suits them best (Bruine de Bruin and Bostrom, 2013). Secondly, surveys allow us to identify the frequency of concepts or opinions of the sample population, as well as to explore issues suggested in the interviews that are not adequately resolved, e.g. gender differences. Thirdly, a survey allows us to transform

qualitative results to quantitative observations and therefore we are able to investigate further with statistical tools the relationships between several variables. For example we tested whether there is a relationship between definitions of uncertainty and financial traders' reactions to it. It is important to clarify that the survey variables were derived from the interview results. In our example, the definitions of uncertainty and financial traders' reactions were defined by the interviewees. This way the methodology ensures the relevance of the topics under discussion, instead of using randomly defined variables by the researcher.

The research project has the approval by the Chair of the ESSL, Environment and LUBS (Ethics reference AREA 14-139) Faculty Research Ethics Committee (May 2017). The survey was designed on Qualtrics software, version May 2017 of Qualtrics (2017), and took approximately 15 minutes to complete. The questions were organized in three sections and each section corresponded to one of the research questions. Each section included multiple screens. The statements were derived from the interview findings and they followed the same themes. Lastly, a pilot survey was released in advance with non-professionals, in order to control for its quality, to ensure that use of jargon was avoided, and to calculate the time length of it.

The survey participants were initially approached through Leeds University Alumni office, and due to low responding rate, more participants were recruited on internet platforms (i.e. LinkedIn) and professional groups of financial traders (trading forums). There exist 337,208 LinkedIn profiles of financial traders, from whom at least 916 were contacted directly by us, and 310 opened the survey link. Our survey sample consists of 210 participants, who were required to have working experience as traders on a trading floor of at least a few months. The participants who declared zero trading experience on a floor, or did not report it at all, were excluded by this analysis. Lastly, they were all given the opportunity to participate in a giveaway of two Amazon vouchers of value £100. The prize winners were randomly chosen once the survey was closed.

The sample is not representative of the population of financial traders, but with the appropriate analyses of the data we reached to informative conclusions. Particularly, a diverse convenience sample, like ours, may be sufficient if a complete list of a specific audience does not exist, and the main goal is to examine potential relationships between

beliefs and behaviours (Bruine de Bruin and Bostrom, 2013). The majority of the participants were located in the UK (77.6%), and the rest were located in countries such as France, Singapore, the US, Canada, Australia and other countries. Sixty-nine percent of the participants declared that they were trading in the UK financial markets. Their average age was 38.23 years (SD=9.83), and their average working experience on the trading floor was 10.3 years (SD=8.14). Most of them were males (78.4%) and 21.6% were females, 58% held an advanced degree (MSc, Professional degree or PhD) and 41.6% had a Bachelors' degree or no degree at all.

The survey participants' working background

All participants were sent the same message which included information about the research. Because the survey was sent with an online link, the process is anonymous and the participants cannot be tracked. Therefore, we cannot obtain information about the financial institutions within which the participants worked, as we did for the interview participants. We have information though about their roles. In order to approach the financial traders, we used the following keywords in the LinkedIn platform's search machine: Forex rates credit trader, algorithmic trader, quantitative analyst/trader, equity future options traders, risk management, credit trader, financial market analyst, portfolio manager, proprietary trader, derivatives trader, commodities markets, fixed income/fixed return trader, oil options broker, sales trader, high-frequency trader, mortgage trader, securitisation trader. This ensures that our participants had sufficient experience in financial trading under uncertainty. Table 8 summarises how these markets function and why they are uncertain.

Table 8. Survey participants' working environment

Searching keywords	Why is this market uncertain?
Forex rates credit trader	It is driven by foreign exchange rates and by a variety of factors that may influence the value of foreign currency, such as political events, weather conditions which may affect exports etc.
Algorithmic/High-frequency trader	Due to the fast transactions and their volume, small mistakes may prove costly. Also, it is a fast-changing market due to technological innovations.
Quantitative analyst/trader	This category of traders relies heavily on quantitative models, complex and difficult to be understood, especially in volatile periods.

Table 8. continued

Searching keywords	Why is this market uncertain?
Equity future, and options traders	This type of trading relies on future values of positions, therefore it is by definition highly uncertain due to price volatility. A type of trader from this category often found in our sample is the oil options broker.
Risk management	Risk management is uncertain because it is based on risk projection, on financial modelling which cannot incorporate into its calculations future unexpected events.
Credit trader	It postpones the repayment of an agreement at a specific point in the future. It is risky due to the fact that the value of the deal may change over time and one of the parties may lose. Same holds for the value of the collaterals.
Financial market analyst	Analysts research the market conditions, some of them work as financial traders as well.
Portfolio manager	Someone who manages day-to-day portfolio movements, i.e. financial trader.
Proprietary trading	When a company invests in its own assets, instead of other companies' stocks. It is risky, because it can drive its market value up, without real investment.
Mortgage trader	Mortgage trading is based on mortgage-backed securities. It is meant to be a less uncertain type of trade, due to relatively steady house prices. Due to the extended securitisation, the credibility of the underlying assets is not well defined and may lead to uncertainty about their real value. The 2008 financial crisis is an example of it.
Securitisation trader	Financial securities are a liquidity instrument. It merges different types of financial assets, often parts of them –known as trenching- and repackages them in order to be sold as an independent investment vehicle. It is a highly uncertain type of trade, because its market price often departs from the value of the repackaged debt obligations.

Sources: The descriptions of the markets' functioning found at the Investopedia (2018b) Accessed on 10th of Aug. 2018)

The survey questions

The first section of the survey included all the questions with regard to financial uncertainty, and it consisted of three screens. The questions were informed from the wave 1 interviews. The questions had the form of statements, and the participants described their degree of agreement in the scale of five options (Likert scale); Strongly disagree (1),

Disagree (2), Neither agree nor disagree (3), Agree (4), Strongly agree (5). The first screen presented the questions about traders' interpretations of uncertainty, as described in the wave 1 by the interviewees. There were four statements which either linked uncertainty with traders' behaviour, e.g. not knowing how to react, not being able to predict the market, or they provided a broader definition such as the fact that uncertainty is fundamental and cannot be avoided. On the second screen, the participants were asked their opinion about the sources of uncertainty. All the potential sources, e.g. natural disasters, news release, human limitations, change in expectations etc. were picked up from the interview analysis. Literature often overlooks the reasons behind uncertainty, so it was important to include these questions for further investigation. Lastly, the third screen explored financial traders' decision-making process under uncertainty on the trading floor. There was a variety of actions against uncertainty according to the wave 1 interviewees. Some of them suggested that they may take into considerations other traders' decision, others may try to collect more information about the cause of uncertainty, they may decide to close their deals and exit the market or they may lose confidence over their judgment and rely more on financial modelling. These were some of the traders' potential reactions to uncertainty. It was important to examine the survey participants' agreement with these statements, as well as to test whether a relationship between different interpretations of uncertainty and reaction towards it existed. Table 9 includes all the questions of the first section of the survey, and how the interview analysis informed the survey results.

Table 9. Wave 3 survey questions about financial uncertainty[2] (section 1 of the survey)

Questions	How did the interview results inform the survey? (Wave 1)
Screen 1: Traders' interpretations of uncertainty	
There is uncertainty when you don't know how to react	Six interviewees described uncertainty as the unknown, the market conditions under which you do not know how to react
There is uncertainty when you cannot predict the market movement	Six interviewees described uncertainty as the inability to predict the market movement
Uncertainty cannot be avoided	Six interviewees described uncertainty as an inherent characteristic of the financial markets, which cannot be avoided.
Screen 2: Sources of uncertainty	
Complex financial innovation may cause uncertainty	Six interviewees described financial innovation both as a source of uncertainty and as a response to it.
Change in market expectations about future events may lead to uncertainty	Four interviewees suggested that an unexpected change in expectations about future events is a source of uncertainty, and it often leads to a quick lack of liquidity.
Continuous news release may lead to uncertainty	Continuous news release was reported as an important source of uncertainty by four financial traders.
Human limitations may lead to uncertainty	Three interviewees supported that human element and other cognitive limitations are a source of uncertainty.
Changes in financial regulation may lead to uncertainty	A continuously changing financial regulatory scheme was also described by two interviewees as a source of uncertainty for the banking sector, due to its unforeseen impact on current trades.

[2] Likert scale: Strongly disagree (1), disagree (2), neither agree nor disagree (3), agree (4), strongly agree (5)

Table 9. continued

Questions	How did the interview results inform the survey? (Wave 1)
Screen 3: Financial traders' decision-making under uncertainty	
Under uncertainty I take into consideration other traders' decisions	Five interviewees suggested that market expectations and other agents' trading decisions should be taken into consideration before any movement takes place.
Under uncertainty I search for more information Under uncertainty I try to identify what causes it	Three of the interviewees reported that under uncertainty, they try to remain calm, and to find more information about the causes of market volatility, before they make any decisions.
Under uncertainty I might exit the market	Four interviewees reported that when the market is panicking and the outcome of any movement is highly unpredictable, they often choose to exit the market and close their deals.
Under uncertainty I rely on financial modelling	Four interviewees suggested that financial modelling based on probabilities is a way to deal with uncertainty, given the traders' human limitations in calculations.
Under uncertainty I set targets for losses and profits	Two interviewees suggested that one way to cope with uncertainty is to set upper and lower limits of losses and profits, respectively.
Under uncertainty I simplify my trades	Another reaction to uncertainty, from a trader's point of view is to simplify his/her trades either by shortening maturity or by simplifying the structure, as suggested by two interviewees.

[2] Likert scale: Strongly disagree (1), disagree (2), neither agree nor disagree (3), agree (4), strongly agree (5)

The second section consisted of the questions around Brexit and/or the Brexit vote, which were informed from wave 2 interviews. These questions were important because they allowed us to investigate financial traders' perceptions around Brexit one year after the EU referendum and test whether the time distance from a shock influenced traders' perception of uncertainty, as the Disaster Myopia Hypothesis suggests.

The participants were asked to express their degree of agreement on a five-point Likert scale; Strongly disagree (1), Disagree (2), Neither agree nor disagree (3), Agree (4),

Strongly agree (5). The fourth screen included the reasons why Brexit may be an uncertain event, as it is important to understand the causes of this uncertain event. The fifth screen explored traders' decision-making before and after the announcement of Brexit. Again there was a variety of reactions to the Brexit announcement, most of them linked with undertaking less risk according to wave 2 analysis. We wanted to test whether risk aversion levels had changed over time. Lastly, the sixth screen consisted of the statements about traders' opinion on Brexit's future impact on the British economy and financial markets. The Brexit vote was an example of financial uncertainty which allowed us to examine traders' true decision-making process with regard to future events. Despite the fact that it has been announced it will take place at some point in the future with unknown consequences on markets and the British economy. Table 10 includes all the questions of the second section of the survey.

Table 10. Wave 3 survey questions about Brexit [3](section 2 of the survey)

Questions	How did the interviews inform the survey? (Wave 2)
Screen 4: Brexit as an uncertain event	
Brexit is still an uncertain event, with respect to the future agreement with the EU	Uncertainty remains on the trading floor, as suggested by three interviewees, even after the referendum. Uncertainty raises with regard to the future agreement between the UK and the EU.
There is a lack of clarity about what Brexit will mean for trading	The lack of information about the future, and the absence of a framework were reported as sources of uncertainty with respect to Brexit, by five interviewees.
Expectations about post-Brexit economic/political events create uncertainty	A possible future domino effect of negative economic and political phenomena after leaving the EU was also a source of uncertainty, according to a female trader.
There is uncertainty because it is the first time a country leaves the EU	The fact that there is no previous experience of an EU-member country exiting the union makes Brexit an uncertain event, according to a male trader.

[3] Likert scale: Strongly disagree (1), disagree (2), neither agree nor disagree (3), agree (4), strongly agree (5)

Table 10. continued

Questions	How did the interviews inform the survey? (Wave 2)
Screen 5: Traders' decision-making after the announcement of Brexit	
After the announcement of Brexit, I remained passive	Five interviewees reported that after the announcement of Brexit they were confused, and they did not know how to react. As a result, they stayed passive and tried not to make mistakes.
After the announcement of Brexit, I simplified my trades After the announcement of Brexit, I avoided risk-taking	According to four interviewees, the market reacted by shortening maturity, simplifying trade and avoiding risk-taking.
After the announcement of Brexit, I exited the market	Three interviewees decided not to keep any positions, therefore, not to have risk exposure, and they exited the market.
Before the EU referendum, I hedged my positions	From a technical point of view, three participants mentioned that hedging strategies were applied before the referendum, to protect their financial portfolios from potential market volatility.
Screen 6: Traders' opinion on Brexit's future impact on the British economy and financial market	
Brexit will lead to further Sterling Pound devaluation	The Sterling Pound devaluation was identified by six interviewees as a short-term effect.
The market became more sensitive to uncertainty after the EU referendum	Five interviewees suggested that the market became more sensitive to uncertainty, after the announcement of Brexit. I.e. news release would cause unusual price volatility.
After Brexit, EU financial regulation must be adjusted by the British regulator After Brexit, UK companies might lose their EU passporting rights	Four interviewees suggested that the legal framework will need to be adjusted by the British financial regulatory services. An example is the loss of the right to operate in any other EU-country without further authorisation required, also known as passporting rights.
In the long-run financial markets will equilibrate at the pre-Brexit levels	Three interviewees suggested that in the long-run financial markets will settle at the pre-Brexit levels again.

Section three explored traders' behavioural/trading characteristics on the trading floor, which was informed by the wave 1 interviews. Particularly, the seventh screen included statements about female professionals' representation on the trading floor, mostly focused on the different hierarchies between men and women financial professionals. For example, during the wave 1 interviews it was stated that women tend to occupy either junior trading position or administrative positions on the trading floor. In this screen, the first question (number 32) required an answer expressed as a percentage. The rest of the questions asked for participants' degree of agreement on a five-point Likert scale, once more; Strongly disagree (1), Disagree (2), Neither agree nor disagree (3), Agree (4), Strongly agree (5). The eighth and ninth screen presented statements about traders' behaviour, which later revealed whether gender similarities and differences existed. We decided to mix the statements about the potential similarities and differences, as derived from the wave 1 interview analysis, instead of asking them separately, to avoid confirmation bias in the traders' answers. That way the participants did not feel that they were expected to give specific questions based on their gender. For the same reason, the statements were expressed in the first person. Therefore, the survey explored differences in the behavioural patterns among the two groups (male-female) instead of gender stereotypes expressed as questions on gender roles. Table 11 includes all the questions of the third section of the survey.

Table 11. Wave 3 survey questions about gender on the trading floor[4] (section 3 of the survey)

Questions	**How did the interviews inform the survey? (Wave 1)**
Screen 7: Female representation on the trading floor	
Women are underrepresented on the trading floor, as in most white-collar professions	One interviewee explained the female underrepresentation due to gender inequality in most-collar professions
Most women on the trading floor hold administrative positions	One interviewee suggested that the women on the trading floor usually work in the back-office, as Pas

[4] Likert scale: Strongly disagree (1), disagree (2), neither agree nor disagree (3), agree (4), strongly agree (5)

Table 11 continued

Questions	How did the interviews inform the survey? (Wave 1)
There is low female representation at senior trading positions Women are underrepresented in better-paid positions	Six participates reported that women traders are mostly met at junior and lower-paid positions
There are not as many female traders, because not enough women study mathematics and/or engineering	Two participants reported that not enough women study maths and engineering
Screen 8: Traders' behavioural characteristics	
I find the trading floor intimidating	Five interviewees described trading floor as a male-dominated working environment, which may be intimidating for women.
I plan to leave the trading floor due to family responsibilities	Two interviewees discussed the different gender roles in the male-breadwinner family model, which may lead female traders to leave the trading floor earlier than their male colleagues.
I am competitive with regard to trading	Seven interviewees identified aggression, risk-taking, competitive nature as a gender similarity
I have good problem-solving skills	Five interviewees identified logical thinking, analytical and problem-solving skills as a gender similarity.
Gender does not play a role in the job of the trader	Three interviewees suggested that gender does not play a role in the job of the trader.
I am careful in terms of financial risk I focus more on long-term views	Eight interviewees suggested that female traders are more careful with the type of risk they undertake on their portfolios. Also they supported that women traders focus more on the long-term views, rather the short-term gains and losses.

Table 11 continued

Questions	How did the interviews inform the survey? (Wave 1)
I am fast in making decisions I might be loud about my success	Male traders were described as faster in making decisions and loud about their success, by eight interviewees.
I have good communication skills	Women's better communication and social skills were highlighted by three interviewees
I might show my ego on the trading floor	Men's ego on the trading floor has been reported as a weakness by two interviewees.

The last screen included questions about the sample demographics. Particularly, the participants were asked their gender, their year of birth, their educational background and degrees, their employment status and the length of their working experience as financial traders. Table 11 shows how the questions about participants' demographic characteristics were asked and coded.

Table 12. Demographics

Questions	Available options
What is your gender?	Male (1) Female (2)
What is your year of birth?	Open-ended, numerical values
Do you hold any degrees?	I don't hold any degrees (1) Bachelor's Degree (2) Master's Degree (3) Professional degree (4) Doctorate (5)
What is your educational background?	Mathematics-Statistics (1) Engineering (2) Finance (3) Economics (4) Law (5) Social sciences (6) Other (7)
What is your current employment status?	Employed full time (1) Employed part time (2) Unemployed (3) Student (4) Retired (5)
How many years of experience do you have on the trading floor?	Open-ended, numerical values
If less than a year, how many months of experience do you have on the trading floor?	Open-ended, numerical values
Are you trading in the UK financial markets?	Yes (1) No (2)
What country are you located in?	Open-ended

3.4 Qualitative analysis

To analyse our qualitative data, we followed another influential source in the area of decision-making research, from Bruine de Bruin and Bostrom (2013), which addresses the application of the descriptive models methodology in social sciences. We choose the descriptive models method because it allows us to identify new definitions, decision-making processes and beliefs that we had not considered in advance or they did not exist in the contemporary literature.

During conducting interviews (waves 1 and 2) we asked open-ended questions without suggesting specific ideas, while encouraging the interviewees to express their opinions for the relevant topics. According to the descriptive models methodology, the interviewer

should remain an active listener and keep a non-judgmental tone (Bruine de Bruin and Bostrom, 2013). When the interviewees asked for help we stated clearly that there were no wrong answers and the goal of the process was to reveal their perspectives. That way we ensured that our qualitative data captured news ideas that may not exist in the current literature, which is also the contribution of this research. For this reason, the descriptive models approach was chosen. Additionally, phone interviews, apart from reducing geographical limitations, allowed us to keep notes about emerging concepts during the process which were further investigated with follow-up questions, without distracting the interviewees (Bruine de Bruin and Bostrom, 2013).

After transcribing the interviews, we analysed them based on frequencies of beliefs emerging from the interviewees (Bruine de Bruin and Bostrom, 2013), in order to identify the most commonly reported opinions of the participants, and their preferred wording, with respect to each question under investigation. We coded the qualitative data for content, following the descriptive models methodology, i.e. by drawing systematic comparisons among the interview content and the scientific literature review (Bruine de Bruin and Bostrom, 2013). We used this analysis to build a descriptive model of the interviewees' behaviour, which was compared to the normative model of decision-making, i.e. the literature review (Morgan et al., 2002). The comparisons among the normative and the descriptive models are presented in the contributions-sections of the empirical chapters of this thesis. This step identifies the interviewees' opinions that agree or disagree with the scientific literature, as well as new topics raised by the participants that contribute to the existing knowledge. When the concepts that were brought up by the interviewees were too similar, we coded them into a general category. We created new codes for new beliefs, and depending on how often a concept was mentioned by them we made the judgment that it was a general belief of financial traders.

As opposed to the standard approach of the descriptive models methodology, we do not search for misunderstandings between financial traders and academics. We do not suggest that financial traders should take action as the literature suggests, and we do not support that there is an ideal way of reacting to uncertainty. Our goal was to investigate how financial traders interpreted the uncertain circumstances under which they were

making decisions, how they reacted to them and what were their opinions about the role of gender in financial trading.

The interview analysis was used to create a follow-up survey, as recommended by the descriptive models methodology, which captured all the relevant beliefs. Based on the most common beliefs, as well as the most intriguing ones, we shaped the survey questions. Tables 9 to 11 show how the survey statements we informed from the interview findings.

3.5 Factor analysis

When survey variables are derived from interview analyses and they report personal opinions, they may also capture similar behavioural patterns among participants. For example in our analysis, the two variables “Under uncertainty I take into consideration other traders' decisions” and “Under uncertainty I rely on financial modelling” which were derived from the wave 1 interview results, they both captured a loss in traders’ confidence in their judgement. As a result, when analysing the quantitative data these two variables may be highly correlated, they may cause multicollinearity in the linear regression analysis of decision-making under uncertainty. To overcome this problem, literature suggests the use of the factor analysis method in order to categorise and reduce the number of variables under research (Tabachnick and Fidell, 1989). Factor analysis of the survey data reduces the number of variables and groups them into categories based on the varimax and oblimin rotations, which capture their common factors (Tabachnick and Fidell, 1989). In our example, the two variables were grouped into a new summary variable under the title “Under uncertainty I follow others’ decision-making”, which reflects their common factor: the loss of confidence in their judgement. The summary variables were created by incorporating the mean values of the initial ones. Appendix A includes all the technical information about the varimax and oblimin rotation results for each summary variable.

Traders’ definitions of uncertainty were categorised into two groups. The first group, under the title “There is uncertainty when you cannot predict and react accordingly”, reflected the behavioural aspect of the definitions of uncertainty. The second group, under the title “There is always uncertainty in the system and cannot be avoided”,

captured the fundamental and systemic nature of uncertainty. The results of the factor analysis of the definitions of uncertainty are summarised in table 13.

Table 13. Definitions of uncertainty, summary variables

Summary variable	Initial variables
There is uncertainty when you cannot predict and react accordingly	There is uncertainty when you do not know how to react There is uncertainty when you cannot predict the market movement
There is always uncertainty in the system and cannot be avoided	Uncertainty cannot be avoided Complex financial innovation may cause uncertainty

All the sources of uncertainty were categorised into one new variable, under the title "Sources of uncertainty", as shown in table 14.

Table 14. Sources of uncertainty, summary variables

Summary variable	Initial variables
Sources of uncertainty	Non-systematic factors may lead to uncertainty Macroeconomic phenomena may lead to uncertainty Change in market expectations about future events may lead to uncertainty Continuous news release may lead to uncertainty Human limitations may lead to uncertainty Changes in financial regulation may lead to uncertainty

Traders' reactions to uncertainty fell into three categories. The first category was interpreted as "Under uncertainty I try to understand its causes", and it described the fact that traders are seeking for more information about the root of uncertainty. The second group, "Under uncertainty I become more risk averse", reflected a more careful approach towards portfolio risk. The last category was titled "Under uncertainty I follow others' decision-making", and shows traders' loss of confidence in their judgment. Table 15 presents the results of the factor analysis for the variables of decision-making under uncertainty.

Table 15. Decision-making under uncertainty, summary variables

Summary variable	Initial variables
Under uncertainty I try to understand its causes	Under uncertainty I try to understand its causes
Under uncertainty I become more risk averse	Under uncertainty I might exit the market Under uncertainty I set targets for losses and profits Under uncertainty I simplify my trades
Under uncertainty I follow others' decision-making	Under uncertainty I take into consideration other traders' decisions Under uncertainty I rely on financial modelling

The sources of uncertainty with regard to Brexit were categorised into one group which was titled "Brexit still creates financial uncertainty", and it showed that Brexit remains an event of uncertainty; as presented in table 16.

Table 16. Sources of uncertainty after the announcement of Brexit, summary variables

Summary variable	Initial variables
Brexit still creates financial uncertainty	Brexit is still an uncertain event, with respect to the future agreement with the EU There is a lack of clarity about what Brexit will mean for trading Expectations about post-Brexit economic/political events create uncertainty There is uncertainty because it is the first time a country leaves the EU

A summary variable about traders' reaction to Brexit was created under the title "After and before the announcement of Brexit I minimised my risk" and it is presented in table 17.

Table 17. Decision-making after the announcement of Brexit, summary variables

Summary variable	Initial variables
After and before the announcement of Brexit I minimised my risk	After the announcement of Brexit, I remained passive After the announcement of Brexit, I simplified my trades After the announcement of Brexit, I avoided risk-taking After the announcement of Brexit, I exited the market Before the EU referendum I hedged my positions

Traders' beliefs about the future impact were categorised into two groups. The first category reflected traders' beliefs about the future impact of Brexit in the short-term and it was titled "In the short-term there will be a negative impact on the British economy", while the second category showed their opinion about the long-term impact, and its title was "In the long-term the market will equilibrate"; as presented in table 18.

Table 18. Predicting the future impact of Brexit, summary variables

Summary variable	Initial variables
In the short-term there will be a negative impact on the British economy	Brexit will lead to further Sterling Pound devaluation The market became more sensitive to uncertainty after the EU referendum After Brexit, UK companies might lose their EU passporting rights
In the long-term the market will equilibrate	After Brexit, EU financial regulation must be adjusted by the British regulator In the long-run financial markets will equilibrate at the pre-Brexit levels

The reasons for low female participation on the trading floor were categorised into two groups. The first group only included the statement "There are not as many female traders, because not enough women study mathematics and/or engineering". The second group captured the social and institutional explanations of female low representation and it was titled "Women are underrepresented in better-paid positions". The summary and the initial variables about low female participation in finance are presented in table 19.

Table 19. Reasons for low female participation, summary variables

Summary variable	Initial variables
Women are underrepresented in better-paid positions	Women are underrepresented on the trading floor, as in most white-collar professions Most women on the trading floor hold administrative positions There is low female representation at senior trading positions
There are not as many female traders, because not enough women study mathematics and/or engineering	Remains the same

There were identified five categories of traders' behavioural characteristics. The first category, which showed traders' human management and analytical thinking skills, was titled "I am careful and analytical when trading". The second category included more aggressive characteristics regarding trading, and its title was "I might show my ego on the trading floor". The third category of behavioural patterns reflected the participants' unwillingness to work on the trading floor in the long-term, was labelled "I am thinking of leaving the trading floor". The fourth category included statements that showed competitive and risk-loving skills when trading, and it was titled "I am more of a risk lover and competitive when trading". And the last category only included the variable "Gender does not play a role in the job of the trader". All of them are summarised in table 20.

Table 20. Traders' behavioural characteristics, summary variables

Summary variable	Initial variables
I am careful and analytical when trading	I have good problem-solving skills I am careful in terms of financial risk I have good communication skills
I might show my ego on the trading floor	I might be loud about my success I might show my ego on the trading floor
I am thinking of leaving the trading floor	I find the trading floor intimidating I plan to leave the trading floor due to family responsibilities
I am more of a risk lover and competitive when trading	I am competitive regarding trading I focus more on long-term views I am fast in making decisions
Gender does not play a role in the job of the trader	Remains the same

Lastly, to ensure the reliability of the survey, and the internal consistency of the summary variables, the Cronbach alpha statistic (1951) was computed (a=0.57). The Cronbach alpha takes values from 0 to 1, with zero meaning no consistency and 100% internal consistency. A Cronbach alpha of 0.57 is acceptable, particularly for a survey that was released for the first time. The Cronbach's alpha and the factor analysis are used to provide evidence that the components of a scale are sufficiently correlated and the grouped items measure the underlying variable (Sullivan and Artino, 2013).

3.6 Quantitative analysis

Following the wave 1 and 2 interviews, an online survey –wave 3- was released in 2017 to increase the sample size and the statistical validity of the interview observations. It also permits the quantitative analysis of the relationships among the variables constructed based on the interview findings. The main goals of this analysis are to examine how common are the beliefs derived from the interview analyses, and what are the relationships –if any- between the beliefs and behaviours (Bruine de Bruin and Bostrom, 2013). The survey questions had the form of statements and the participants were asked to declare their degree of agreement in the scale of five options (Likert scale); Strongly

disagree (1), Disagree (2), Neither agree nor disagree (3), Agree (4), Strongly agree (5). Likert scale data often require non-parametric procedures, (i.e. distribution-free methods, such as tabulations, contingency tables, chi-square statistics, the Mann-Whitney U test), because the observations are not continuous values. According to the literature though, our sample size (N=210>50) is sufficiently large to allow the use of parametric analysis as well (means, standard deviations, Pearson's r correlation, independent-samples t-test) (Allen and Seaman, 2007; Sullivan and Artino, 2013). Parametric analysis is preferable, over non-parametric, due to its higher explanatory power.

The first step of the survey data analysis, for all research questions, was to present the most commonly reported answers. Measures of central tendency (mean) and dispersion (standard deviation) were computed to summarise the survey data. This thesis presents the most frequent definitions of uncertainty, its sources and the statements about decision-making under uncertainty. We also report the most common beliefs and reactions with regard to Brexit as an uncertain event, as well as the most common beliefs about its future impact on the British economy. Lastly, we present the most common beliefs about low female representation on the trading floor and the most common trading behaviours. The means were interpreted on the Likert scale [strongly disagree (1), disagree (2), neither agree nor disagree (3), agree (4), strongly agree (5)]. Additionally, for each statement we report whether its mean value is significantly different from the neutral value -mid-point 3 on the Likert scale- based on a one-sample t-test, in order to test the robustness of our results.

The second step of the survey data analysis was to test if there were there any significant relationships between our variables. We used the Pearson's Product Moment Correlation Coefficient to test if there were any significant relationships between traders' reactions to uncertainty with the definitions of uncertainty they give. We also tested if there was a significant relationship among traders' reaction to the announcement of Brexit and the sources of uncertainty with regard to it, as well as between their reactions to the announcement of Brexit and their opinions on Brexit's future impact on the British economy**.** The Pearson's Product Moment Correlation Coefficient is the most commonly used measure of the strength of association between two variables (Buckingham and Saunders, 2004, p.219). The correlation is symbolised as r, referred to as Pearson's r

correlation. It is measured on a scale +1 (strong positive correlation) to -1 (strong negative correlation). An r equal or close to 0 reveals a weak or non-existent relationship.

The third step of the survey data analysis was to test for differences in the means of the populations under investigation. Specifically, we tested for differences in opinions among UK-based and non-based survey participants, as well as between male and female traders. An independent-samples t-test was conducted to compare the perception of Brexit as an uncertain event, the reactions to the announcement of Brexit and their opinions about Brexit's future impact among participants who traded in the UK markets, and the ones who did not. Also, we tested whether there were gender differences in the participants' trading behaviour, as well as if they had different views on the reasons behind low female participation on the trading floor. Independent-samples t-tests were used to test the significance of a difference between the mean values of two groups; independent of each other (Buckingham and Saunders, 2004, p. 251). Additionally, a measure of effect size, called Cohen's d (Cohen, 1988), was measured. Cohen's d is a common measure of substantive difference used in social sciences. It is measured on a scale from +1 to 0; the closer it is measured to unit, the larger is the difference among the two groups. Caution should be paid because the sample sizes between the participants who traded in the UK financial markets (N_{UK}=139) and the ones who did not ($N_{non\text{-}UK}$=62) were different. Same holds for the sample sizes between men (Nm=163) and women (Nf=45), which reflects the female underrepresentation on the trading floor.

To verify our results, we also applied the Mann-Whitney U (1947) [Wilcoxon rank sum (1945)] test, which is the equivalent non-parametric test for differences in the means of the ranks of the populations under investigation. It compares the mean of two independent samples, after ranking by order the scores of the two populations. The survey scores were ranked on a Likert scale from 1 to 5. We took this further step because our data often failed to pass the normality and/or homoscedasticity diagnostic tests, hence we performed an additional, non-parametric test suitable to non-linear observations.

The last step of the survey data analysis was a linear regression analysis. In social sciences, the least squares regression analysis is a commonly used modelling technique, which explores relations among variables (Buckingham and Saunders, 2004, p. 261). Despite the fact that our survey data were ordinal, the large sample size (N=210) allowed the use of

linear regression analysis. Linear regression analysis was not used to search for causality, but to find related association among key variables, while the statistical significance of the predictors was used to show this association. Therefore, linear regression analysis was used to test if the two definitions of uncertainty significantly predicted traders' reaction to it. The selection of the variables in our linear regression analysis was based on the Pearson correlation analysis, from step 2. All reported tests are two-tailed, because we do not presume either a positive or a negative correlation. We also used linear regression analysis to test our hypothesis; whether traders' perception of uncertainty influenced their reaction to uncertain events, and to verify the Pearson correlation analysis based on the predictors' significance level. We also used linear regression analysis to test whether decision-making before and after the announcement of Brexit was significantly predicted by the sources of uncertainty with regard to Brexit and by traders' short and long-term expectations about its future economic impact. Again, the selection of variables was not arbitrary, but it was based on the Pearson correlation analysis. Lastly, we used linear regression analysis to test whether financial traders' gender significantly predicted their trading behaviour. We did not interpret the results though due to collinearity among the dependent and the independent variables.

The regressions were run both with and without taking into consideration the demographic variables (gender, education, years of experience and participation in the UK markets) to test the robustness of our results. It is possible to test the robustness of a regression analysis by adding or omitting a number of independent variables to the initial estimations (Brown, et al., 2008). Further robustness checks are presented in section 3.7 Diagnostic tests. Lastly, table 21 summarises all the questions answered based on survey data and the methods used to answer them.

Table 21. Survey data analysis summary

Questions under investigation	Methods
1. What were the most frequent definitions of uncertainty, its sources and the statements about decision-making under uncertainty? 2. What were the most common beliefs and reactions with regard to Brexit as an uncertain event, as well as the most common beliefs about its future impact on the British economy? 3. What were the most common beliefs about low female representation on the trading floor and the most common trading behaviours?	• Measures of central tendency (mean) and dispersion (standard deviation) • We reported whether the mean value was significantly different from the neutral value (mid-point 3) based on a one-sample t-test: robustness check
1. Was there a significant relationship between traders' reactions to uncertainty with the definitions of uncertainty they give? 2. Was there a significant relationship among traders' reaction to the announcement of Brexit and the sources of uncertainty with regard to it? 3. Was there a significant relationship among traders' reaction to the announcement of Brexit and their opinions about its future impact on the British economy?	• Pearson's Product Moment Correlation Coefficient
1. Did the participants who traded in the UK markets have a different opinion compared to the ones who didn't with regard to: • Brexit as an uncertain event? • Markets' reaction to the announcement of Brexit? • And lastly, to Brexit's future impact on the British economy? 2. Did men and women give different reasons about low female participation on the trading floor? 3. Were there any gender differences in the participants' trading behaviour?	• Independent-samples t-test • Cohen's d to measure the size of the difference • Mann-Whitney U test
1. Did the definitions of uncertainty significantly predict traders' reaction to it? 2. Did the sources of uncertainty with regard to Brexit significantly predict traders' reaction before and after the Brexit vote? 3. Did the traders' short and long-term expectations about Brexit's future impact, significantly predict traders' reaction before and after the Brexit vote? 4. Did financial traders' gender significantly predict their trading behaviour?	• Linear regression analysis • All regressions were subject to diagnostic tests for meaningful results • Robustness checks put in place, by running the regression both with and without the demographic variables

3.7 Diagnostic tests

We performed the diagnostic tests for model specification, for normality of errors and homoscedasticity for all the regression models of this thesis. The results are fully presented in the relevant sections in the empirical chapters, along with the corresponding models. In this section we discuss the rationale of the robustness checks.

The Ramsey Regression Equation Specification Error -RESET- (1969) test was performed to test the model specification. The test shows whether the model under investigation suffers from omitted variable bias, in other words if there are more explanatory variables, which are not taken into account. The null hypothesis of the test is that the model has no omitted variables (correct specification). In our analysis we often rejected the null at 5% significance level (when $p<0.05$). We expected that our models may suffer from omitted variables bias because they were based on individuals' self-reported opinions, derived from the interview analyses. We did not aim to uncover all the reasons/variables that may influence financial traders' decision-making, but to cross-check the results of the correlation analysis. For that reason, we did not interpret the beta coefficients, and we focused on the statistical significance of the predictors.

The normality of the residuals was tested by the Jarque-Bera (1987) test and its null hypothesis is that errors follow a normal distribution. When the normality of residuals assumptions is violated (when $p<0.05$, at 5% significance level) the coefficients are biased and therefore should not be interpreted.

Homoscedasticity was tested by the Breusch-Pagan (1979) test. Its null hypothesis is that errors' variance is constant, i.e. the size of the error term remains constant across values of an independent variable. If the test rejects the null hypothesis (when $p<0.05$, at 5% significance level), the errors are heteroscedastic. To solve this, we corrected the models by rerunning them with robust standard errors.

There is no test for strict exogeneity, therefore we explained why the predictors of each model were chosen against their independent variable (why x predicts y, and not vice versa). Lastly, serial correlation in errors was not tested, because the survey data were not time series, and hence the test was irrelevant.

3.8 Conclusions

Despite the extensive use of algorithmic trading in financial markets, research on financial traders' decision-making remains crucial in understanding markets' functioning (DeBondt et al., 2010). Financial traders have abilities that models do not. For example, they can assess non-market information and qualitative data, such as political decisions, and how they may influence the market movements. They use model projections about the market, but they are not constrained by them. For these reasons, it is important to understand how they react to uncertainty, as well as whether gender influences their decisions.

We are interested in investigating financial traders' decision-making under uncertainty, without making presumptions about their behaviour. Hence we apply the five-step protocol of descriptive models, which is extensively used in psychological/decision-making studies (Morgan et al., 2002). We adopt the Keynesian definition of uncertainty, i.e. that uncertainty is fundamental and unmeasurable, we test the Disaster Myopia Hypothesis by tracking and comparing financial traders' perception of risk and uncertainty over time, and we search for gender similarities and differences on the trading floor, as the feminist literature suggests.

The pluralistic literature review plays the role of the normative model, which represents the theory behind financial traders' decision-making and the role of gender in finance. A descriptive model was derived by the two rounds of open-ended interviews with financial traders, covering questions on gender and uncertainty. A confirmatory survey was released a year later, based on the interview analyses, in order to increase the statistical validity of our sample and to allow for quantitative analysis as well.

We did not identify knowledge gaps among the population under research and the scientific community, as we did not adopt the approach that there is an ideal way of thinking and behaving on the trading floor. Instead, our intention was to reveal new dimensions of decision-making under uncertainty in finance, which are not covered by the existing literature. Therefore we compared the normative and the descriptive models to identify the contributions to the contemporary scientific literature.

The data were collected in three waves. Wave 1 corresponds to the pre-referendum, phone interviews (February-May 2016), with 13 financial traders located in the UK. At this

stage we asked the participants to answer open-ended questions about financial uncertainty, its source and their reactions to it. We also asked them to express their opinion regarding the role of gender on the trading floor and to report any similarities and differences they could think of among female and male traders, including trading characteristics, hierarchical positions, professional development etc.

The second stage was wave 2, the post-referendum, phone interviews. We contacted the same group of individuals between February and May 2016 in order to repeat the questions on financial uncertainty. According to the Disaster Myopia Hypothesis there is a systematic tendency to underestimate shock probabilities, which increases as time passes since the last economic shock took place (Guttentag and Herring, 1986). The referendum result fitted the Keynesian theory of fundamental uncertainty, as it was not generally expected by the markets and in wave 1 none of the participants referred to it as a potential case of uncertainty. Therefore, it gave us the chance to research how financial traders' perception of uncertainty and their decision-making changed over time.

The interviewees were institutional traders and they all had working experience on trading floors of financial institutions. We chose to interview institutional traders for the purpose of this research, because they deal with high volumes of trade and therefore their movements have a greater impact on market prices, compared to independent traders. Also, institutional traders' experience on trading floors means that their behaviour is influenced by their colleagues' reactions as well, which is a factor identified in the Keynesian theory of uncertainty as the beauty contest paradigm. All interviewees had working experience on the sell-side of the market, which is part of investment banks and covers activities such as structuring and selling financial products, research for particular companies and other market execution services. The sell-side was chosen due to the fact that it is more prone to fluctuations and uncertainty, as it covers the riskier types of financial services. Lastly, all interviewees had working experience in leading financial institutions. The survey sample consists of a more diverse population, covering a variety of trading roles in the financial markets, with sufficient trading experience.

Waves 1 and 2 were analysed, and the key findings and concepts were used to inform the third wave of data collection, an online survey. The Post-Keynesian, "old" behavioural and feminist theories of decision-making under uncertainty were used to inform the analyses

of the interviews. The survey statements were constructed based on the interview findings from waves 1 and 2, as suggested by the descriptive models protocol. The survey allowed us to expand our sample, to turn qualitative information into quantitative one through coding and therefore, it allowed us to test for relationships between variables. Additionally, we were able to search how financial traders' opinion changed over time.

Behavioural variables derived from a specific group of interviewees may be highly correlated, because they capture similar characteristics and opinions across questions. For example, in our analysis the survey participants who agreed that there is uncertainty when you do not know how to react, they also suggested that under uncertainty market movements cannot be predicted. For that reason we conducted a factor analysis, which grouped the highly correlated variables that capture similar behaviours. These two variables were synthesised and summarised under the title "There is uncertainty when you cannot predict and react accordingly", to avoid multicollinearity among our predictors.

Additionally, we used a variety of methods for appropriate data analysis in order to answer our research questions. Measures of central tendency and dispersion were used to report the degree of agreement or disagreement of survey participants with the survey statements. Pearson's Product Moment Correlation Coefficient was used to reveal statistically significant relationships between our variables. Then independent-samples t-tests, as well as the non-parametric Mann-Whitney U tests, were applied to search for differences among groups of respondents, for example male and female financial traders. Also the size of these differences in opinions was measured by Cohen's d measure. Lastly, linear regression analysis was used to review the correlation analysis. Our results were subject to appropriate diagnostic checks for meaningful results.

4. How do financial traders behave under uncertainty?

4.1 Introduction

This chapter presents an analysis of the qualitative and quantitative data we collected in waves 1 and 3, respectively, in order to investigate financial traders' decision-making process under uncertainty, as well as the contributions of this research to the existing knowledge. We analysed the interview results in comparison to the existing literature, to identify the contributions of this research. Following the descriptive models methodology, we used the interview results to create a survey and increase the sample population. The survey also allows us to examine the relationships between different beliefs and behaviours. To remain consistent with the chosen methodology, we report the number of interviewees who agreed with each finding, because we analysed our data based on frequencies. For the same reason, we report the most representative quotes in Appendix B.

The design of the interview questions was informed by the descriptive models methodology, and by the Keynesian and Post-Keynesian theories of uncertainty. The questions were open-ended, in order to allow the thirteen participants to express their opinions, using the wording of their preference, without leading them to specific answers (Morgan et al., 2002). Also, we ensured that the questions remained consistent with the Keynesian definition of unmeasurable uncertainty, by rephrasing them to unknown risks, when it was needed.

4.2 Interview analysis- wave 1

4.2.1 Definitions of uncertainty

Wave 1 interviews started by asking the interviewees to give their definitions of uncertainty based on their own experience. In cases where the interviewees responded by describing risk (measurable uncertainty) we rephrased the question, asking the interviewees how they would define "unknown risks". Our intention was to investigate whether financial traders were aware of the presence of fundamental uncertainty, as defined by Keynesian and Post-Keynesian theories. Keynesian uncertainty is defined as the unforeseen future events, which cannot be forecasted by mathematical models, it is unmeasurable and different from risk (Keynes, 1936). If fundamental uncertainty exists in

financial markets, then its impact on traders' decision-making limits the usefulness of financial, quantitative models to predict the market movements, such as the algorithmic trading. In general, all interviewees acknowledged the presence of fundamental uncertainty when investing in financial markets. This fact has implications when mainstream economics and the "new" behavioural economics attempt to model mathematically the human behaviour, because they ignore its unpredictability under circumstances of fundamental uncertainty.

In addition, the interviews explored the financial traders' different perceptions of uncertainty, as they may have an impact on their reactions and decision-making process (Dow, 2014). Instead of assuming what they may believe, we used the descriptive model methodology to ask them directly of their opinions.

The UK-based financial traders gave several descriptions of financial uncertainty and without contradicting with each other, they all presented different dimensions of fundamental and radical uncertainty. Specifically, six participants described uncertainty as the unknown, a situation where they do not know how to react, and they cannot predict how the market will react to it as well. They suggested that under uncertainty everything is possible to happen, in traders' meetings lots of arguments may be given about all the reasons the markets may go higher on lower, on a daily basis. As Shackle (1949) has suggested, in a continuously changing environment individuals cannot have in advance knowledge about the future stages of the world. The market movements may change from one moment to the next, and this is a difficult situation to manage. For example, the sudden release of news and headlines may lead to a big market reaction for a period of time, even if it is a rumour and nothing else changes, as three interviewees reported. Also, uncertainty may have different degrees of importance, depending on its impact on traders' decision-making. According to an interviewee:

"There are several degrees (of uncertainty), it is not like black and white. It would be clear that the higher the impact of an event, the higher the uncertainty would be about it." (Interview, wave 1, a male trader with less than five years of experience)

According to the wave 1 interview findings, uncertainty is not only present, but also fundamental in the functioning of financial markets. Six participants described uncertainty

as an inherent characteristic of finance, which cannot be avoided or eliminated. Those participants viewed uncertainty as the driving force of the market, to which a trader has to adjust his or her behaviour. A male interviewee with more than fifteen years of experience expressed the view that the financial market does not operate as the Efficient Market Hypothesis (EMH) suggests. According to the EMH (Fama, 1969) the capital market will efficiently allocate capital stock ownership, due to the fact that security prices fully reflect all available information on preferences. Therefore, our evidence suggests that markets are unpredictable and even if prices reflect preferences, uncertainty constrains financial modelling from predicting the next market movement and from allocating resources efficiently. Preferences are established based on the available information, which is never complete due to the fact that the environment, within which traders make decisions, keeps changing (Shackle, 1979).

Indeed, financial modelling was associated with uncertainty, by six interviewees, due to its mathematical complexity. According to a female trader:

“The danger (of financial innovation) starts when there is too much of it, it is not clearly understood, the structures are not transparent, people rely on ratings rather than a true, clear understanding of the risk. It is used as getting risk off the balance-sheet, which should still be on it.” (Interview, wave 1, more than ten years of experience)

We conclude that financial innovation may lead to uncertainty, due to financial traders’ limited understanding of its complex functioning. In contrast to the theory of portfolio diversification (Markowitz, 1952), financial innovation may not necessarily lead to a trade-off between risk and return, but to the spread of uncertainty due to traders’ cognitive limitations that constrain them from understanding its complexity (Simon, 1955; 1956).

As financial uncertainty results to quick price changes and market volatility, because of financial traders’ immediate reaction, it also has an impact on market liquidity (Keynes, 1936; wave 1 interviews). Keynesian theory suggests that fundamental uncertainty leads people to hold more liquidity as a mean of security, also known as the liquidity preference (Keynes, 1936). Our evidence also suggests a relationship between withdrawing market liquidity, avoiding risk and the rise of financial uncertainty. According to a female trader:

“When we entered into the financial crisis, the first thing that happened was that the market was completely dried up with liquidity, and there was no depth. The response was not exactly fear, but it was tremendous uncertainty.” (Interview, wave 1, more than ten years of experience)

We may conclude that during periods when financial traders experience uncertainty, they withdraw liquidity from the market and they avoid undertaking further risks and expanding their investment portfolio, which was described by the interviewee as the absence of market depth. This has implications on their decision-making process, which we examine later, and the reason is the psychological dimension of liquidity. Keeping their (or their clients) liquidity out of the market, offers them greater security against financial uncertainty and further flexibility to anticipate the unknown future. As liquidity preference suggests, financial traders save their liquidity, specifically their clients’ liquidity, for future investment. This view was supported by two interviewees.

4.2.2 Sources of uncertainty

Neither the mainstream nor the Keynesian and Post-Keynesian literatures on financial markets pay much attention to the sources of financial uncertainty. Speculative investment is often recognised as the source of financial uncertainty in Post-Keynesian economics (Minsky, 1992; Earl, 1990), but there is no further investigation. While in mainstream economics the sources of uncertainty do not play a significant role; they are defined as external shocks and they have an impact only for a limited period of time, known as short-term deviations from the long-term equilibrium price (Fama, 1969; 1998). This research covers this gap in the literature by approaching financial traders and asking them directly the factors that give rise to uncertainty on the trading floor.

The most commonly reported source of uncertainty, in interviews-wave 1, were the non-systematic factors, i.e. unexpected events that do not occur on a frequent basis and they are often random. Six participants suggested that non-repetitive big scale events, such as natural disasters, terrorist attacks, important political decisions and big accidents are examples of sources of uncertainty. This description fits the mainstream narrative of external shocks, but in the established view these events are of limited importance as they only have an impact in the short-term, and they are interpreted as short-lived deviations from the equilibrium prices (Fama, 1969; 1998). In contrast, our evidence suggests that

such events may have a substantial impact on the financial institutions' functioning and financial traders' decision-making. For example, according to a female trader with more than five years of experience, the 2011 Japanese earthquake forced traders from London who were trading in the US dollar/Yen exchange market to work on shifts, so someone would track the market movements 24 hours per day. The panic in the market led to big losses, even if traders had taken precautionary measures to minimise their risks, such as hedging strategies. Another example of non-systematic factors was the terrorist attack of 9/11 in the US. According to a male trader:

"Every risk is known, if you make a list long enough you will eventually put on it the terrorist attack. At that point it was an unknown risk, because there was no one back then thinking it was going to happen." (Interview, wave 1, more than ten years of experience)

Therefore, we may conclude that having a complete list of possible future events is not sufficient information, if people do not believe that these events will actually occur. Prediction about the future has two basic characteristics; it is treated as if it is happening, and it depends on the degree of someone's belief that it will happen (Shackle, 1949).

Macroeconomic phenomena all over the world were also reported as a common source of uncertainty by five interviewees. Traders' preferred wording was "fundamentals", because these economic phenomena may have a substantial effect on someone's portfolio, even if the source of uncertainty is located in a different country. For example, a male trader reported that:

"Despite the fact that European fundamentals were really good, although not amazing; uncertainty existed everywhere else, in the US (the oil exposure), in China (floating down the economy), in Syria (the refugee crisis), and it affected the European markets." (Interview wave 1, less than five years of experience)

Moreover, along with the previous finding about non-systematic factors as a source of uncertainty, we conclude that the use of a list of possible future events is not a realistic approach to describe decision-making under uncertainty, because it can never be complete in principle, as long as uncertain events from all over the world can influence someone's investment portfolio (Shackle, 1972).

Market sentiments and the average opinion is another source of uncertainty, based on four interviewees' opinion. Particularly, unexpected change in market expectations about future events may lead to changes in market liquidity. Individual traders' decision-making is not only influenced by their personal beliefs, but they also incorporate the average opinion of the final outcome into their decisions, in an attempt to make the right guess about the future, also known as the beauty contest paradigm (Keynes, 1936). Their response to market fear is unpredictable, given the variety of the available investment choices. According to a male trader with more than twenty years of experience:

"Traders might believe that interest rates are very low. They may decide to buy a stock which has a big dividend. Or they might decide to not invest in the stock market at all. They might decide the best place to make some return is commercial property. They might think that in the stock market the earnings or the expectations for earnings are too high, so they might pull their money out and put it in a safer haven." (Interview, wave 1)

The interviewee described a variety of trading choices, which were driven by markets' negative expectations about fundamentals, particularly the interest rates. As a result, suddenly traders may move their liquidity from one market to the other, as he said "not because people necessarily do not like investing in a stock, a sector, a country, or a market", but because there get influenced by the average opinion.

Another factor that drives the market sentiments is the release of news, which was identified by four participants as an important source of uncertainty. Traders are constrained by their human cognitive limitations and knowledge, also suggested by three interviewees. Their rationality is bounded by their knowledge or its absence about the environment where they belong to, and their ability to process this knowledge in order to make a decision and cope with uncertainty (Simon, 2000). A female trader with more than ten years of experience mentioned:

"When the headlines first hit the market, there is an element of uncertainty because you are not always sure how to read them. For example, in China at the moment they are devaluing the currency. You might not be an expert in Chinese economy or their policies." (Interview wave 1)

Hence, the sources of uncertainty are interlinked with each other. In the abovementioned example we identify three sources of uncertainty, the continuous news release, the traders' bounded rationality and a non-systematic factor, in this case the devaluation of the Chinese currency. The transformation of these beliefs into quantitative data through the use of a survey enables us to disentangle the impacts of these sources on traders' decision-making.

While the interview results indicate that cognitive limitations are an important source of uncertainty, greed was also a reported source of uncertainty, specifically rogue trading. Four interviewees mentioned the case of the UBS rogue trading scandal. Such an example is not mentioned in the literature, either in the established or the critical view, and it is connected with the limited understanding of financial innovation. In the UBS example "The rogue trader came from the back office, he knew how to go around operation" (Interview, wave 1, a male trader with more than fifteen years of experience). The rogue trader had previous working experience from a technical position, what the interviewee described as the "back office", which is the quantitative research behind financial modelling. The rogue trader had knowledge of how the investment tools were operating and he "was trading using the firm's money and hiding the trades. Because he knew how all the technology worked, he built a loss about two billion dollars", according to a female trader with more than ten years of experience (Interview, wave 1).

As a result, financial institutions stopped moving people from the back-office operations to the front office-trading floor, because it was seen as too risky, according to an interviewee. This finding is consistent with traders' definition of uncertainty about their limited understanding of financial innovation. It may be in financial institutions' interest to employ traders who cannot take advantage of the system for their own profitability, in order to protect their reputation. Indeed, a financial institution's reputation was described as one of its core assets, by three interviewees, because it reflects to its stock price and consequently to the uncertainty around its investments. The absence of good reputation and the relatively small size of someone's trading counterparty are factors of uncertainty with respect to trade. For example:

"If you are investing in BNP bank you know they will not go to bankruptcy, because in this case the French government would step in. As opposed to investing in some small private

bank, something like internet-based, you have much more uncertainty (…) you are not sure what they are doing with your cash." (Interview, wave 1, a male trader with more than fifteen years of experience)

Lastly, part of the continuously changing reality is also the changing regulatory framework within which financial traders make investment movements (interviews, wave 1). This is a new dimension into our analysis, as two interviewees reported that changes in financial regulation are a source of uncertainty. Once regulatory changes are introduced, the new framework has an impact not only on the future trades, but also on the ones that have already been in place. According to a female trader with more than ten years of experience:

"Today a transaction is attractive under the current (regulatory) framework. If the framework changes and the structure has not matured, it might not be attractive anymore." (Interview wave 1)

The contemporary literature in macroeconomics' focuses on the use of the most appropriate model in monetary policy (Dow, 2004), rather than the impact of regulatory changes on uncertainty. This finding highlights the need for further investigation of both traders' and regulators' decision-making, and how they are linked with financial uncertainty.

4.2.3 Decision-making under uncertainty

As shown in the literature review, financial traders' decision-making plays a central role in understanding how financial markets function. The established view and the rational agent model (Von Neumann and Morgenstern, 1944) suggest perfect foresight of future events, as long as prices reflect individuals' preferences. Uncertainty should not influence *homo economicus'* decision-making, firstly because financial risks are eliminated through diversification of portfolio investments, and secondly because these shocks only have a short-term effect. The "new" behavioural economics builds on this framework and it interprets financial traders' reaction to uncertainty as an overreaction to news, which translates to short-term deviations from the equilibrium prices.

On the other hand, in Keynesian theory, several patterns of decision-making may arise under uncertainty. Individuals' decision-making is driven from their short-term

expectations about profits, while their long-term expectations about the general economic environment do not have an immediate impact (Keynes, 1936). They are incapable of optimising intertemporal rational choices (Davidson, 2011), and in extreme cases of uncertainty they may paralyse. The fear of the unknown could force them to hold more liquidity and to postpone consumption. Liquidity would provide them with greater certainty and flexibility to anticipate the unknown future. As uncertainty constrains individuals' decision-making, they lose confidence over their judgement and they may decide to follow the market or else the average opinion, also known as the beauty contest. They are also driven by animal spirits and pre-existing social conventions, which make up for the lack of knowledge and the lack of confidence in their knowledge (Keynes, 1936). Another possible reaction to uncertainty is to seek for as much rationality as the situation allows, according to the Human Abilities and Characteristics approach (HAC) (O'Donnell, 2015).

We may conclude that the Keynesian and the Post-Keynesian theories recognise the complexity of human nature, which explains the heterogeneity of decision-making processes under uncertainty and suggests a limited usefulness of forecasting models. This contrasts with the established view which suggests a standard model of rational behaviour, with small differentiations, i.e. the "new" behavioural economics which is also equilibrium focused. While, the "old" behavioural economics follows the narrative of non-mainstream theories, and it focuses on individuals' bounded rationality and the complexity of their decision-making, which force them to use rules of thumb, for example by downsizing the alternatives options (Simon, 1955; 1956).

In analysing the qualitative data obtained in the interviews undertaken, special attention has been paid to the possible links between interviewees' observations and the various economic theories of decision-making in financial markets. Our interest here is to find behavioural patterns that we can later include into the survey, as well as to identify behaviours that are missing from the current literature. We continued the interviews by asking the participants how they would react to financial uncertainty. Frequently, they had already described a real case of financial uncertainty when we asked them about its sources, therefore they would often describe their true reaction to an uncertain event. We do not focus on specific examples; instead we focus our analysis on behavioural

patterns and frequencies of behaviours. We do report though some interesting or unique examples.

Financial traders' decisions-making

We continued the wave 1 interviews by asking the participants to describe their reactions to financial uncertainty. One of the most commonly reported reactions was to follow the market expectations and to take into account other agents' trading decisions before making any movement. Five participants suggested that when fundamental uncertainty hits the trading floor, they need to understand how the market interprets the news and to adjust their decision-making accordingly. Observing how other traders behave in these situations is part of it. Moreover, they suggested that traders may lose confidence over their judgement, and thus they prefer to follow the average opinion, assuming that the masses -the market in this case- are better informed than them, as described in the beauty contest paradigm (Keynes, 1936). Specifically, they reported that under fundamental uncertainty traders tend to change their view much faster, compared to periods of financial stability.

In extreme cases of market volatility and uncertainty, financial traders often choose to exit the market and close their deals to avoid financial loses (wave 1 interviews). Four interviewees reported that in cases of panic, when the outcome of uncertainty is highly unpredictable and they find it difficult to make a decision about future agreements, then it is rational for them to hold no position. A female interviewee, with more than five years on a trading floor, described her experience as: "Any trade we had, we closed it straight away. That was after losing a lot of money already". As the non-ergodicity principle suggests, under uncertainty financial traders cannot use past data to forecast the future because the pattern (distribution) has changed. Although Davidson (2011) describes non-ergodicity as the general state of the world, according to our findings it exists as an extreme occasion. Even in this extreme case, undertaking less risk and closing deals it may be the rational choice for traders, given the circumstances. We may conclude, that financial traders still search for as much rationality as the situation allows, in agreement with the Human Abilities and Characteristics approach (O'Donnell, 2015).

Another interesting finding is that the type of trade someone holds may have an impact on his/her reaction to fundamental uncertainty, as suggested by four participants. This

relationship between decision-making and the type of trade does not appear in the contemporary literature. Another factor that influences traders' behaviour is the time-scope of their deals, i.e. whether they focus on short-term or long-term views. The long-term trades do not allow much flexibility in someone's reaction according to a female trader with more than ten years of experience. Similarly, the liquidity type of each trade influences traders' decision-making.

"If you trade something more liquid, when bonds go up or down, then you can probably afford to be more flexible. If you trade something illiquid you have to go with your long-term view and hope it works." (Interview, wave 1, a female trader with more than five years of experience)

Liquidity once more is described as a factor of financial decision-making, due to the flexibility it provides to the trader. The more liquid assets allow greater margins of reaction to uncertainty.

Apart from the type of trades, the trader's personality plays also a key role in his/her decision-making according to four participants. Risk tolerance or risk aversion is one of the behavioural traits that have impact on their decision-making. For example, three traders suggested that under fundamental uncertainty they try to remain calm, rational and focused. That means that they may decide to research more and to find more information about the causes of market volatility, before they make any decisions. According to a female trader with more than ten years of experience:

"(You) do not react suddenly before having extra information, because you cannot make the right judgments. The best thing to do is to try research what is going on, but not react without knowing the full information." (Interview, wave 1)

This finding complements the previous statement, that under uncertainty financial traders search for as much rationality as the situation allows, which can be expressed in different ways. Other traders, for example, may lose confidence over their analytical abilities and they may choose to rely more on financial modelling based on probabilities, as suggested by four interviewees. Another participant described that under fundamental uncertainty the most rational option is to run different scenarios based on the available information.

“The best estimate if you have done statistics is to run some models and have lots of simulations. I cannot position my book to an unknown risk, because I do not know what is going to happen, so how could I react to something that I do not know? The best thing I can do is to know my risk, run my risk scenario and see how my book is going to behave in scenarios A, B, C” (Interview, wave 1, a female trader with more than ten years of experience)

Apart from the scenario analysis, another example of technical trading as a response to uncertainty is hedging. Firms use financial derivatives in order to reduce the unwanted portions of risk exposure, also known as hedging (Fox, 2009). Three interviewees reported that they responded to uncertainty by applying hedging techniques of balancing risk exposure on their financial portfolios.

However, financial traders may not be given the freedom to choose their own movements, according to two participants. As one interviewee described it, reacting to uncertainty is a collective action and “there are processes in place, which make sure beforehand that if something bad happens on the trading floor you know how to react” (interview, wave 1, a male trader with more than five years of experience). Therefore, professional traders may be required to follow their institutions’ trading strategy, which is designed in advance.

Another way to cope with uncertainty is to set upper and lower limits of losses and profits, respectively, according to two interviewees. Once their portfolio’s performance violates these benchmarks, they might decide to leave the market. That way they gain some control over their losses, and they do not allow themselves to overreact to market panic.

Another reaction to uncertainty, from a trader’s point of view is to adjust his/her trades either by shortening maturity or by simplifying the structure, as suggested by two interviewees. Such a decision would give them the flexibility to change one parameter in the future, with the counterparty’s consent, without having to rid of everything. An interviewee gave a relevant example:

“Another reaction is that all trades used to be long-term in Europe. Now people try to restrict maturity and do shorter transactions” (Interview, wave 1, a female trader with more than ten years of experience)”

Overall, we conclude that simpler, more liquid and short-term trade deals may be the outcome of fundamental uncertainty.

Lastly, a male trader, with more than ten years of experience, acknowledged the limitations of his own knowledge and the need to search for other professionals' advice. Another male trader (less than five years of experience) described decision-making as a process where he often recalls similar experiences from the past, he anchors himself to the previous situation, what followed the event, and he tries to benefit out of it. These last two decision-making processes were not as popular as previous findings. The use of a follow-up survey will allow us to test whether a bigger sample of financial traders will agree or disagree with these views.

Financial regulators' decision-making

The interviewees were also asked to express their opinion about financial regulators' decision-making under uncertainty. Accepting full rationality or not, leads to different policy recommendations. Mainstream theories suggest full rationality and market adjustment through a price mechanism, hence they do not require regulatory intervention. On the other hand, non-mainstream economic theories support an active role for regulatory authorities under the scope of financial stability. Specifically, Dow (2014) suggests the use of a variety of model uncertainties in financial regulation, in the grounds of methodological pluralism and involvement of the human judgment.

According to the wave 1 interviewees, the regulators' decision-making differs from their own. Six participants reported that the regulators use their past experiences in order to shape new regulations, which could prevent a financial crisis. When they were asked about their decision-making only one trader talked about anchoring himself to past experience. The reason behind may be their different roles. Regulators goal is to ensure that financial institutions can afford extra pressure in cases of uncertain events. From a technical point of view, they assess institutions' resilience to uncertainty with stress tests. Three interviewees described financial regulators as individuals with more long-term views, who only react to large events that last for a long period of time; as opposed to financial traders, who react to daily uncertainty. When fundamental uncertainty hits the market and they face a first-time-to-happen event, their reaction might be delayed due to the absence of similar past experience. An example is the 2008 financial crisis because:

"(…) regulators were aware that the banks were not keeping enough capital on their balance sheets and they were using financial innovation for speculative purposes. That means that regulators had not experienced anything similar before." (Interview, wave 1, a male trader with more than five years of experience)

The participant continues by explaining that around 2010-2011 the regulation was adjusted based on the 2008 experience in order to avoid similar incidents in the future. To conclude, financial traders' decision-making is described as a continuous learning process, which they update based on new knowledge. Additionally, six participants suggested that regulators should be more proactive rather than reactive and they should have a process already in place.

An interesting finding that emerges in our qualitative data and does not appear in the existing literature is the relationship between asymmetric regulation and financial uncertainty. Four interviewees identified asymmetric regulation among different types of financial institutions as a source of uncertainty. For example, real money clients, asset managers and pension funds are not as regulated as banks according to the participants. A new financial crisis could start in a less regulated area of finance, for example the pension market or the insurance market, which would spread uncertainty in the broader banking sector as a domino effect. Also, different regulations between international financial centres were identified as a source of uncertainty, due to the rising opportunities for speculation. Specifically, one participant suggested that the UK and the US need one financial regulator (Interview wave 1, a female trader with more than ten years of experience).

Lastly, although there is no consensus among interviewees with respect to the efficiency of banking regulation, three of them agreed that it should remain in place to protect the ones who do not benefit from financial profits.

4.2.4 The role of financial regulation

Following the previous question about regulators' decision-making, we asked a more specific, follow-up question about financial traders' opinion on the absence of financial regulation with regard to uncertainty. Six participants supported that there is a positive relationship between the absence of regulation and financial uncertainty. Less regulation

is linked with speculative trading, due to the absence of supervision. Speculative trading can cause market disruption and price volatility, which will result in higher financial uncertainty. Also regulation sets the limits of risk that a bank can undertake on its balance-sheet. Therefore, when uncertainty rises and a financial institution becomes vulnerable due to excessive exposure to risk "the market will read it as a potential catastrophe for every single participant, as it happened with Lehman Brothers back in 2007-2008", according to a male trader with less than five years of experience.

On the contrary, three participants believed there is no relationship between uncertainty and the absence of regulation because "no matter what regulation, markets will find a way to become volatile or uncertain in a situation" (a male trader with less than five years of experience).

Based on our evidence, markets do not operate as the Efficient Market Hypothesis suggests; they do not reach equilibrium through a price mechanism that reflects preferences. It is interesting that financial traders acknowledged speculative trading and they were worried about less regulated areas of finance that could create a domino effect, when uncertainty rises. To conclude, the majority of the interviewees suggested a positive relationship between deregulation and uncertainty, apart from three of them who believed that uncertainty cannot be eliminated.

4.3 The contributions of the wave 1 interviews

Our qualitative findings from the wave 1 interviews suggest that there is no evidence of full rationality in financial markets, as defined in mainstream economics. To the opposite, there is a variety of decision-making processes under uncertainty in the markets.

To start with, one of the contributions of the interviews is that they allowed the interviewees to express their own opinions about the topics under research, which is the reason of adopting the descriptive models methodology in the first place. Interviewees gave different descriptions of uncertainty, but generally they all agreed that fundamental uncertainty exists in the market and it is not measurable. They suggested that the future is not entirely predictable and there are limitations to our knowledge, even under the assumption of market cyclicality. They also identified risk and uncertainty as separate concepts. According to the Keynesian definition of fundamental uncertainty, future

economic events cannot be accurately forecasted by quantitative models; therefore individuals have to adjust their decision-making process to potential surprises and unexpected events. Interviewees' descriptions agree with the Keynesian theories of uncertainty, particularly the radical definitions (see table 1). Uncertainty was described as the unknown, and an inherent characteristic of financial markets. There was evidence suggesting that the institutional definition of uncertainty (Financial Instability Hypothesis) exists as well, when interviewees described financial innovation as speculative behaviour which may turn the system vulnerable to uncertainty. But the contribution with regard to financial traders' interpretations of uncertainty is the relationship between financial innovation and uncertainty. The interviewees suggested that due to financial innovation's mathematical complexity, they do not necessarily fully understand its implications and they acknowledge their cognitive limitations, as supported by the "old" behavioural economics (Simon, 1955; 1956). It is the first time that traders' limited cognitive capacity is directly linked with fundamental uncertainty. The follow-up survey allows us to test whether a bigger sample would also define financial uncertainty as traders' inability to predict the market movement.

The sources of uncertainty are often overlooked by the Post-Keynesian literature. We found that market expectations about future events play an important role for financial traders, and when the market sentiments change that may cause uncertainty, as Keynesian theory suggests. Once more bounded rationality is linked with fundamental uncertainty, because the interviewees recognised their human limitations and their greed as sources of uncertainty. The UBS rogue trading example given by several interviewees, explains why it is in the financial institutions' interest to prevent their traders from understanding financial innovation, and this is a contribution of this thesis. It was stated by the interviewees that financial traders are not familiar with the mathematical structure behind financial innovation. While in the UBS example once a quantitative researcher moved to a trading position he hid massive losses because he knew how to overcome the electronic system. This scenario of rising uncertainty, which is driven by greed, does not appear in the contemporary literature.

Another contribution is the role of financial regulation and how it is linked with the rise of financial uncertainty. Particularly, interviewees suggested that changes in financial

regulation make their trades uncertain because they cannot foresee the impact on their current portfolio synthesis. Basically, changes in the regulatory framework also have an impact on the existing trades, and therefore they are not able to predict their profitability before their structure matures. Another interesting point about financial regulation that does not appear in the literature is its asymmetric presence among different areas of finance. Interviewees expressed their fear of a financial crisis starting in a less regulated area of finance, for example the pension or insurance markets, could create a domino effect for the whole banking sector.

The next step of the analysis focused on financial traders' decision-making under uncertainty. As already discussed, there is strong evidence that financial traders are aware of fundamental uncertainty as defined in Keynesian and Post-Keynesian theories, but even in moments of market panic and chaos they still have to react to the news. During the wave 1 interviews, they suggested a variety of decision-making processes under fundamental uncertainty, which is the most important contribution of this chapter. The Keynesian and the Post-Keynesian literatures suggest that under conditions of fundamental uncertainty there are two behavioural patterns. Individuals either panic and paralyse (Davidson, 2011; Shackle, 1979) or they seek for as much rationality as the situation allows by following animal spirits and the average opinion, by adjusting their liquidity preference, or/and by adopting different strategies to cope with uncertainty (Keynes, 1936; O'Donnell, 2015). In the "old" behavioural economics it is suggested that under circumstances of fundamental uncertainty, individuals acknowledge their cognitive limitations, they learn from past experiences and they use rules of thumb to anticipate uncertainty (Simon, 1955; 1956). Our analysis shows that traders' use their past experience to anchor themselves and their reaction to uncertainty does not need to be chaotic and unstructured. Specifically, we found supporting evidence for the beauty contest assumption, given that financial traders take into consideration other agents' decision as well. Also, there is supportive evidence for the Human Abilities and Characteristics approach (O'Donnell, 2015), given that our interviewees reported that under uncertainty they try to remain calm and to find more information about the causes of market volatility; in other words they seek for as much rationality as the situation

allows. There is a variety of reported reactions though, which do not correspond to previous literature and these are our contributions.

Firstly, when panic hits the market traders still have to react to it, they do not paralyse but they may decide to close their deals and exit the market especially in periods of great volatility. Another interesting finding is that under uncertainty they lose confidence over their own judgment and while following the better-informed market is one possible reaction, relying more on financial modelling is another scenario that is not reported in the literature. Given their limited understanding of how financial innovation is structured, this is a danger to the market because it may lead to the spread of uncertainty. A third reaction is how they set up limits for profits and losses, before exiting the market. It is easy to be carried away by market sentiments and overreact to news. To control their human limitations they set boundaries for investment decisions. Regarding their liquidity preference, they gave a more technical description than what the Keynesian literature provides. They explained that under uncertainty they simplify the structure and the maturity of their deals, which translates to greater liquidity, more flexibility to react to uncertainty and less undertaken risk. They reported that they do not always have the freedom to choose their own strategy against an uncertain event, as they may be bounded by their institution's strategies. A financial institution's reputation is one of its core assets, therefore a collective action to cope with uncertainty may already be in place. Lastly, we cannot define general rules about traders' decision-making under uncertainty, only a descriptive framework of it, because their behaviour is often constrained by the types of their deals and their personality.

Individuals' decision-making in financial markets is defined to a great extent by their role. For example financial regulators react to uncertainty in different ways compare to financial traders, because their role is to maintain the resilience of the system. As a result they do not react to day-to-day news, but only to big scale uncertain events and they stay long-term focused. We do not expand further on regulators' behaviour, because it is not directly linked with our research question, which focuses on financial traders' decision-making, hence questions were not covered by the survey.

Table 22 summarises the contributions of the wave 1 interviews about traders' decision-making, in advancing knowledge and the existing literature.

Table 22. Wave 1 interviews, types of financial uncertainty and decision-making processes

Interview results-wave 1			New evidence/ existing in the literature
Types of financial uncertainty	**Sources of uncertainty**	**Decision-making process**	
Uncertainty is the unknown, when you do not know how to react. An inherent characteristic of the financial markets, which cannot be avoided.	Expectations about future events are a source of uncertainty and they often lead to lack of liquidity.		Radical definitions of Keynesian uncertainty Liquidity preference
		Other agents' trading decisions should be taken into consideration. Try to remain calm and to find more information about the causes of market volatility.	Beauty contest HAC approach
Traders are unable to predict the market movement.	Cognitive limitations and greed.	Use past experience.	Bounded rationality theory

Table 22. continued

Interview results-wave 1			New evidence/ existing in the literature
Financial innovation may cause uncertainty.	Non-systematic factors. Macroeconomic phenomena. Continuous news release. Changing financial regulatory.	Traders often choose to exit the market and close their deals. They rely more on financial modelling. They set upper and lower limits of losses and profits, respectively. They simplify their trades by shortening maturity or by simplifying the structure. They follow their company's strategies. It depends on someone's type of trade and personality.	Contributions

4.4 The conclusions of the wave 1 interview analysis

Based on the wave 1 interview analysis, we conclude that financial traders acknowledged the important role of fundamental uncertainty on the trading floor and its influence on their decision-making. Therefore, attempts to model mathematically the human behaviour are of limited usefulness in periods of high uncertainty, and we should be aware of the limitations of the market forecasting models that build on the rational agent model. We found supporting evidence for the radical interpretation of the Keynesian uncertainty, when traders face the unknown and they are not sure how to react to it. Apart from fundamental uncertainty though, interviewees also acknowledged the limitations of their rationality in decision-making, their human limitations in understanding financial innovation, as well as the fact that greed often drives their decisions. We may conclude, as suggested by the interviewees, that financial markets do not function in an efficient

way as defined in mainstream economics. Even in an ideal world where prices reflect traders' preferences, the latter are determined by the available information which is never complete, due to the changing environment within which traders make decisions (Shackle, 1979). Therefore, when uncertainty is introduced the price patterns change and uncertainty constrains the price mechanism from allocating the available resources efficiently.

When panic hits the market traders still have to react to it, they do not paralyse, as some Post-Keynesian economists suggest (Davidson, 2011; Shackle, 1979). As a response to fundamental uncertainty, they adopt a variety of decision-making processes, which cannot be summarised by a unique model of economic behaviour. They stay rational and calm, to the extent that the situation allows and in extreme cases they may decide to close their deals and exit the market especially in periods of great volatility. Overall, it is a collective action, a decision or a series of them, they have to make within an institution. Hence, they have to take into consideration other traders' decision-making as well. This shows that despite the rise of algorithmic trading, the role of the financial trader remains a crucial one.

With regard to financial innovation, this research reveals a new relationship between the use of financial modelling and financial traders' decision-making. Despite the fact that the interviewees reported their constrained understanding of financial innovation, they also suggested that under circumstances of fundamental uncertainty they lose confidence over their own judgement and they may end up over-relying on financial modelling, which they follow as guidance against the unknown. Additionally, banking institutions do not allow employees' movement from operations to the trading floor, because it is too risky for their reputation to allow people with good understanding of their trading models in the front office. For example, in the case of the UBS rogue trader, his technical knowledge allowed him to hide big losses from the bank.

As financial innovation fuels the inherent instability of the financial markets, the need for financial regulation becomes more prominent. Particularly, the wording asymmetric regulation emerges in the wave 1 interview findings. According to the interviewees, a new financial crisis could start in a less regulated area of finance, which would raise uncertainty in the broader financial sector as a domino effect. The reason behind is that less regulation

is linked with speculative trading, which can cause market disruption and price volatility, due to the absence of supervision. For example, regulation sets the limits of risk that a bank can undertake on its balance-sheet. As a result, when uncertainty rises in a less regulated financial area, the institutions could become vulnerable due to excessive exposure to risk which does not appear on their balance-sheet as a result of financial innovation.

Another aspect of financial regulation, which emerged during the wave 1 interviews, is that a frequently changing regulatory framework was identified as a source of uncertainty. Regulatory changes have an impact not only on future trades, but also on the ones that have already been in place. Consequently, financial traders may move to shorter-term investments, due to the fact that they cannot know how future regulatory changes will affect their longer-term trades. Indeed, financial traders' reaction to uncertainty has a great impact on market stability, due to changes in their liquidity preference. Under uncertainty interviewees reported that they may simplify the structure of their deals and shorten their maturity, because it gives them more freedom to stay flexible in the future if uncertainty hits the floor. In other words, they prefer to hold more liquid assets to anticipate unexpected events in the future. That could result to greater price volatility and instability in the market, because their lack of commitment to long-term trades shows a willingness to move their clients' capital among stocks, sectors, countries or markets, driven from the market's perception about profitability which changes often over time.

We may conclude that several factors have an impact on financial traders' decision-making; uncertainty, animal spirits and greed can lead to fragile markets without depth and panic. But disentangling the influence of each of these factors requires the use of quantitative data. For example, we cannot examine further the relationship between traders' interpretations of uncertainty and decision-making processes based on qualitative data**.** The use of a survey, on the other hand, allows us to examine this relationship with the use of a correlation analysis. Therefore, the choice of the descriptive models methodology is the most appropriate one for our research. Firstly, it allows us to unveil individuals' beliefs without making presumptions about their decision-making, and secondly it allows the transformation of the qualitative data into quantitative, as well as its analysis with the appropriate techniques.

Lastly, we suggest that economics should engage further with psychological and decision-making studies in order to build strong and realistic micro-foundations in a pluralistic approach. Particularly, Post-Keynesian economics could benefit because of its inherent realism and its open system analysis, which allows insights from other disciplines.

4.5 Survey analysis- wave 3

4.5.1 What were the most common definitions of uncertainty?

Although Likert scale data often require non-parametric procedures, (i.e. distribution free methods, such as tabulations, contingency tables, chi-square statistics, the Mann-Whitney U test) the sample size of our survey (N=210) was sufficiently large to allow the use of parametric analysis as well (means, standard deviations, Pearson's r correlation, independent-samples t-test) (Allen and Seaman, 2007; Sullivan and Artino, 2013). Measures of central tendency (mean) and dispersion (standard deviation) were computed to summarise the data for traders' beliefs about financial uncertainty on the trading floor. The means were interpreted on the Likert scale [strongly disagree (1), disagree (2), neither agree nor disagree (3), agree (4), strongly agree (5)]. It is also reported whether the means of the variables were significantly different from the neutral value (mid-point 3) based on a one-sample t-test.

Generally, the survey participants agreed with the definitions of uncertainty, which were derived from the interview results. Particularly, the statements "Uncertainty cannot be avoided" and "There is uncertainty when you do not know how to react" were the most commonly agreed upon, followed closely by "There is uncertainty when you cannot predict the market movement". Lastly, "Complex financial innovation may cause uncertainty" was the least commonly reported definition. Regarding the summary variables, participants agreed that "There is always uncertainty in the system and cannot be avoided", which we describe as market-level uncertainty; and that "There is uncertainty when you cannot predict and react accordingly", which we describe as individual-level uncertainty.

These results agree with the definition of the Keynesian, fundamental uncertainty, which cannot be reduced or avoided, while future cannot be accurately forecasted by mathematical models (Keynes, 1936). All the definitions of uncertainty, including the

summary variables, were significantly higher from the mid-point (3), which reflects neutrality. Table 23 presents the results of this analysis.

Table 23. Definitions of uncertainty-wave 3 survey results

Variable	Mean	Standard deviation
Uncertainty cannot be avoided	3.92**	1.07
There is uncertainty when you do not know how to react	3.59**	1.08
There is uncertainty when you cannot predict the market movement	3.57**	1.09
Complex financial innovation may cause uncertainty	3.44**	1.00
Summary variables	**Mean**	**Standard deviation**
Market-level uncertainty: There is always uncertainty in the system and cannot be avoided	3.67**	0.80
Individual-level uncertainty: There is uncertainty when you cannot predict and react accordingly	3.57**	0.90

N=210, **Significantly different from test value 3 at 0.01 level based on a one-sample t-test (2-tailed)

4.5.2 What were the most common sources of uncertainty?

The most commonly reported source of uncertainty was the non-systematic factors, followed by changes in financial regulation and macroeconomic phenomena. Market expectations were also reported as a source of uncertainty, as the Post-Keynesian theory suggests. In Keynesian theory, the ways in which economic agents react to uncertainty and form expectations play a key role in agents' behaviour (Keynes, 1936, ch.12). Lastly, human limitations and news release were the least commonly reported sources of uncertainty, yet their means showed participants' agreement with them.

All the sources of uncertainty were summarised into a single variable under the title "Sources of uncertainty". All means were significantly higher from the mid-point. Table 24 presents the results of this analysis.

Table 24. Sources of uncertainty-wave 3 survey results

Variables	Mean	Standard deviation
Non-systematic factors may lead to uncertainty (e.g. natural disasters, political decisions, terrorism etc.	4.18**	0.86
Changes in financial regulation may lead to uncertainty	3.97**	0.84
Macroeconomic phenomena may lead to uncertainty (e.g. GDP growth, inflation, exchange rates)	3.70**	0.95
Change in market expectations about future events may lead to uncertainty	3.67**	0.98
Human limitations may lead to uncertainty	3.41**	1.00
Continuous news release may lead to uncertainty	3.18**	1.06
Summary variable	**Mean**	**Standard deviation**
Sources of uncertainty	3.68**	0.61

N=208, **Significantly different from test value 3 at 0.01 level based on a one-sample t-test (2-tailed)

4.5.3 What were the most common reactions to uncertainty?

Participants strongly agreed with the statements "Under uncertainty I search for more information" and "I try to identify what causes it". They also agreed that under uncertainty they set targets for losses and profits, they simplify their trades, they take into consideration other traders' decisions and they might exit the market. All means were significantly higher from the mid-point. Lastly, they disagreed with the statement "Under

uncertainty I rely on financial modelling", which was not statistically different from the mid-point on the Likert scale.

The summary variables showed that under uncertainty participants are more concerned about its causes and they are more careful with the risk they undertake. Furthermore, they follow others' decision-making, which agrees with the beauty contest paradigm (Keynes, 1936). According to the latter, when individuals make decisions they also take into account other agents' opinion. Table 25 presents the results of this analysis.

Table 25. Decision-making under uncertainty-wave 3 survey results

Variables	Mean	Standard deviation
Under uncertainty I search for more information	4.21**	0.80
Under uncertainty I try to identify what causes it	4.14**	0.84
Under uncertainty I set targets for losses and profits	3.63**	1.07
Under uncertainty I simplify my trades	3.51**	0.97
Under uncertainty I take into consideration other traders' decisions	3.36**	1.05
Under uncertainty I might exit the market	3.25**	1.10
Under uncertainty I rely on financial modelling	2.87	1.00

Table 25. continued

Summary variables	Mean	Standard deviation
Under uncertainty I try to understand its causes	4.17**	0.71
Under uncertainty I become more risk averse	3.46**	0.73
Under uncertainty I follow others' decision-making	3.11**	0.76

N=205, **Significantly different from value test 3 at 0.01 level (2-tailed)

4.5.4 Were there any significant relationships between traders' reactions and their definitions of uncertainty?

Pearson's Product Moment Correlation Coefficient is the most commonly used measure of the strength of association between two variables (Buckingham and Saunders, 2004, p.219). The correlation is symbolised as r, referred to as Pearson's r correlation. It is measured on a scale +1 (strong positive correlation) to -1 (strong negative correlation). An r equal or close to 0 reveals a weak or non-existent relationship.

A Pearson correlation analysis was used to examine the relationship between traders' reactions and the definitions they give. There was a significant, positive correlation between the following variables "There is uncertainty when you cannot predict and react accordingly" and "Under uncertainty I try to understand its causes" [r (208) =0.20, $p<0.01$[5]]. There was also a weak, positive relationship between traders' inability to predict the future and to react accordingly, and their strategy to follow others' decisions [r (208) =0.01, $p>0.05$]. Lastly, there was a nonsignificant correlation of 0.09 ($p>0.05$) between individual-level uncertainty and risk aversion.

There was a significant, positive correlation between the variables "There is always uncertainty in the system and cannot be avoided" and "Under uncertainty I follow others' decision-making" [r (208) =0.16, $p<0.05$]. There was a nonsignificant relationship between the market-level uncertainty and risk aversion [r (208) =0.06, $p>0.05$]. Lastly, the market-level uncertainty was not significantly correlated with traders' tendency to search for its causes [r (208) =0.03, $p>0.05$].

[5] All reported tests are two-tailed

The results suggest that when individuals face the individual-level uncertainty and they do not know how to react to it immediately, instead their reaction is to understand its causes before making any decisions. While, when they deal with the market-level uncertainty, which cannot be avoided in general, they tend to lose confidence over their own judgement and they prefer to follow others' decisions or the market movements. We may conclude that when uncertainty is perceived as a barrier to an individual's decision-making, in other words when it has a direct influence on his/her reactions, financial traders prefer not to rush their decisions, and instead they try to understand the sources of uncertainty and how they might influence their portfolios. On the other hand, when uncertainty is perceived as a large-scale phenomenon, which cannot be avoided or manipulated by individuals, they choose to follow the market movement. Hence, traders' reaction to uncertainty depends on their perception of it.

4.5.5 Diagnostic tests and linear regression analysis

Linear regression analysis was used to test if the definition of uncertainty "There is uncertainty when you cannot predict and react accordingly" and the demographic variables (gender, education, years of experience and participation in the UK markets) significantly predicted traders' effort under uncertainty to understand its causes. In social sciences, the least squares regressions are commonly used as a modelling technique, to explore relations among variables (Buckingham and Saunders, 2004, p. 261). Although the survey data were ordinal, the large sample size (N=210) allowed the use of linear regression analysis in order to check the robustness of the correlation analysis. We ran the models to test whether the relations derived from the correlation analysis remained significant after taking into account the traders' demographic characteristics. We did not interpret the beta coefficients given that the diagnostic tests often showed violation of the linear regression model assumptions. Instead we interpreted the p values of the variables under investigation.

Age was not included in the regression analysis, as it was highly correlated with and substituted by the traders' years of experience. Location was also excluded because it was highly correlated with and substituted by the traders' participation in the UK financial markets. The latter was chosen for more meaningful results, as traders who were located in the UK did not necessarily trade in the British financial markets. This was a requirement,

in order to be able to compare the results of uncertainty as a general case and the more focused case of the Brexit referendum, in the following empirical chapter of this thesis. Lastly, the summary variables –derived from the factor analysis- were used in the regression analysis to avoid multicollinearity.

In model 1, the definition of uncertainty "There is uncertainty when you cannot predict and react accordingly" significantly predicted traders' decision-making under uncertainty, particularly their efforts to understand its causes at 1% significance level ($p<0.01$). This result agrees with the correlation analysis. Lastly, the results of model 1 indicate that the predictor explained 4.1% of the variance.

The diagnostic tests for model specification, for normality of errors and for homoscedasticity were performed for model 1. The Ramsey Regression Equation Specification Error -RESET- (1969) test was performed to test the model specification. Model 1 suffers omitted variables bias ($p<0.05$, we rejected the null hypothesis that the model had no omitted variables at 5% significance level). The variable "Under uncertainty I try to understand its causes" was not only predicted by the variable "There is uncertainty when you cannot predict and react accordingly, but there were other significant factors as well which were not taken into consideration by our model. The coefficients were biased and therefore should not be interpreted. The normality of the residuals was tested by the Jarque-Bera (1987) test, and the null hypothesis that the errors followed a normal distribution was rejected at 1% significance level ($p<0.01$). Again, this test showed that the coefficients were biased and therefore should not be interpreted. Homoscedasticity was tested by the Breusch-Pagan (1979) test, and the test failed to reject the null hypothesis that the errors' variance was constant at 5% significance level ($p>0.05$), hence the errors were homoscedastic. Lastly, strict exogeneity was ensured by the fact that traders' reaction followed their interpretation of uncertainty and therefore was predicted by it; because they first realised that uncertainty existed and then they reacted to it, and not vice versa.

In model 2, the demographic variables (gender, education, years of experience and participation in the UK markets) did not significantly predict the values of the dependent variable ($p>0.05$). The definition of uncertainty "There is uncertainty when you cannot predict and react accordingly" remained a significant predictor at 1% significance level

($p<0.01$). Lastly, the results of model 2 indicate that the five predictors explained 6% of the variance.

The diagnostic tests for model specification, for normality of errors and for homoscedasticity were performed for model 2. Model 2 suffered omitted variables bias, based on the Ramsey RESET (1969) test ($p<0.05$, we rejected the null hypothesis that the model had no omitted variables at 5% significance level). The variable "Under uncertainty I try to understand its causes" was not only predicted by the variable "There is uncertainty when you cannot predict and react accordingly" and the traders' demographic characteristics, but there were other significant factors as well which were not taken into consideration by our model. The coefficients were biased and therefore should not be interpreted. The normality of the residuals was tested by the Jarque-Bera (1987) test, and the null hypothesis that the errors followed a normal distribution was rejected at 1% significance level ($p<0.01$). The test suggests that the coefficients were biased and therefore should not be interpreted. Homoscedasticity was tested by the Breusch-Pagan (1979) test, and the test failed to reject the null hypothesis that the errors' variance was constant at 5% significance level ($p>0.05$), hence the errors were homoscedastic. Lastly, strict exogeneity was ensured because traders first realised that uncertainty existed and then they reacted to it. Also, their behaviour could had been influenced by their demographic characteristics, i.e. gender, location etc., but not vice versa.

Models 1 and 2, and their diagnostic tests are summarised in table 26.

Table 26. Summary of models 1 and 2

	Model 1	**Model 2**
Dependent variable	Under uncertainty I try to understand its causes	Under uncertainty I try to understand its causes
Constant	3.59**	3.46**
	[0.00]	[0.00]
There is uncertainty when you cannot predict and react accordingly	0.16*	0.17*
	[0.03]	[0.02]
Gender		0.10
		[0.41]
Education		0.08
		[0.42]
Years of experience		0.00
		[0.60]
Trading in the UK markets		0.10
		[0.35]
N		
Diagnostic tests	210	199
R^2	0.04	0.06
F statistics	F(1,208)=9.02	F(5,193)=2.46
P-value	0.00	0.14
Ramsey RESET test/model specification	F(3,205)=3.34	F(3,190)=2.99
	[0.02]	[0.03]
Jarque-Bera test/normality of errors	Adj x^2=29.73	Adj x^2=31.41
	[0.00]	[0.00]
Breusch-Pagan test/homoscedasticity	x^2=3.52	x^2=2.37
	[0.06]	[0.12]

**p<0.01 *p<0.05, p values in []

The second behavioural variable under investigation was “Under uncertainty I follow others’ decision-making”. In model 3, the variable “There is always uncertainty in the system and cannot be avoided” was a significant predictor of traders’ behaviour and their decision to follow others’ investment movements at 5 % significance level ($p<0.05$). This result agrees with the correlation analysis. Lastly, the results of model 3 indicate that the predictor explained 2.6% of the variance.

Model 3 passed the Ramsey RESET (1969) test for model specification ($p>0.05$, we failed to reject the null hypothesis that the model had no omitted variables, at 5% significance level). Model 3 also passed the Jarque-Bera (1987) test, we failed to reject the null

hypothesis that the errors followed a normal distribution 5% significance level ($p>0.05$). Thirdly, the Breusch-Pagan (1979) test about homoscedasticity, failed to reject the null hypothesis that the errors' variance was constant at 5% significance level, hence the errors were homoscedastic ($p>0.05$). Lastly, strict exogeneity was ensured because traders first realised that uncertainty existed in the system and then they reacted to it, by following others' decision-making.

A fourth model was also computed in order to include the demographic variables (gender, education, years of experience and participation in the UK markets). In model 4, the second definition of uncertainty remained a significant predictor at 5% significance level ($p<0.05$), but none of the demographic variables (gender, education, years of experience and participation in the UK markets) significantly predicted the values of the dependent variable ($p>0.05$). Lastly, the results of model 4 indicate that the five predictors explained 5.7% of the variance.

Model 4 passed the Ramsey RESET (1969) test for model specification ($p>0.05$, we failed to reject the null hypothesis that the model had no omitted variables, at 5% significance level). It also passed the Jarque-Bera (1987) test, we failed to reject the null hypothesis that the errors followed a normal distribution 5% significance level ($p>0.05$). The Breusch-Pagan (1979) test failed to reject the null hypothesis that the errors' variance was constant at 5% significance level, hence the errors were homoscedastic ($p>0.05$). Lastly, strict exogeneity was ensured, as in model 3, because traders first realised that uncertainty existed in the system and then react to it, by following others' decision-making. Additionally, traders' decision to follow others' reaction could had been influenced by their demographic characteristics, but not vice versa.

Models 3 and 4, and their diagnostic tests are summarised in table 27.

Table 27. Summary of models 3 and 4

	Model 3	**Model 4**
Dependent variable	Under uncertainty I follow others' decision-making	Under uncertainty I follow others' decision-making
Constant	2.54**	2.51**
	[0.00]	[0.00]
There is always uncertainty in the system and cannot be avoided	0.15*	0.14*
	[0.02]	[0.03]
		0.21
		[0.11]
Gender		0.02
		[0.81]
Education		0.00
		[0.16]
Years of experience		0.18
		[0.10]
Trading in the UK markets	210	199
N		
R^2	0.02	0.05
F statistics	F(1,208)=5.63	F(5,193)=2.36
P-value	0.01	0.04
Diagnostic tests		
Ramsey RESET test/model specification	F(3,205)=0.64	F(3,190)=0.98
	[0.58]	[0.40]
Jarque-Bera test/normality of errors	Adj x^2=5.32	Adj x^2=3.76
	[0.06]	[0.15]
Breusch-Pagan test/homoscedasticity	x^2=0.00	x^2=0.12
	[0.96]	[0.72]

**p<0.01,* p<0.05, p values in []

4.6 Contributions of survey analysis

The quantitative findings collected during the wave 3 survey, and analysed further with statistical and regression techniques, provide supporting evidence for the presence of the Keynesian and fundamental uncertainty in financial markets, as well as its influence on financial traders' decision-making. Also, this research adds value to the contemporary literature by linking the traders' interpretation of uncertainty with their reaction to it.

Two main definitions of uncertainty on the trading floor emerged from the wave 3 survey analysis. The first definition of uncertainty, the market-level uncertainty was described by the participants as always present in financial markets, which cannot be limited or avoided. The market-level interpretation of uncertainty is an example of the beauty contest paradigm (Keynes, 1936) in terms of decision-making. Particularly, the correlation and regression analyses showed that traders' perception of the market-level uncertainty was linked and sufficiently explained by their choice to follow the better-informed masses. In other words, financial traders suggested that when they lose confidence over their own estimates due to fundamental uncertainty at macro level (market-level) they choose to follow the market's perception over future gains and losses. In this case either they follow other traders' decisions and the market's animal spirits or/and they incorporate in their decision-making the expectations of the average opinion, as the beauty contest paradigm suggests (Keynes, 1936, ch.13).

The second definition of uncertainty, the individual-level uncertainty focuses on individuals' difficulty to predict the future market states and react accordingly. The data analysis suggested that when financial traders interpret uncertainty as an obstacle to their own decision-making and not necessarily as a macro-phenomenon, they seek for as much rationality as the situation allows (O'Donnell, 2015), by researching further about its sources. Given that the survey participants did not distinguish between the different sources of uncertainty (based on the factor analysis, table 24), the latter were not linked with specific behaviours. Instead, as verified by the wave 1 interview findings and the wave 3 survey analysis, under the individual-level uncertainty financial traders may take some time to research how these sources of uncertainty influence their deals and portfolios.

Lastly, there is further evidence that traders' decision-making under uncertainty depends on their interpretation of the latter. Specifically, we found in the wave 3 survey analysis that under uncertainty financial traders may become more risk averse. Given that the survey statements did not link the definition of uncertainty with risk, we did not find any relationship between traders' risk aversion and their interpretation of uncertainty (see table 28). We did not include a risk-focused definition of uncertainty, because it did not

appear as a relevant concept in the wave 1 interview analysis, following the descriptive models methodology.

The wave 3 survey contributions with regard to decision-making under uncertainty on the trading floor are summarised in table 28. The means of the survey statements are reported in parentheses.

Table 28. Wave 3 survey, definitions of financial uncertainty and corresponding decision-making processes

Survey results-wave 3		**New evidence/ existing in the literature**
Definitions of uncertainty	**Decision-making under uncertainty**	
Market-level uncertainty: There is always uncertainty in the system and cannot be avoided (M=3.67**)	Under uncertainty I follow others' decision-making (M=3.11**)	Fundamental uncertainty: future events are unforeseen and cannot be predicted by economic forecasting/ Individuals follow animal spirits and the beauty contest paradigm. (Keynes, 1936)
Individual-level uncertainty: There is uncertainty when you cannot predict and react accordingly (M=3.57**)	Under uncertainty I try to understand its causes (M=4.17**)	Individuals adopt strategies to cope with uncertainty (O'Donnell, 2015). They are seeking as much rationality as allowed by the circumstances.
-	Under uncertainty I become more risk averse (M=3.46**)	Contribution

**Significantly different from test value 3 at 0.01 level based on a one-sample t-test (2-tailed)

4.7 Conclusions of survey analysis

Based on the analysis of the wave 3 survey, we may conclude that there is a variety of decision-making processes under uncertainty adopted by financial traders, as well as a variety of interpretations of uncertainty on the trading floor. After applying a factor analysis on the raw survey data, which aims to categorise and reduce the number of

variables under research (Tabachnick and Fidell, 1989), we identified two interpretations of uncertainty and three decision-making processes on the trading floor.

Another conclusion we derive from the analysis of the wave 3 survey is the way financial traders understand uncertainty on the trading floor and how it influences their decision-making. Particularly, they may interpret uncertainty at macro-level which is beyond their control, and therefore they choose to follow the market sentiments and animal spirits due to the fact that they lose confidence over their own judgment. Or they may interpret uncertainty at micro-level which they feel they can deal with, and hence they choose to stay calm, understand the causes of uncertainty and search for further information. In both cases the survey participants supported that they try to seek as much rationality as possible depending on their interpretation of financial uncertainty. Their answers are aligned with the human abilities and characteristics approach, according to which individuals adopt strategies to cope with uncertainty (O'Donell, 2015).

On the other hand, mainstream theory suggests that uncertain events in financial markets should be treated as exogenous shocks, due to the fact that the markets will equilibrate in the long-run by the invisible hand (Fama, 1998). Such shocks lead to temporary deviations for the equilibrium point, as long as individuals react in a rational way, i.e. under utility maximisation assumptions. Particularly, the Capital Asset Pricing model reduces traders' decision-making down to minimising risk while maximising the expected return, suggesting that hedging is their best strategy in handling the undertaken risks (Ross, 1976). Based on the analysis of the wave 3 survey, we did not find supporting evidence that traders' act on a rational basis and under full information circumstances. Also, hedging was only one of their reported reactions to uncertainty. In contrast, we identified a variety of reactions to uncertainty from staying calm and searching for further information, to closing existing trades and exiting the market. Hence, we cannot conclude that the rational choice model is a representative model for decision-making under uncertainty.

Overall, we suggest that the use of the descriptive models methodology enhances the realism of the Post-Keynesian theories of uncertainty with behavioural insights. It does not only provide evidence against full rationality in decision-making, but it also contributes to the microeconomic foundations of Post-Keynesian economics in a non-mathematical, closed-system approach as suggested by Jefferson and King (2010).

5. How did financial traders behave after the announcement of Brexit?

5.1 Introduction

While, chapter 4 examines financial traders' decision-making under fundamental uncertainty, as a general case, without specifying an example of uncertainty on the trading floor, chapter 5 is a follow-up, "results" chapter which examines a specific case of fundamental uncertainty on the trading floor, the outcome of the Brexit referendum.

In this chapter we analyse the wave 2 interview results in comparison to the existing literature, in order to identify the contributions of this research. Following the descriptive models methodology, we used the interview results in order to create a survey and increase the sample population. The survey allows us to examine the relationships between the different beliefs and behaviours, as well as to examine if and how financial traders' beliefs about decision-making after the Brexit referendum changed over time. To remain consistent with the chosen methodology, we report the number of interviewees who agreed with each finding, because we analyse our interview data based on frequencies. For the same reason, we report the most representative quotes in Appendix B.

The design of the interview questions was informed by the descriptive models methodology and the Keynesian and Post-Keynesian theories of uncertainty, as well as the Disaster Myopia Hypothesis from the "old" behavioural economics. The questions were open-ended, in order to allow the ten participants to express their opinions, using the wording of their preference, without leading them to specific answers (Morgan et al., 2002). We did not ask initially about Brexit as a case of fundamental uncertainty in order to avoid confirmation bias in their answers. When the interviewees suggested that the Brexit vote was an unforeseen event to them, we adjusted the follow-up questions, keeping the same structure of wave 1 interviews. Firstly, we asked them to give us an example of financial uncertainty, then why the event was uncertain, their reactions to it (both traders' and regulators' reaction) and lastly, we asked their opinion about Brexit's future impact on the British economy.

5.1.1 The Brexit vote as a case of fundamental uncertainty

The Brexit vote was identified as a case of fundamental uncertainty because during the wave 1 interviews -a few months before the referendum- none of the interviewees referred to it as a case of uncertainty and they did not consider it as a potential outcome of the referendum. Although it was already announced that the Brexit referendum was taking place in June 2017, financial traders treated it as an unknown. They associated the Brexit outcome with a very low probability to occur which they treated almost as equal to zero, a mental shortcut known in "old" behavioural economics as the threshold heuristic (Guttentag and Herring, 1986). Their inability to foresee the impact of the referendum on the market allowed us to treat their reaction to the announcement of Brexit, as a focused example of decision-making under fundamental uncertainty.

According to the Keynesian definition of fundamental and unmeasurable uncertainty, future economic events cannot be accurately forecasted by quantitative models, therefore, individuals have to adjust their decision-making process to potential surprises and unexpected events (Keynes, 1936). Our hypothesis was that the Brexit vote was a case of fundamental uncertainty, based on the fact that our UK-based interviewees had not referred to it as a potential case of uncertainty during the wave 1 interviews. This hypothesis was tested in the wave 2 interviews.

We repeated the same interview questions in wave 2 with the same interviewees, without asking them initially about the Brexit referendum directly and we kept the opening question general about financial uncertainty purposefully; in order to test our hypothesis whether the Brexit vote was an unforeseen event they had overlooked a few months earlier. That way we avoided confirmation bias in the interviewees' answers and by following the descriptive models methodology, we allowed the interviewees to express their own views, without interference of our prejudgments (Morgan et al., 2002).

Based on the "old" behavioural economics, and particularly the Disaster Myopia Hypothesis (DMH), when financial markets are driven by unrealistic optimism, investors systematically underestimate shock probabilities and the presence of uncertainty (Guttentag and Herring, 1986). We could describe the months before the Brexit referendum as the first stage of a case of Disaster Myopia, where they were driven by optimism around the result of the Brexit referendum and therefore they underestimated

the outcome of a Brexit vote. This systematic tendency to underestimate shock probabilities increases as time passes since the last economic shock took place. We suggest that the Brexit referendum was an example of fundamental uncertainty on the trading floor, which allowed us to test the DMH at three different points of time. Wave 1 interviews established the Brexit vote as an unforeseen event, then we conducted the wave 2 interviews which revealed how the financial traders' react to a real case of fundamental uncertainty, and lastly the wave 3 survey was released a year later and allowed us to search the impact of time on assessing uncertainty, as the DMH suggests.

5.2 Interview analysis- wave 2

5.2.1 The Brexit vote as a case of fundamental uncertainty

Our hypothesis was that the Brexit vote was a case of fundamental and unmeasurable uncertainty, due to the fact that the UK-based interviewees had not referred to it as a case of potential uncertainty during the wave 1 interviews. This hypothesis was tested in wave 2 interviews. Initially we asked the participants to give examples of uncertainty based on their own experience. All ten participants referred to the outcome of the Brexit referendum, confirming our hypothesis. Their answers were driven by the availability heuristic from the "old" behavioural economics literature, according to which individuals' judgement is influenced by the available information associated with an event, and what they can bring first in their mind (Guttentag and Herring, 1986). During the period August-September 2016, the market was still in shock from the outcome of the Brexit referendum. Eight participants suggested that the Brexit vote was not expected by the cycles of the City and the consensus among financial professionals in London was against it, similarly to the polls.

A male trader with more than five years of experience reported that the stock market collapsed as a result of the surprise of institutions and individual investors. Particularly, the devaluation of the Sterling Pound was described by four participants as the market correcting itself for not foreseeing earlier the outcome of the referendum. Hence, we conclude that prices may reflect market participants' preferences, but their preferences are influenced by the available information, which cannot be complete in principle (Shackle, 1979). Similarly, in the case of the Brexit referendum, the prices reflected the

traders' belief of a non-Brexit vote and when the surprise and the uncertainty hit the floor, the value of the Pound collapsed and led to market volatility.

Lastly, three participants described the Brexit vote as a case of fundamental uncertainty due to the unknown outcome of the Brexit negotiations. Based on their comments, uncertainty remained on the trading floor, because of the unknown future agreement between the UK and the EU, after triggering article 50 of the Treaty of Lisbon. One female trader with more than ten years of experience described two possible scenarios, a soft Brexit which would include trade agreements with the EU and a hard, no-deal Brexit. Essentially, she eliminated the possibilities that she needed to take into account, in order to cope with the uncertainty surrounding the potential outcomes, as also described in the bounded rationality theory (Simon, 1972; 1957).

The wave 2 interviewees systematically underestimated the probability of the Brexit vote, during a relatively calm period, in accordance with the DMH. The release of the survey at a later stage allowed us to test if and how financial traders' opinions around an uncertain event changed over time. Our findings suggest that the outcome of the Brexit referendum was a case of fundamental uncertainty, but it is also useful to understand why financial traders did not consider the Brexit vote as a possible outcome. The reasons that establish this event as fundamentally uncertain are developed in the following section.

5.2.2 Why was the Brexit vote an uncertain event?

The next interview question focused on the reasons that made the Brexit vote an uncertain event. The most commonly reported reason was the lack of knowledge and clarity about the processes after the referendum, according to five interviewees. At that time there had not been announced a definite framework of policy decisions, such as when the Brexit would happen and what trade legislation would be suggested or agreed among the UK and the EU. A male participant with more than ten years of experience mentioned that:

"Brexit is uncertain because it is unclear what it means to be out of the EU, in terms of trade, in which ways we interact with the EU, where the currency is going to be, it is unclear. (…) There would be less uncertainty if there was a framework." (Interview, wave 2)

Another male trader (with more than fifteen years of experience), also described Brexit as a case of uncertainty due to the fact that there was no previous experience of an EU-member country exiting the union. This anchoring effect emerged in the wave 1 interviews as well, where the interviewees suggested that they use past similar experience to adjust their decision-making to uncertain events.

Lastly, two participants identified expectations about future economic events as a source of uncertainty. Specifically, the interviewees' expressed their fear for a domino effect of negative economic and political phenomena after leaving the EU. This was described as the long-term impact, as opposed to the immediate, short-term impact of the Sterling Pound depreciation. Therefore we observe that individuals' assessment of uncertainty included both short-term and long-term expectations about the outcomes of the Brexit vote, which we examine further in the following section.

5.2.3 Financial traders' reaction to the announcement of the Brexit vote

The analysis of the first questions of the wave 2 interviews verified our hypothesis, that the Brexit vote was recognised as a case of fundamental uncertainty by the participants. The next step was to ask the interviewees how they reacted once the outcome of the referendum was announced.

The majority of the interviewees, five out of ten, described their first reaction to the news as confusion, because they did not know what to do. They were in shock, paralysed by the unexpected outcome of the referendum. As a result, in many cases they remained passive while they were trying to avoid mistakes. The announcement of the Brexit vote raised the infinite regress problem, as described by Shackle (1979), according to which uncertainty paralyses the investor and prevents him/her from making a decision. This initial passive reaction though could not have lasted for long.

A female trader with more than ten years of experience, reported that "(it was) more about observing on what others were saying, what the different reports were suggesting" (interview wave 2). Similarly to the wave 1 interview findings, other traders' reactions were taken into account. This finding suggests that trying to understand how the market will react to uncertainty is crucial before making any decisions. Hence, the participants remained calm and they were trying to read the market, to understand the market

psychology and to seek for as much rationality as the situation allowed (O'Donnell, 2015), despite their initial shock.

Another interesting finding that emerged from the wave 2 interviews was a change in the traders' attitude towards risk. Firstly, four participants stated that shortly before the day of the referendum, both individual traders and institutions had already started reacting by shortening the maturity of their trades, by simplifying them and by avoiding risk-taking. A male trader with more than ten years of experience reported that he avoided long-term trades and he expressed his belief that other traders also were conscious about market volatility and uncertainty, which resulted in undertaking less risk on their portfolios. Two more participants suggested that the extended market uncertainty forced traders to move into short-term investments, instead of long-term trades.

This risk aversion was not only a behavioural characteristic of individual traders, but also of financial institutions, which encouraged their employees to eliminate their risk exposure by holding no positions, according to a male trader with more than twenty years of experience. Indeed, three interviewees decided to keep no positions, to avoid risk exposure, and to exit the market. The same trader mentioned:

"If you look at market volumes going into the vote, they were quite low across most of the market." (Interview, wave 2, a male trader with more than twenty years of experience)

This argument agrees with the wave 1 finding about traders' liquidity preference, where one participant described the withdrawal of liquidity as absence of market depth.

The third reported attitude towards risk was the extensive use of hedging strategies which were applied in advance, in order to protect traders' financial portfolios from potential market volatility (wave 2 interviews). Three participants reported that they protected themselves by substituting unwanted risky assets, for example trades that would had been highly impacted by the Pound devaluation, by less risky assets. According to a male trader with more than five years of experience:

"We protected ourselves by 80% of what we would lose, if we had not put in place the hedging strategies." (Interviews, wave 2)

We may conclude that there is a relationship between financial traders' attitude towards risk under fundamental uncertainty and their liquidity preference.

Lastly, three participants stated that decision-making under uncertainty depends on the type of trade held in someone's portfolio. For example, according to a male trader with more than fifteen years of experience:

"Some markets did not get affected much. For people trading German government bonds or US treasury bonds, Brexit is not going to have that big influence. But for other things, e.g. currencies and UK equities, it had a big impact." (Interview, wave 2)

Based on this information, we conclude that different markets face different uncertainties and this fact allows traders' to protect their portfolios through hedging.

5.2.4 Regulators' reaction to the announcement of the Brexit vote

We also asked the interviewees' opinion about the regulators' reaction to the Brexit vote, but there was not a clear consensus. Four participants reported an active intervention from the regulatory authorities. A female trader with more than ten years of experience reported that:

"Brexit (vote) happened on a Friday, and then on Monday everyone in our bank was told that they had come together with the whole banking society of London, and they were discussing with the regulators. All the banks in the financial industry were working together with the regulator on what could be done. I would say that the UK regulator was quite proactive on it. They were not very open to the public (…) they were working with the organisations on a confidential basis." (Interview, wave 2)

The interviewee mentioned that a close collaboration between the banking sector and the regulatory authorities took place soon after the Brexit vote was announced. Another participant described the Central Bank's intervention as "liquidity measures, because investors were liquidating the assets they were holding" (a male trader with more than five years of experience). Therefore we conclude that regulators' reacted quickly to the traders' fear and risk aversion. On the other hand, two participants were not aware of financial regulators' reaction to the Brexit vote. Lastly, one trader reported that regulators did not react at all.

The interviewees also expressed their opinion about regulators' future decision-making. Three participants underlined the need for adjusting the current EU financial regulatory framework, with respect to the British laws. Particularly, a female trader (more than ten years of experience) referred to the need of preserving the right of EU passporting for the UK-based financial institutions. Passporting is a firm's right, which is registered in an EU-member country, to operate in any other EU-country without further authorisation required. This concern is also prominent in the wave 2 interview answers about the future impact of Brexit on the British economy.

Additionally, three participants suggested that regulators should not react at all to Brexit, two of them supported their argument by describing Brexit as a political decision to be made. Lastly, two of them suggested that financial regulation should be reduced after Brexit.

5.2.5 What will be the future impact of the Brexit on the British economy?

According to Keynes (1936) investors' decision-making is influenced by their short-term expectations about their expected profit, while the long-term expectations about the general economic environment do not have as strong impact on their actions. The Brexit vote was an uncertain event which allowed us to examine traders' expectations about the future, because Brexit's future economic consequences were unknown at the time of the wave 2 interviews. Hence, we asked the participants' opinion about Brexit's future impact on the British economy, in order to examine later the relationship between traders' expectations and their decision-making.

An interesting finding was that financial traders shaped both short-term and long-term expectations, which were very different from each other (wave 2 interviews). Six participants described that the short-term impact of the Brexit vote would be the Pound devaluation. Those short-term expectations were described as "the mechanisms readjusting itself to the new reality" by a male trader with less than five years of experience and it was suggested that similar events "of volatility will occur within the next couple of years, when announcements will be made" (female trader with more than ten years of experience).

On the other hand, three participants suggested that in the long-run financial markets will equilibrate at the pre-referendum levels again. Particularly, they mentioned that the final impact on the British economy will depend on the outcome of the negotiations among the UK and the EU, but once market volatility would settle down they expected the market to "(…) recover and find a new steady state" (female trader with more than ten years of experience). This interpretation of short-term and long-term expectations agrees with the Efficient Market Hypothesis (Fama, 1969), according to which market anomalies, such as volatility and traders' overreaction to news, are treated as short-term return deviations from the long-term equilibrium point. Hence, the impact of the short-term expectations according to the EMH is limited. Not everyone though agreed with the positive long-term expectations, as two interviewees identified hard Brexit as a possible scenario, with a negative impact on the British economy for a longer period of time from five to ten years. They suggested that the most significant damage for financial sector would be the loss of the passporting rights, with a long-lasting effect.

In order to examine whether the traders' decision-making after the announcement of the Brexit vote was influenced by their pessimism about the short-term consequences or/and their optimism about the long-term impact, we need to gather further quantitative data. This is a limitation of the interview analysis, but the follow-up survey allows us to test if this relationship exists.

Generally, the market became more sensitive to uncertainty after the referendum, according to five participants. The market was already anxious because of the Brexit vote, and traders became more aware of other potential uncertain events that could occur in the near future, compared to the wave 1 interview findings. Several examples were given:

"Following up from the Brexit decision, the atmosphere is a lot more paranoid about unknown risks. Suddenly, the European crash tests that we recently had, a potential referendum in Italy coming up next month, the coup in Turkey, all of these are seen as potentially larger than they would be on their own. Brexit has created an atmosphere of sensitivity and fear about the risk undertaken." (Interview, wave 2, a male trader with more than ten years of experience)

“The US elections are coming up, the interest rate decisions, the global markets are pretty elevated from a risky perspective as well.” (Interview, wave 2, a male trader with more than ten years of experience)

According to Guttentag and Herring (1986), when individuals’ confidence in estimation is high they focus on calculable risk, while when their confidence is low they pay more attention to fundamental uncertainty. Our findings agree with this theory. The interviewees appeared to be more aware of potential uncertainties after the announcement of the Brexit vote, such as the European banking stress tests, the 2016 US elections, the Turkish coup attempt of 2016, and others. During the wave 1 interviews, the participants gave past examples of uncertain events, cases they had experienced already. While in wave 2 interviews, the participants referred to future uncertain events, even though not necessarily linked with the Brexit.

One of the reported future uncertainties was the impact of Brexit on financial regulation. It was discussed by four participants that the legal framework would need to be adjusted by the British financial regulatory authorities. Particularly, they referred to the UK’s loss of passporting rights and its potential negative effect on the British financial industry. One interviewee focused on the US companies that register in the UK, in order to operate in the EU markets without further authorisation requirements.

“Lots of the US headquarters are based in London so they can trade with the EU financial institutions. If passporting is not allowed because of Brexit, then these firms will need to have another headquarter somewhere within Europe, to be able to trade with any EU financial institution. If that happens lots of people will also move out of London, they will lose a lot of taxes etc.” (Interview, wave 2, a female trader with more than ten years of experience)

The loss of passporting rights denotes the shrinkage of the financial services on the City, because the non-EU institutions will need to move their headquarters somewhere within the EU or to register new ones with extra costs. Additionally, it is unclear what will be the impact of the changing regulatory scheme on the existing trades.

Lastly, two participants were unable to give an answer, either positive or negative, about the future impact of the Brexit on the British economy.

5.3 The contributions of the wave 2 interviews

The months before the Brexit referendum can be described as the first stage of a case of Disaster Myopia, based on the wave 1 interview findings. The UK-based financial traders were driven by their optimism, and as a result they underestimated the outcome of the Brexit vote. For that reason, the EU referendum was chosen for further investigation as a specific case of fundamental uncertainty in financial markets, with a follow-up round of interviews (wave 2). Indeed, one of the contributions of this research is that our hypothesis, that the Brexit vote was a case of fundamental and unmeasurable uncertainty, was verified by the wave 2 interview findings.

In wave 2 interviews analysis we also observed a consistency with regard to the interviewees' answers about their decision-making under uncertainty. While in wave 1 interviews they described a variety of decision-making processes, in wave 2 findings the majority of the participants consistently reported greater risk aversion. The next contribution is the relationship between the Brexit vote and traders' reaction to it by eliminating their exposure to risk. They reported that they avoided to undertake risk on their portfolios and a few were advised to do so by the financial institutions they were working for. They also applied hedging strategies before the referendum, in order to substitute deals that could be negatively influenced by the Brexit vote with less risky assets. In extreme cases, a few decided to close their deals and exit the market, due to price volatility and the unpredictability of the market.

It was also reported that the market became more sensitive to potential uncertainties, e.g. the US elections, the Italian referendum and the Turkish coup attempt (wave 2 interviews). The interviewees' higher awareness of uncertainty agrees with the Disaster Myopia Hypothesis; they could have overestimated the probabilities of those uncertainties due to the short period of the two months between the referendum and the wave 2 interviews. We will examine further our hypothesis, that the Brexit vote was not only a specific case of fundamental uncertainty, but also a case of Disaster Myopia by gathering and analysing further data at a later point of time, in wave 3 survey. Wave 3 survey which was released a year later, allowed us to search the effect of time on traders' interpretation of uncertainty, and how it influences their decision-making.

Another concept of decision-making that appears in wave 2 interviews, but not in the wave 1 ones, was the distinction between short-term and long-term expectations about the future impact on the British economy. The short-term and long-term expectations have a central role both in the established view and the critical literature. On one hand, according to the Efficient Market Hypothesis (Fama, 1969) the short-term expectations play the role of the disturbance in financial markets, which causes short-term deviations from the price equilibrium and their long-term impact is insignificant. On the other hand, in the General Theory (Keynes, 1936), individuals' short-term expectations about profitability are the ones that drive their investment movements and their decision-making. According to the latter, investors shape long-term expectations about the general economic activity, which they also take into account in their decision-making, but the impact on investors' decision-making is not as significant as the one of the short-term expectations. In other words, investors focus more on their potential profitability, rather than the general economic activity when they make decisions. The contribution of the wave 2 interviews is that we defined the short-term expectations as the Pound devaluation, and the long-term ones as the belief that the market will equilibrate to the pre-Brexit levels. We can investigate their impact on traders' decision-making in the wave 3 survey, following the descriptive models methodology. Particularly, we test the impact of both short-term and long-term expectations on traders' decision-making after the Brexit vote, in section 5.5.

Lastly, the impact of a changing regulatory framework on financial uncertainty was verified both in the wave 1 and 2 interview findings. In the second wave it becomes more specific around the loss of UK-based companies' passporting rights, which would lead to the shrinkage of the financial sector in the City. Companies that were trading in the EU markets will have to move or open headquarters in Germany, Paris or somewhere else within the EU, if the UK passporting rights will be lost. The absence of a framework around the financial regulatory changes was identified as a source of uncertainty in wave 2 interviews. We conclude that Central Banks can play a crucial role in periods of uncertainty, an argument that is further developed in the following section.

Table 29 summarises the contributions of the wave 2 interviews about traders' decision-making, in advancing knowledge and the existing literature.

Table 29. Wave 2 interviews, Decision-making after the Brexit referendum and financial traders' expectations

Interview findings-wave 2			New evidence/ existing in the literature
The Brexit vote and uncertainty	**Decision-making after the announcement of the Brexit vote**	**Expectations about Brexit's future impact**	
It was not expected to happen. It is still uncertain, with respect to the future agreement with the EU. Expectations about the post-Brexit economic/political events created uncertainty.		Short-term expectations: Pound devaluation and market volatility	Radical definitions of Keynesian uncertainty
	Traders remained passive. They observed other traders' reaction. They simplified their trades, and shortened the maturity.		Infinite regress problem Beauty contest Liquidity preference
		Long-term expectations: financial markets will equilibrate at the pre-Brexit levels.	Efficient Market Hypothesis

Table 29. continued

Interview findings-wave 2			New evidence/ existing in the literature
The Brexit vote and uncertainty	**Decision-making after the announcement of the Brexit vote**	**Expectations about Brexit's future impact**	
There is no previous experience of an EU-member country exiting the union.			Bounded rationality theory
Wave 1 Interviews: The very low probability of the Brexit vote was treated almost as equal to zero.			Disaster Myopia Hypothesis: The threshold heuristic
Wave 2 interviews: All participants referred to the Brexit vote as a case of uncertainty.			The availability heuristic
Brexit was recognised as an uncertain event by all participants. There was a lack of clarity/framework about what Brexit will mean for trading.	They avoided risk-taking. They exited the market. They hedged my positions. It depended on the type of trade.	The market became more sensitive to uncertainty. EU financial regulation must be adjusted by the British regulator. UK companies may lose their EU passporting rights.	Contributions

5.4 The conclusions of the wave 2 interview analysis

Our first conclusion based on the wave 2 interview findings is that traders' perception of uncertainty around specific events -in this case the Brexit referendum- may change over time, as suggested by the Disaster Myopia Hypothesis (Guttentag and Herring, 1986). Financial traders do not behave as predicted by the rational agent model (Von Neumann and Morgenstern, 1944), because they are influenced by the market sentiments. Despite the fact that the information about the Brexit referendum was available in advance, they adopted a myopic approach towards its outcome, influenced by the market optimism. If they were behaving rationally, as defined in the established view, they should had foreseen the Brexit vote, or at least associated it with a higher probability to occur, because it is not a case of a short-term deviation. It is rather an uncertain event with a long-term impact, especially for the UK-based financial institutions that may lose their passporting rights. The result of this shock was the rise of the financial traders' awareness of uncertainty. The market became more sensitive to potential unexpected events, which resulted in price volatility when announcements were made (wave 2 interviews). The result of this awareness was financial traders' risk aversion, another key finding of wave 2 interviews.

The second conclusion of this research is the relationship between financial traders' attitude towards risk under fundamental uncertainty and their liquidity preference (wave 2 interviews). Although during the wave 1 interviews the participants reported a variety of decision-making processes under uncertainty, in the second wave of interviews their answers were more specific and all of them reported some level of risk aversion after the announcement of the Brexit vote. They avoided risk, they simplified their trades and shortened their maturity, they exited the market and they took precautionary measures, such as hedging strategies, in order to reduce their risk exposure. Those movements had an impact on the market liquidity, as traders showed a preference for shorter and more liquid trades, due to the greater flexibility they offered.

Their decision to hold greater liquidity has policy implications under the scope of market stability. As described during the wave 2 interviews, immediately after the announcement of the Brexit vote, regulators set up in place liquidity measures to prevent the collapse of the UK market - a possible outcome given the Pound devaluation. Another factor that

policy makers should take into consideration is traders' short-term and long-term expectations. Given that financial traders shape expectations about future events, which may have an impact on their decision-making, regulators could influence these expectations by providing a framework of the future policies they intend to adopt. Or else regulators could eliminate the negative impact of financial uncertainty, by signalling their intentions about the upcoming regulatory changes. The wave 2 interview data does not allow us to examine whether both types of expectations play a significant role in financial traders' reactions. To be able to derive a more specific conclusion, and to test whether there was a significant relationship between long-term, short-term expectations and traders' reaction to the Brexit vote, we released a survey that captured a bigger sample of financial traders. The wave 3 survey analysis is presented in the following section.

5.5 Survey analysis- wave 3

5.5.1 What were the most common beliefs with regard to Brexit as an uncertain event?

Although Likert scale data often require non-parametric procedures, (i.e. distribution free methods, such as tabulations, contingency tables, chi-square statistics, the Mann-Whitney U test) the sample size (N=210) was sufficiently large to allow the use of parametric analysis as well (means, standard deviations, Pearson's r correlation, independent-samples t-test) (Allen and Seaman, 2007; Sullivan and Artino, 2013). Measures of central tendency (mean) and dispersion (standard deviation) were computed to summarise the data for traders' beliefs about financial uncertainty with regard to Brexit on the trading floor. The means were interpreted on the Likert scale [strongly disagree (1), disagree (2), neither agree nor disagree (3), agree (4), strongly agree (5)]. We also report whether the means of the variables were significantly different from the neutral value (mid-point 3) based on a one-sample t-test.

Financial traders strongly agreed that the future agreement with the EU made Brexit an uncertain event and that expectations about post-Brexit political and economic events were sources of uncertainty. They also agreed that the lack of clarity about post-Brexit financial regulatory framework and the fact that it is a first-time event of a country leaving the EU, increased uncertainty. All variables were summarised under the title "Brexit still creates financial uncertainty". All means were significantly higher from the mid-point, and

the results are presented in Table 30. These results agree with the interview results, where the majority of participants reported that Brexit still remains an uncertain event.

Table 30. Sources of uncertainty with regard to Brexit- wave 3 survey results

Variables	Means	Standard deviations
Brexit is still an uncertain event, with respect to the future agreement with the EU	4.19**	0.92
Expectations about post-Brexit economic/political events create uncertainty	4.10**	0.78
There is lack of clarity about what Brexit will mean for trading	3.86**	1.00
There is uncertainty because it is the first time a country leaves the EU	3.70**	0.93
Summary variable	**Means**	**Standard deviations**
Brexit still creates financial uncertainty	3.96**	0.72

N=210, **Significantly different from test value 3 at 0.01 level based on a one-sample t-test (2-tailed)

5.5.2 What were the most common reactions to the Brexit referendum?

The most commonly reported reaction to the Brexit referendum from a trader's point of view was to hedge his/her positions, with a mean significantly higher than the mid-point. The participants disagreed with the statement that they simplified their trades after the Brexit referendum, although it was not statistically different than the mid-point on the Likert scale. They also disagreed that they remained passive, they avoided risk and that they exited the market. These means were found significantly lower than the mid-point. All variables were summarised under the title "After and before the Brexit referendum I minimised my risk". The data showed that traders reacted beforehand, trying to limit their potential losses by hedging their deals in advance, but they did not avoid risk-taking. Table 31 summarises these findings.

Table 31. Decision-making after the Brexit referendum -wave 3 survey results

Variables	Mean	Standard deviation
Before the EU referendum I hedged my positions	3.46**	1.00
After the announcement of Brexit, I simplified my trades	2.87	1.03
After the announcement of Brexit, I remained passive	2.62**	1.10
After the announcement of Brexit, I avoided risk-taking	2.39**	1.03
After the announcement of Brexit, I exited the market	2.01**	0.92
Summary variable	**Mean**	**Standard deviation**
After and before the Brexit referendum, I minimised my risk	2.67**	0.63

N=209, **Significantly different from test value 3 at 0.01 level based on a one-sample t-test (2-tailed)

5.5.3 What were the most common beliefs with regard to the future impact of Brexit?

Participants agreed that after Brexit, the UK financial companies might lose their EU passporting rights and that financial markets became more sensitive to uncertainty after the announcement of Brexit. The Sterling Pound devaluation as a result of the referendum was commonly agreed by the survey participants. They also agreed that the regulation should be adjusted in the future and that in the long-run the market will equilibrate at the pre-Brexit levels.

These results were categorised into short-term and long-term effects. The survey participants agreed that Brexit will have a negative short-term impact on the British economy, but they also agreed that in the long-run the market will equilibrate again. To conclude, traders' predictions about post-Brexit phenomena were organised based on the time horizon of their effects. All means were significantly higher from the mid-point and the results are shown in Table 32.

Table 32. Predicting the future impact of Brexit- wave 3 survey results

Variables	Mean	Standard deviation
After Brexit, UK companies might lose their EU passporting rights	3.54**	0.95
The market became more sensitive to uncertainty after the EU referendum	3.45**	1.01
Brexit will lead to further Sterling Pound devaluation	3.41**	0.99
After Brexit, EU financial regulation must be adjusted by the British regulator	3.37**	0.96
In the long-run financial markets will equilibrate at the pre-Brexit levels	3.17**	1.06
Summary variables	**Mean**	**Standard deviation**
In the short-term there will be a negative impact on the British economy	3.46**	0.69
In the long-term the market will equilibrate	3.27**	0.78

N=208, **Significantly different from test value 3 at 0.01 level based on a one-sample t-test (2-tailed)

5.5.4 Was there a significant relationship among traders' reaction to the Brexit referendum and the sources of uncertainty with regard to it?

A Pearson correlation analysis was used to examine the relationship between traders' reactions and the sources of uncertainty with regard to the Brexit referendum. All reported tests are two-tailed. We found a significant and positive relationship between the belief that Brexit still creates financial uncertainty and the participants' response to it [$r(208) = 0.23$, $p < 0.01$].

We may conclude that traders who applied hedging strategies on their portfolios before the EU referendum, also believed that Brexit was still a source of financial uncertainty.

5.5.5 Were there any significant relationships among traders' reaction to the Brexit referendum and their beliefs about its future impact?

There was a significant, positive relationship between the short-term effects of Brexit and traders' reaction to the Brexit referendum [r (208) =0.21, p<0.01]. There was also a positive relationship between the long-term effects of Brexit and participants' reaction to the Brexit referendum, which was not statistically significant [r (208) =0.66, p>0.05].

Overall, financial traders took into consideration the short-term, negative effects when they had to react immediately to the announcement of Brexit. On the contrary, they did not take into account the positive and long-term effects of Brexit, the moment they faced uncertainty.

5.5.6 Were there any differences in beliefs about Brexit as an uncertain event, between the participants who traded in the UK market and the ones who did not?

An independent-samples t-test was conducted to compare the perception of Brexit as an uncertain event, among participants who traded in the UK market and the ones who did not. The independent-samples t-tests are used to test the significance of a difference between the mean values of two groups, which are independent of each other (Buckingham and Saunders, 2004, p. 251). Additionally, a measure of effect size was measured, called Cohen's d (Cohen, 1988). Cohen's d is a common measure of substantive difference used in social sciences. It is measured on a scale from +1 to 0; the closer it is measured to unit, the larger is the difference among the two groups. Caution should be paid because the sample sizes between the participants who traded in the UK financial market (N_{UK}=139) and the ones who did not ($N_{non\text{-}UK}$=62) are different.

There was no significant difference among the participants who traded in the UK financial market (M=3.99, SD=0.72) and the ones who did not (M=3.84, SD=0.75) when they were asked whether Brexit is still an uncertain event, t (199) =-1.33, p>0.05, d=-0.18.

In order to verify our results, we also conducted a non-parametric analysis of testing differences among the two groups, the Mann-Whitney U test. The null hypothesis is that the samples were drawn from populations with the same mean of ranks. We failed to reject the null hypothesis (z=-1.51, p>0.05), hence there was no significant difference among the means of the ranks of the participants who traded in the UK financial market

and the ones who did not, when they were asked whether Brexit is still an uncertain event. Overall, the data showed that Brexit was perceived as an uncertain event for financial traders globally.

5.5.7 Were there any differences in decision-making before and after the announcement of Brexit, between the participants who traded in the UK market and the ones who did not?

There was no significant difference among the participants who traded in the UK financial markets (M=2.66, SD=0.67) and the ones who did not (M=2.69, SD=0.57) on their reaction to the Brexit announcement, t (199) =0.31, p>0.05, d=0.04.

We also performed the Mann-Whitney U test, which failed to reject the null hypothesis (z=0.34, p>0.05). There was no significant difference among the means of the ranks of the participants who traded in the UK financial markets and the ones who did not, on their reaction to the announcement of Brexit.

5.5.8 Were there any differences in expectations about Brexit's future impact on the British economy, between the participants who traded in the UK market and the ones who did not?

There was no significant difference among the participants who traded in the UK financial markets (M=3.43, SD=0.69) and the ones who did not (M=3.49, SD=0.72) with regard to Brexit's short-term impact on the British economy, t (199) =0.55, p>0.05, d=0.07. Also, there was no significant difference among the participants who traded in the UK financial markets (M=3.28, SD=0.78) and the ones who did not (M=3.23, SD=0.78) regarding Brexit's long-term impact on the British economy, t (199) =-0.44, p>0.05, d=-0.06.

We also performed the Mann-Whitney U test, which failed to reject the null hypothesis (z=0.93, p>0.05). There was no significant difference among the means of the ranks of the participants who traded in the UK financial markets and the ones who did not, with regard to Brexit's short-term impact on the British economy. Also, there was no significant difference among the means of the ranks of the participants who traded in the UK financial markets and the ones who did not, with regard to Brexit's long-term impact on the British economy (z=-0.54, p>0.05).

The last two questions show that both traders' reaction to Brexit and their opinion about Brexit's impact on the British economy did not get influenced from the fact that some participants traded in the UK financial markets and others did not.

5.5.9 Diagnostic tests and linear regression analysis

Linear regression analysis was used to test if the sources of uncertainty with regard to Brexit and its future impact on the British economy, along with the demographic variables, significantly predicted traders' decision-making before and after the Brexit referendum.

Due to multicollinearity, the three explanatory variables ("Brexit still creates financial uncertainty", short-term and long-term effects) were tested separately. Particularly, the belief that "Brexit still creates financial uncertainty" was significantly correlated both with the short-term effects ($r(208) = 0.51$, $p < 0.01$) and the long-term ones ($r(208) = -0.25$, $p < 0.01$). Also, the short and the long terms effects were correlated to each other ($r(208) = -0.15$, $p < 0.01$). The models 5 to 10 summarise the results of this analysis.

In model 5 the belief that "Brexit remains an uncertain event" was a significant predictor of traders' decision-making before and after the Brexit referendum ($p < 0.01$), and it explained 5.6% of the variance.

The diagnostic tests for model specification, for normality of errors and homoscedasticity were performed for model 5. Model 5 passed the Ramsey RESET (1969) test for model specification ($p > 0.05$), we failed to reject the null hypothesis that the model had no omitted variables, at 5% significance level). The variable "After and before the Brexit referendum I minimised my risk" was sufficiently predicted by the variable "Brexit still creates financial uncertainty". The normality of the residuals was tested by the Jarque-Bera (1987) test, and the null hypothesis that the errors followed a normal distribution was rejected at 5% significance level ($p < 0.05$). The test suggested that the coefficients were biased and therefore should not be interpreted. Homoscedasticity was tested by the Breusch-Pagan (1979) test, and the test rejected the null hypothesis that the errors' variance was constant at 5% significance level ($p < 0.05$), hence the errors were heteroscedastic. To solve this, we ran the model with robust standard errors. Lastly, strict exogeneity was ensured because traders minimised their risk due to the fact that Brexit remained an uncertain event, and not vice versa.

In model 6, the statement “Brexit still creates financial uncertainty” remained a significant predictor ($p<0.01$), along with traders’ educational background ($p<0.05$). The independent variables explained 7.9% of the variance.

Model 6 passed the Ramsey RESET (1969) test for model specification ($p>0.05$, we failed to reject the null hypothesis that the model had no omitted variables, at 5% significance level). The variable “After and before the Brexit referendum I minimised my risk” was sufficiently predicted by the variable “Brexit still creates financial uncertainty” and the demographic variables. The normality of the residuals was tested by the Jarque-Bera (1987) test, and the null hypothesis that the errors followed a normal distribution was rejected at 5% significance level ($p<0.05$). The test suggested that the coefficients were biased and therefore should not be interpreted. Homoscedasticity was tested by the Breusch-Pagan (1979) test, and the test failed to reject the null hypothesis that the errors’ variance was constant at 5% significance level ($p>0.05$), hence the errors were homoscedastic. Lastly, strict exogeneity was ensured because traders minimise their risk due to the fact that Brexit remained an uncertain event, and not vice versa. Also, the demographics may influence traders’ behaviour but not vice versa. Models 5 and 6 are presented in Table 33.

Table 33. Summary of models 5 and 6

	Model 5	**Model 6**
Dependent variable	After and before the Brexit referendum, I minimised my risk	After and before the Brexit referendum, I minimised my risk
Constant	1.85**	1.81**
	[0.00]	[0.00]
Brexit still creates financial uncertainty	0.20**	0.18**
	[0.00]	[0.00]
Gender		0.18
		[0.08]
Education		0.19*
		[0.03]
Years of experience		0.00
		[0.15]
Trading in the UK markets		-0.03
		[0.69]
N	210	199
R^2	0.05	0.07
F statistics	F(1,208)=12.96	F(5,193)= 3.32
P value	0.00	0.00
Diagnostic tests		
Ramsey RESET test/model specification	F(3,205)=0.70	F(3,190)=0.07
	[0.55]	[0.97]
Jarque-Bera test/normality of errors	Adj x^2=6.84	Adj x^2=7.38
	[0.03]	[0.02]
Breusch-Pagan test/homoscedasticity	x^2=3.92	x^2=1.62
	[0.04]	[0.20]

**p<0.01,* p<0.05, p values in []

In model 7 Brexit's negative, short-term effects on the British economy were a significant predictor of traders' decision-making before and after the Brexit vote (p<0.05), and they explained 3.3% of the variance.

Model 7 passed the Ramsey RESET (1969) test for model specification (p>0.05, we failed to reject the null hypothesis that the model had no omitted variables, at 5% significance level). The variable "After and before the Brexit referendum I minimised my risk" was sufficiently predicted by the variable "In the short-term there will be a negative impact on the British economy". The normality of the residuals was tested by the Jarque-Bera (1987) test, and the null hypothesis that the errors followed a normal distribution was rejected

at 5% significance level ($p<0.05$). The test suggested that the coefficients were biased and therefore should not be interpreted. Homoscedasticity was tested by the Breusch-Pagan (1979) test, and the test rejected the null hypothesis that the errors' variance was constant at 5% significance level ($p<0.05$), hence the errors were heteroscedastic. To solve this, we ran the model with robust standard errors. Lastly, strict exogeneity was ensured because the short-term effects on the British economy may influence traders' reaction to the Brexit vote, but not vice versa.

In model 8, the short-terms effects remained a significant predictor ($p<0.05$), along with traders' educational background ($p<0.05$). The independent variables explained 6.6% of the variance.

Model 8 passed the Ramsey RESET (1969) test for model specification ($p>0.05$, we failed to reject the null hypothesis that the model had no omitted variables, at 5% significance level). The variable "After and before the Brexit referendum I minimised my risk" was sufficiently predicted by the variable "In the short-term there will be a negative impact on the British economy", as well as by the demographic variables. The normality of the residuals was tested by the Jarque-Bera (1987) test, and the null hypothesis that the errors followed a normal distribution was rejected at 5% significance level ($p<0.05$). The test suggested that the coefficients were biased and therefore should not be interpreted. Homoscedasticity was tested by the Breusch-Pagan (1979) test, and the test failed to reject the null hypothesis that the errors' variance was constant at 5% significance level ($p>0.05$), hence the errors were homoscedastic. Lastly, strict exogeneity was ensured because the short-term effects on the British economy and the traders' demographic characteristics may influence their reaction to the Brexit vote, but not vice versa. Models 7 and 8 are presented in Table 34.

Table 34. Summary of models 7 and 8

	Model 7	**Model 8**
Dependent variable	After and before the Brexit referendum, I minimised my risk	After and before the Brexit referendum, I minimised my risk
Constant	1.99**	1.95**
	[0.00]	[0.00]
In the short-term there will be a negative impact on the British economy	0.19**	0.15*
	[0.00]	[0.01]
Gender		0.17
		[0.11]
Education		0.20*
		[0.02]
Years of experience		0.00
		[0.30]
Trading in the UK markets		0.00
		[0.76]
N	210	199
R^2	0.04	0.06
F statistics	F(1,208)=9.39	F(5,193)=2.72
P value	0.00	0.02
Diagnostic tests		
Ramsey RESET test/model specification	F(3,205)=1.23	F(3,190)=1.26
	[0.30]	[0.26]
Jarque-Bera test/normality of errors	Adj x^2=6.22	Adj x^2=6.70
	[0.04]	[0.03]
Breusch-Pagan test/homoscedasticity	x^2=5.79	x^2=1.26
	[0.01]	[0.26]

**p<0.01,* p<0.05, p values in []

Model 9 showed that the Brexit's long-term effects on the British economy were not a significant predictor of decision-making before and after the Brexit vote (p>0.05), and they explained 0.4% of the variance.

Model 9 passed the Ramsey RESET (1969) test for model specification (p>0.05, we failed to reject the null hypothesis that the model had no omitted variables, at 5% significance level). The variable "After and before the Brexit referendum I minimised my risk" was sufficiently predicted by the variable "In the long-term the market will equilibrate". The

normality of the residuals was tested by the Jarque-Bera (1987) test, and the null hypothesis that the errors followed a normal distribution was rejected at 5% significance level ($p<0.05$). The test suggested that the coefficients were biased and therefore should not be interpreted. Homoscedasticity was tested by the Breusch-Pagan (1979) test, and the test failed to reject the null hypothesis that the errors' variance was constant at 5% significance level ($p>0.05$), hence the errors were homoscedastic. Lastly, strict exogeneity was ensured because the long-term effects on the British economy may influence traders' reaction to the Brexit vote, but not vice versa.

Model 10 showed again that the Brexit's long-term effects on the British economy were not a significant predictor and neither were any of the demographic variables ($p>0.05$). The independent variables explained 4.8% of the variance.

Model 10 passed the Ramsey RESET (1969) test for model specification ($p>0.05$, we failed to reject the null hypothesis that the model had no omitted variables, at 5% significance level). The variable "After and before the Brexit referendum I minimised my risk" was sufficiently predicted by the variable "In the short-term there will be a negative impact on the British economy", as well as by the demographic variables. The normality of the residuals was tested by the Jarque-Bera (1987) test, and the null hypothesis that the errors followed a normal distribution was rejected at 5% significance level ($p<0.05$). The test suggested that the coefficients were biased and therefore should not be interpreted. Homoscedasticity was tested by the Breusch-Pagan (1979) test, and the test failed to reject the null hypothesis that the errors' variance was constant at 5% significance level ($p>0.05$), hence the errors were homoscedastic. Lastly, strict exogeneity was ensured because the Brexit's long-term effects on the British economy and the traders' demographic characteristics may influence their reaction to the Brexit vote, but not vice versa. Models 9 and 10 are summarised in table 35.

Table 35. Summary of models 9 and 10

	Model 9	**Model 10[6]**
Dependent variable	After and before the Brexit referendum I minimised my risk	After and before the Brexit referendum I minimised my risk
Constant	2.49**	2.19**
	[0.00]	[0.00]
In the long-term the market will equilibrate	0.05	0.09
	[0.33]	[0.12]
Gender		0.17
		[0.12]
Years of experience		0.00
		[0.76]
Trading in the UK markets		-0.01
		[0.86]
N	210	199
R^2	0.00	0.04
F statistics	F(1,208)=0.92	F(5,193)= 1.98
P value	0.33	0.08
Diagnostic tests		
Ramsey RESET test/model specification	F(3,205)=0.48	F(3,190)=1.16
	[0.69]	[0.32]
Jarque-Bera test/normality of errors	Adj x^2=8.05	Adj x^2=9.22
	[0.01]	[0.00]
Breusch-Pagan test/homoscedasticity	x^2=1.38	x^2=0.07
	[0.23]	[0.78]

**p<0.01,* p<0.05, p values in []

These results suggest that traders' decision-making mechanism after and before the Brexit referendum was predicted by their beliefs that Brexit remained an uncertain event and that the short-term effects will be negative for the British economy. On the contrary, their belief that in the long-term the market will equilibrate to the pre-Brexit levels was not a significant predictor of their trading behaviour. Lastly, traders' educational background was also a significant predictor of their trading behaviour with regard to Brexit.

[6] The independent variable education is omitted purposefully, due to significant correlation with the variable "In the long-term the market will equilibrate"

5.6 Contributions of survey analysis

The quantitative findings collected during the wave 3 survey and analysed further with statistical and regression techniques, provide supporting evidence for the Keynesian theory of short-term expectations (Keynes, 1936), as well as for the Disaster Myopia Hypothesis (Guttentag and Herring, 1986). The correlation and regression analyses showed that financial traders reacted to the announcement of Brexit by incorporating into their decision-making their negative short-term expectations, in alignment with the Keynesian theory of expectations. According to the latter, it is the entrepreneurs' short-term expectations about their expected profit that dictate their decisions on production; while they also form long-term expectations about the general economic environment (Keynes, 1936). Similarly, based on the wave 3 survey findings, the survey participants formed expectations about the negative short-term impact and the long-term positive impact of Brexit, but they only took into account the short-term expectations.

The second contribution of the wave 3 survey analysis with regard to decision-making is the supporting evidence for the Disaster Myopia Hypothesis, according to which the time distance since the last economic shock that took place influences the individuals' perception of uncertainty and risk (Guttentag and Herring, 1986). Similarly, traders' opinion about decision-making under uncertainty changed after the shock of the Brexit referendum. In the wave 1 interviews (a few months before the referendum) the outcome of the Brexit referendum was not considered a case of uncertainty, given that none of the interviewees mentioned it as such. As opposed to the wave 2 interviews (a month after the referendum) where all participants reported the referendum outcome as a case of financial uncertainty, and they also described higher levels of risk aversion as a reaction it. This contrasts with the wave 3 survey findings (a year after the referendum), when the participants disagreed with the statement "After and before the Brexit referendum, I minimised my risk", which was derived from the wave 2 interviews findings, following the descriptive models methodology. We may conclude that financial traders' opinion about uncertainty and risk aversion changed over time due to the time distance since the last shock (the Brexit referendum) that took place, as suggested by the Disaster Myopia Hypothesis. The implications of this finding are discussed further in the following section.

The wave 3 survey contributions with regard to financial traders' decision-making after the Brexit referendum are summarised in table 36. The means of the survey statements are reported in parentheses. Note that in some cases the results show disagreement with the survey statement (when M<3).

Table 36. Wave 3 survey, the role of expectations in decision-making under uncertainty

Survey results-wave 3		**New evidence/ existing in the literature**
Financial traders' expectations	**Decision-making after the announcement of Brexit**	
In the short-term there will be a negative impact on the British economy (M=3.46**) In the long-term the market will equilibrate (M=3.27**)		Keynesian theory of short-term expectations
	After and before the Brexit referendum, I minimised my risk (M=2.67**)	Disaster Myopia Hypothesis

**Significantly different from test value 3 at 0.01 level based on a one-sample t-test (2-tailed)

5.7 Conclusions of survey analysis

We may conclude that the Brexit vote was a case of fundamental and unmeasurable uncertainty and its outcome remained uncertain with respect to the future agreement with the EU, at the time of the wave 3 survey (June-July 2017). Additionally, the estimated probability of Brexit to occur was systematically underestimated during the pre-referendum, wave 1 interviews as opposed to the post-referendum, wave 2 interviews where the markets were described as sensitive to uncertainty. It is also possible that financial traders underestimated their reaction to the announcement of Brexit in the wave 3 survey, due to the time gap between their reaction to the Brexit referendum (summer 2016) and the survey release date (summer 2017). Overall, the case of the Brexit referendum was a case of Disaster Myopia in finance and figure 2 shows how financial traders' perception of uncertainty and risk aversion changed overtime.

Figure 2. Empirical evidence for Brexit as a case of Disaster Myopia Hypothesis

There are two implications based on the quantitative findings collected by the wave 3 survey. Firstly, our evidence shows that regulatory authorities and central banks need to be aware of the role of short-term expectations in financial decision-making. Having this knowledge, the regulatory authorities could potentially influence the market's short-term expectations by signalling their intentions around regulatory changes, especially in times of uncertainty. The Brexit is an example where the Bank of England could influence the short-term expectations, by announcing a plan about the post-Brexit financial regulation under the British law. The second implication is based on the fact that geographical borders were not a significant factor in interpreting uncertainty before and after the referendum, as well as with regard to the traders' reaction to it. Therefore, both the British and the EU regulators should corporate in influencing short-term expectations under the scope of financial stability and they should provide more information about their future collaboration.

6. What are the gender differences and similarities among financial traders?

6.1 Introduction

In Post-Keynesian economics the role of gender is limited and linked with the economic growth driven by consumption (Onaran, 2015), rather than explored in relation to decision-making under uncertainty. In the mainstream literature, despite the fact that *homo economicus* in the rational agent model is gender-neutral, research suggests that gender may play an important role in decision-making in finance. There is supporting evidence that financial performance may benefit from greater gender diversity in financial governance (Francoeur et al., 2008; Campbell and Minguez-Vera, 2008). The conclusions are not definite though, given that there is also evidence that shows no relationship between gender diversity in finance and firms' profitability (Carter et al., 2010; Dalton et al., 1998).

The established literature focuses on firms' financial performance rather than on equity among male and female financial professionals. In contrast the feminist literature suggests that higher female participation in top decision-making positions of financial institutions would not have prevented the 2008 financial crisis, but it would have prevented a narrow groupthinking in financial decision-making (Young, 2014). Feminist scholars also draw insights from other disciplines in favour of gender diversity. For example, according to the Lehman Sisters' Hypothesis (LSH) higher female participation in financial decision-making would lead to more sustainable financial markets due to women's greater risk aversion, as well as gender differences in ethics, moral attitudes and leadership style; based on findings from psychological and neuroscience studies (Van Staveren, 2014).

Empirical evidence of gender differences in risk aversion, in the "new" behavioural finance, is inconclusive though. For instance, according to a study of 3000 domestic and international US-based equity funds, women managers of mutual funds are not found consistently more or less risk averse than their male colleagues (Bliss and Potter, 2003). On the other hand, Powel and Ansic (1997) based on two computer-based laboratory experiments suggest that women are undertaking less risk than men, regardless other factors such as levels of familiarity, framing and uncertainty.

While the “new” behavioural finance literature focuses on gender differences in risk aversion levels, Nelson (2014; 2018) suggests that researchers should focus more on gender similarities rather than differences. We adopt this approach to investigate gender similarities and differences in financial decision-making under uncertainty. We do not focus on risk aversion differences, instead we follow the descriptive models approach, which allows the participants to express their opinion on the topic. There may be differences and similarities that do not appear in the literature and as a result financial traders may have insights we are not aware of. The descriptive models scheme suggests the use of mixed methods; initially open-ended interviews, which reveals financial traders’ opinion on gender differences and similarities in finance, and then a follow-up survey that tests the interviewees’ beliefs with the use of quantitative analysis (Morgan et al., 2002).

The application of mixed methods is in align with the feminist literature. Nelson (1996) criticises the academic dualism around positive and social sciences, which develops further into quantitative and qualitative methodologies. She describes how masculinity is related to precision, reason and the dominance of the rational agent model, while femininity is associated the opposite statements such as emotions, irrationality and weakness. She points out that emotions are not the opposite of rationality, indeed that would be irrationality, and by excluding emotions from our analysis we do not necessarily reach higher precision. Instead she suggests that emotions and rationality are complementary to each other, given that a healthy and balanced behaviour involves both traits. Similarly, Van Staveren (2010b) criticises the dominance of modelling methods in the research area of unpaid labour and care and suggests that feminist economics should make use of both quantitative and qualitative methods. Specifically, she describes the use of models by empirical feminist economists as pragmatic, which serves a useful and analytical purpose and does not focus on the complexity of the model. We conclude that the use of the descriptive models is methodologically compatible with the feminist economics for the following reasons. The descriptive models method allows insights from the discipline of decision-making, it does not re-affirm the status quo (e.g. risk aversion differences are not presumed in our analysis) and it replaces deductive hypothesis testing by allowing the participants to express their concerns without prior assumptions about their behaviour (Bechtold, 1999).

6.1.1 Female underrepresentation in finance

In this section we present the empirical literature that demonstrates the female underrepresentation in finance. A study of 200 firms in the UK financial sector (The Treasury Committee report, 2018) showed that women in senior positions are strongly underrepresented. Particularly, on average only 23% of Board members were women, while women consisted only 14% of Executive Committees. Out of the 23% female Board members, only 7% were executive directors with an active role in the firms' decision-making. Those were usually placed in firms' support functions rather than profit generating functions, such as HR, communications, legal and compliance, marketing, strategy, treasury, audit, policy and public affairs. The study describes women's underrepresentation in finance as a "pyramid" model where the number of women diminishes in line with seniority.

In the US, among a sample of 7,700 portfolio managers of mutual funds as of March 31, 2015, only 9.4% are women (Lutton and Davis, 2015). The same study supports that only 2% of the US mutual fund assets are managed exclusively by women, as opposed to the 74% of the industry's assets that are managed exclusively by men.

There is also evidence of female underrepresentation in financial regulatory authorities. The top decision-making positions in the US and the EU financial governance institutions, intergovernmental, private and global regulatory institutions, as well as in the regulatory reform organisations are almost exclusively occupied by male professionals (Schuberth and Young, 2011). Same holds for the EU National Central Banks, Ministries of Finance and other professional networks (Young, 2014). In the World Bank 16% of the Executive Directors are female, while in the governance of the International Monetary Fund (IMF) there is only one female Executive Director (4%) (IMF Policy Paper, 2016). Table 37 summarises the publicly available evidence on female participation in finance.

Table 37. Female participation in finance

Organisation	Position	% of female professionals
UK financial sector- 200 firms	Boards members	23%
	Executive committees	14%
US financial sector- 7,700 individuals	Portfolio managers	9.4%
World Bank	Executive Directors	16%
IMF	Executive Directors	4%

Sources: The Treasury Committee, 2018; Lutton and Davis, 2015; IMF Policy Papers, 2016

6.1.2 Gender differences and similarities tested by the descriptive model methodology

Our hypotheses are that female underrepresentation in finance exists and there are both gender differences and similarities (Nelson, 2014; 2018). We adopted the descriptive model methodology because it allows the financial professionals to define the gender differences and similarities on the trading floor, based on their experience and free from presumptions (Morgan et al., 2002). During the wave 1 interviews we asked the interviewees' opinion about female participation on the trading floor and gender similarities and differences among financial traders. The questions were open-ended, in order to allow the thirteen participants to express their opinion, using the wording of their preference, without leading them to specific answers (Morgan et al., 2002). Then we continued with follow-up, more specific questions on gender differences, such as gender roles in finance and differences in career paths among male and female financial traders, in order to investigate the presence of female underrepresentation in more senior roles, as suggested in the literature (Schuberth and Young, 2011; The Treasury Committee report, 2018). We analysed the wave 1 interview results in comparison to the existing literature, to identify the contributions of this research. Also, to remain consistent with the chosen methodology, we report the number of interviewees who agree with each finding, because we analysed our data based on frequencies. For the same reason, we report the most representative quotes in Appendix B.

Following the descriptive models methodology, we used the interview results to create a survey and increase the sample population. In the survey the statements about the potential similarities and differences -as derived from the interview analysis- were mixed

to avoid confirmation bias in the traders' answers. Additionally, the survey statements were stated in the first person. That way the participants did not feel that they were expected to give specific questions based on their gender. Therefore, the survey explored differences in the behavioural patterns among the two groups (male-female) instead of gender stereotypes expressed as questions on gender roles.

Independent-samples t-tests were used to test the significance of a difference between the mean values of behavioural patterns among the female and male survey participants (Buckingham and Saunders, 2004, p. 251). We also applied the Mann-Whitney U (1947) test, which is the equivalent non-parametric test for differences in the means of the ranks of the populations (female-male) under investigation. We took this further step because our data sometimes failed to pass the normality of the residuals diagnostic test (Jarque-Bera). Hence, we verified the robustness of the independent samples t-tests. Additionally, a measure of effect size called Cohen's d was measured (Cohen, 1988). Cohen's d is a common measure of substantive difference used in social sciences. Nelson (2018) suggests the use of Cohen's d; according to her a statistically significant difference of means or means of the ranks does not necessarily establish gender differences if the size of this differences is negligible.

6.2 Interview analysis-wave 1

6.2.1 Female representation on the trading floor

While there is evidence of the female underrepresentation in finance at international level, during the wave 1 interviews we focus on the UK financial sector due to the sample's restricted size (13 participants). This is consistent with the descriptive models methodology, which suggests smaller sample sizes for the initial interviews (Morgan et al., 2002). Our hypothesis is that the interviewees' opinion will agree with the existing empirical evidence. To begin with, we asked them how common it is for women to participate on the trading floor based on their experience.

The majority of the interviewees (12 out of 13) reported some level of gender inequality on the trading floor. Particularly, eight participants (four males and four females) replied that the female presence on the trading floor is quite unusual. Six participants (three women and three men) reported that the percentage of female participation on the

trading floor has improved compared to the past, but it is still very low. They also suggested that this improvement in gender balance is met mostly in junior trading positions. Lastly, only a male trader with more than five years of experience reported that it is common to find female professionals on the trading floor, although later he specified his answer about women in administrative positions.

Our wave 1 interview findings agree with the literature on female underrepresentation in finance, especially in more senior positions (The Treasury Committee report, 2018; Lutton and Davis, 2015; Schuberth and Young, 2011; IMF Policy Papers, 2016).

6.2.2 Reasons behind women's low participation on the trading floor

We also asked the participants' opinion about the reasons of female underrepresentation. Three female and two male traders described the trading floor as a male-dominated working environment, which feels intimidating for women. A female trader with more than five years in a trading position shared her experience:

"I was always intimidated, it was me in a room with 25 men. In the morning meeting, I was a little bit scared to open my mouth a lot of the time. And you get shout down a lot by a guy. Most women I know, certainly are more junior levels, tend to keep themselves and head down, trying to do a good job." (Interview, wave 1)

Along with the hostile environment towards women, it was also suggested that trading may be as a less attractive role to women, compared to other disciplines such as law, accounting or medicine, by two participants (a male and a female). On the other hand, empirical literature suggests that women are usually placed in firms' support functions rather than profit generating functions (The Treasury Committee report, 2018), therefore we cannot conclude that it is necessarily women's choice or preference.

Another reported reason behind female underrepresentation was the different educational paths women and men choose at an earlier stage of their career, according to two interviewees (a female and a male). For example, a female trader with more than ten years of experience mentioned that:

"Trading and structuring are more technical roles and traditionally they attract people with engineering or mathematical background, which I think statistically have more males

in undergraduate studies. This is translated to more men going into the (financial) business." (Interview, wave 1)

It was also suggested by two participants (a male and a female) that due to behavioural differences among men and women, the latter prefer to stay away from the "aggressive, rude and exclusionary" environment of the trading floor, as described by one of them.

Moreover, two female participants discussed the different gender roles in the male-breadwinner family model, which may lead female traders to leave the trading floor earlier than their male colleagues. This view does not appear in the contemporary literature. Specifically, a female trader with more than ten years of experience reported:

"A man has the responsibility for his family and he does not have a choice, he has to be the breadwinner. My incentive to do that job was never to be the breadwinner (my husband works). I worked as hard as men and when I said I was burning out and getting tired after 10 years of doing it, I was able to walk away from it. Whereas when men want to walk out, because a lot of them would be as much burned as me, they cannot." (Interview, wave 1)

The same interviewees suggested that women are often forced to leave the trading floor due to family responsibilities. Overall, the trading floor was described as a working environment that does not promote work-life balance for its employees.

Lastly, a male trader (less than five years of experience) identified the low representation of female traders as a case of gender inequality, which exists in most high-skilled (white-collar) sectors.

6.2.3 Gender similarities among female and male financial traders

After establishing the female underrepresentation on the trading floor and investigating the reasons behind it, we continued the wave 1 interviews by asking the participants' opinion on similarities among male and female traders. This is a contribution to the existing literature which focuses on gender differences rather than on similarities. We identified two categories of behavioural similarities; the first category consists of dominant characteristics, while the second one on intellectual attributes.

Firstly, we discuss the category of the dominant characteristics. Two female and five male participants suggested that both genders adopt some level of aggressive behaviour on the trading floor and they develop a risk-loving profile, which is part of the trader's job. It was also reported that traders, both males and females, have a competitive and ambition-driven personality. While the literature often focuses on women's greater risk aversion (Powel and Ansic, 1997; Van Staveren, 2014) the wave 1 interview results show that a risk-loving behaviour is necessary for the job of the trader, regardless the gender. Specifically, a female trader with more than ten years of experience described male and female financial traders as:

"(…) similar in the sense that they are focused people, they think very quickly, they do not mind taking on challenges, they have shorter-term spam and they are very aggressive and intense. It is the same whether male or female. They can be very firm and dominant people." (Interview, wave 1)

These competitive and aggressive characteristics are necessary for an individual to be successful on the trading floor, according to a male trader with more than ten years of experience:

"The main similarity among men and women in finance is how driven they are, how much they care about succeeding. One thing people in finance have in common is that they are very motivated, competitive and often quite intelligent people. (…) Ambition-driven competitiveness is definitely a thing they have in common. I think those are the key similarities, strong, competitive, ambitious character." (Interview, wave 1)

The second category of similarities focuses on traders' intellectual behavioural traits. The job of a financial trader requires logical thinking and strong analytical and problem-solving skills regardless of someone's gender, according to three female and two male participants. This finding is also a contribution to the existing literature, as it is the first time that we have evidence which highlights the importance of the traders' intellectual and analytical skills. For example, one female trader with more than ten years of experience reported:

“In my experience, they (traders) tend to be very logical and analytical, they tend to be cool-head and intellectual, but also they need to be able to evaluate rapidly the risk and the award of a certain situation.” (Interview, wave 1)

The job of a financial trader requires analytical skills and numeracy, depending on the hierarchy though the requirements and the responsibilities may change (wave 1 interview). According to a male trader with more than ten years of experience:

“Both (male and female traders) have analytical approach to risk and pricing, both have good interpersonal skills, both have worked hard up to the point where they are. A junior trader is an analytic, calm but assured risk-taker. A senior trader is the above, but it is more aggressive in an interpersonal situation.” (Interview, wave 1)

Another similarity according to three participants (two females, one male) was that both male and female traders have similar educational background. Lastly, two female participants and a male one suggested that gender does not play a role in the job of trader, and a female trader (more than five years of experience) was not able to answer the above question.

6.2.4 Gender differences among female and male financial traders

We also asked the interviewees to express their opinions about differences among female and male financial traders. We detected one main difference described both by female and male participants; the fact that female traders were described as more thoughtful in terms of financial risk compared to their male colleagues. This finding is in alignment with the Lehmann Sisters Hypothesis (Van Staveren, 2014), according to which women are more careful with the risk they undertake. For example, a female trader with more than five years of experience mentioned:

“I believe women are more conservative. Not necessarily that they take less risk and they make less money or have less profitable trades. I think they are more careful in the risk they might take. When they take a big risk, they will really consider it. They do lots of research and they put limits in place.” (Interview, wave 1)

It was often stated by the interviewees that female traders focus more on the long-term views of their trading deals than their male colleagues, who were observed to change their views quickly. It was stated that:

“I would say they (female traders) are more of long-term thinking, they would take longer to think about and make a decision. Whereas men are better in making quicker decisions, whether this is right or wrong. ” (Interview, wave 1, a female trader with more than ten years of experience)

“Even if a woman and a man are making ten million in a year, the man would have huge swings in a day. I have never seen a woman that caused huge swings.” (Interview, wave 1, a female trader with more than five years of experience)

Our findings on women’s thoughtful behaviour towards risk, their long-term focus and their consistent opinion over time, agrees with prior evidence according to which women fund managers value more financial discipline compared to their male colleagues (Barclays Wealth, 2011). On the other hand, men were described as faster in making decisions and louder about their success. This view was suggested by four female and four male traders. The wave 1 findings suggested that male traders tend to focus more on short-term views and to be less thoughtful about their undertaken risk, compared to their female colleagues. For instance it was stated that:

“Some male traders are probably more gung-ho. I would not say aggressive, but I would say a bit more willing on taking a gamble and think about it later. Because of their ego of potentially winning. The female traders I worked with were more thoughtful when making decisions.” (Interview, wave 1, a male trader with more than twenty years of experience)

“Men can change their views quite fast. It made me an impression that all the women traders I’ve seen stand by their views more firmly than men.” (Interview, wave 1, a male trader with less than five years of experience)

Women’s better communication and social skills were also highlighted by one female and two male participants. It was suggested that “women tend to be better in conflict resolution, they are doing better in communication and team spirit” by a male trader with more than ten years of experience. While women were praised for building better

relationships with their colleagues, men's ego on the trading floor was reported as a weakness by two interviewees (a female and a male). Particularly, a male trader with more than ten years of experience described it as a "weakness which can lead to excess greed in finance and might result in bubbles". Indeed, women's financial discipline and communication skills, as opposed to men's ego and spontaneity are evidence for gender differences in leadership, as suggested by the Lehmann Sisters Hypothesis (Van Staveren, 2014). Their implications are further discussed in the conclusions section (6.4).

An interesting finding, which is not discussed in the contemporary literature, was that both genders (a woman and two men) believed that the opposite gender deals better with stress and losses on the trading floor. A female trader with more than ten years of experience said "a strength for men is that they often might finish a difficult day, but tomorrow they come in equally happy and they just deal with it", but a similar argument about women was given by a male trader with less than five years of experience.

Two female and three male participants believed that there are no significant differences among male and female traders and it depends on the individuals' personality. Women's self-selection bias was also reported by a male trader with more than fifteen years of experience, who explained that:

"In a male-dominated environment, such as financial trading, women are trying to do well, to get into trading and to succeed. Female traders tend to be reasonably aggressive, because when everyone else is men in a team of traders, then a woman may feel that she needs to prove herself". (Interviews, wave 1)

Lastly, a male trader (more than five years of experience) emphasised men's weakness to report to a senior female trader, as a stereotypical residual on the trading floor, while women's emotional awareness was identified as a weakness by a male trader with more than ten years of experience.

6.2.5 Gender roles in finance

Prior empirical evidence does not only show female underrepresentation in finance, but also lower representation in active roles in the firms' decision-making (The Treasury Committee report, 2018; Schuberth and Young, 2011; IMF Policy Paper, 2016). For that

reason, after asking the interviewees' opinion about gender differences, in wave 1 interviews, we continued with a follow-up, more focused question on gender roles in finance and career path differences. To this question the answers of female and male traders diverged significantly. Women were more aware of gender inequality on the trading floor than the male participants. While all female participants reported at least some level of inequality on the trading floor, four male participants believed that there are no concrete roles between male and female professionals. They supported their view by describing financial markets as a meritocratic working environment.

It was consistently reported that in certain areas of finance female participation is significantly higher than the trading floor (wave 1 interviews). Specifically, three women and three men reported higher female representation in sales departments. There were two explanation provided. Firstly because "in sales, communication skills or coordinating relations are required and the idea is that women are better than men" (interviews, wave 1, a male trader with less than five years of experience). The second reason was given by a male trader with more than fifteen years of experience, according to him whom:

"Sales is a customer-facing position and they (banks) know their clients are predominantly males who like dealing with women, because selling is a softer skill. That is why appearance, likeability and all those things matter." (Interviews, wave 1)

It was also reported that female representation is higher in research (by three female interviewees) and in legal departments (by one male and one female participants). While about the trading floor, it was reported (by two female traders and a male one) that women hold almost exclusively administrative, back-office positions.

Our findings about women's higher participation in sales, research and law departments agree with prior evidence that women are often directed in firms' support functions, such as HR, communications, legal and compliance, marketing and others, rather than profit generating functions (The Treasury Committee report, 2018). The same study describes women's underrepresentation in finance as a "pyramid" model where the number of women diminishes in line with seniority. Our wave 1 interview findings support this argument. Particularly, the absence of women in senior and better-paid positions within financial institutions was reported by three female and two male interviewees.

Additionally, two female participants referred to recruitment programmes launched by UK-based financial institutions, in order to support the women's professional development. This initiative may lead to higher female representation in junior trading position, but it does not necessarily translate to improved gender diversity in more senior positions. The interviewees also observed that undertaking maternity leave can be an obstacle to women's professional development and promotion.

Lastly, two male participants reported differences in opportunities and payments, without specifying them. Two female and three male participants supported that there are no differences in career opportunities and payments, and two male participants were not aware of professionals' payments in general, hence they could not answer.

6.3 Contributions of the interviews

There are two main contributions of the wave 1 interviews on the role of gender in financial markets. Firstly, we explored both gender differences and similarities and secondly, we employed the descriptive models approach to investigate new beliefs based on financial traders' experience that do not appear in the existing literature. As a result, we departed our analysis from the dichotomy of the female risk aversion and the male risk-seeking behaviour.

Specifically, with regard to gender similarities our analysis contributes to the existing literature by highlighting the common characteristics among female and male financial traders that are necessary for the job. While the literature often focuses on women's greater risk aversion (Powel and Ansic, 1997; Van Staveren, 2014) the wave 1 interview results show that a risk-loving behaviour is necessary for the job of the trader in general and regardless the gender. A financial trader regardless her/his gender needs to have some personality characteristics in order to stay into business, such as a risk-seeking, ambition-driven and competitive personality. Financial traders also need to have intellectual personality traits, such as analytical thinking and good problem-solving skills. These characteristics according to our findings are met by both genders in the industry. It was also explained by the interviewees that there is some level of self-selection bias and the people who choose to follow this career -either men or women- already carry these characteristics.

Regarding gender differences, we do not only focus on the analysis of risk aversion differences, because the descriptive models methodology allowed the interviewees to discuss their concerns about gender differences that are overlooked by the contemporary literature. Firstly, a variety of gender differences were discussed that aim to explain female underrepresentation. For instance, it was suggested that women are underrepresented in the better-paid divisions (i.e. trading floor), as well as in better-paid, senior roles within financial institutions. Another contribution of this analysis is the discussion of the different gender roles in the male-breadwinner family model, which may lead female traders to leave the trading floor earlier than their male colleagues. Also, it was suggested that the female underrepresentation is rooted at an earlier career stage, due to the fact that the trading floor attracts graduates with mathematical background or studies in engineering, areas that may also attract fewer women in the first place.

Certain behavioural differences were also mentioned in the wave 1 interviews. Generally, female traders' were praised for their softer skills, such as emotional awareness and good communication skills. As opposed to male traders that were described faster in making decisions and louder about their success. Men's overconfidence was described as ego and a weakness on their trading floor. The market implications of these behavioural differences are further discussed in the next section 6.4.

The abovementioned gender similarities and differences are investigated further with the wave 3 survey that was released at a later stage. Table 38 summarises the contributions of the wave 1 interviews about the gender differences and similarities among financial traders, in advancing knowledge and existing literature.

Table 38. Wave 1 interviews, Gender differences and similarities on the trading floor

Interview findings-wave 1		**New evidence/ existing in the literature**
Gender similarities	**Gender differences**	
Gender does not play a role in the job of a trader		Gender-neutral rational-agent
No supporting evidence		Established view: there is a relationship between gender diversity in financial governance and the firms' profitability
No supporting evidence		"New" behavioural finance: Risk aversion differences Differences in financial decision-making strategies
	Women: Are more careful in terms of financial risk Focus more on long-term views	Feminist economics; LSH: differences in risk aversion, moral ethics and leadership
	Women: Are underrepresented in better-paid positions Hold administrative positions Are underrepresented at senior trading positions	Low female participation in financial governance Empirical evidence on the "pyramid model"-low female participation in senior positions

Table 38. continued

Interview findings-wave 1		New evidence/ existing in the literature
Gender similarities	**Gender differences**	
Women and men: Are risk lovers Are competitive with regard to trading Are ambition-driven Have good problem-solving skills and analytical thinking There is some self-selection bias when women choose to work on the trading floor (equally risk-seeking and competitive)	*Women:* Are underrepresented on the trading floor, as in most white-collar professions May find the trading floor intimidating Leave the trading floor earlier due to family responsibilities Have better communication skills Not enough women study mathematics and/or engineering Are more emotionally aware Deal better with stress *Men:* Are faster in making decisions Are loud about their success Show their ego on the trading floor Deal better with stress Find it difficult to report to senior female traders	Contributions

6.4 Conclusions of the interviews

The first conclusion of this analysis is that the use of the descriptive models methodology revealed financial traders' beliefs about their personality characteristics, which were not discussed in the contemporary literature. We identified both dominant and intellectual personality traits as gender similarities among financial traders. On the one hand, both female and male traders were characterised by aggression, risk-taking behaviour, competitive nature and an ambition-driven personality. On the other hand, they were both characterised as logical individuals, with analytical thinking and good problem-solving skills. These characteristics were examined further in the wave 3 survey.

The main difference we identified was that women were described as more careful about the risk they undertake because they focus more on the long-term views of their portfolios, as opposed to men's overconfidence and ego that were identified as weaknesses. Female financial discipline could have a positive impact on the overall market stability at a macro level, as the Lehman Sisters Hypothesis (Van Staveren, 2014) suggests. Prior empirical evidence also shows that women fund-managers value more financial discipline compared to their male colleagues (Barclays Wealth, 2011). Indeed, women's financial discipline and better communication skills, as opposed to men's ego and spontaneity were evidence for differences in leadership. As Young (2014) suggests, higher female participation in top positions of financial institutions cannot prevent a financial crisis, but it could prevent a narrow groupthinking in financial decision-making that results in herd behaviour. We may conclude that gender diversity and more equal distribution of the top-decision-making, senior positions among men and women could have a positive impact on the firms' risk exposure, and therefore on market's vulnerability in periods of price volatility and uncertainty.

Women's representation in finance should not only focus on the numbers, but also on the type of positions they occupy. According to our findings (wave 1 interviews) and the literature (The Treasury Committee report, 2018), financial institutions deliberately choose women in customer-facing positions such as sales, whereas gender diversity is improved in non-profit generating areas, such as in the legal and research departments. Once more men's overconfidence could lead to narrow group-thinking on the trading floors of financial institutions. While women on the trading floor occupy either junior trading positions or administrative roles. As a result, the low female representation in financial leadership further fuels into the predominantly masculine culture in finance.

Lastly, the male-breadwinner family model was identified as a reason of higher male representation in senior trading positions. It was suggested that due to family responsibilities women may choose to leave the trading floor before they get promoted to more senior positions. Maternity leave was also identified as an obstacle to a woman's career development on the trading floor. Indeed, in the UK, the parental leave scheme is gender-biased as the paid maternity leave might last up to six months, while the paid paternity leave is limited to two weeks (Gov.uk, 2019). These conditions lead women to

exit temporarily the working force, and after undertaking maternity leave they may lose career development opportunities, which creates a gender wage gap and leads to female underrepresentation in better-paid positions.

In the following section we present the wave 3 survey analysis on gender differences and similarities on the trading floor, which tests the interviewees' beliefs with the use of quantitative methods (Morgan et al., 2002).

6.5 Survey Analysis- wave 3

6.5.1 What were the most common beliefs about low female representation on the trading floor?

Although Likert scale data often require non-parametric procedures, (i.e. distribution free methods, such as tabulations, contingency tables, chi-square statistics, the Mann-Whitney U test) the sample size (N=210) was sufficiently large to allow the use of parametric analysis as well (means, standard deviations, Pearson's r correlation, independent-samples t-test) (Allen and Seaman, 2007; Sullivan and Artino, 2013). Measures of central tendency (mean) and dispersion (standard deviation) were computed to summarise the data for traders' beliefs about low female representation on the trading floor. The means were interpreted on the Likert scale [strongly disagree (1), disagree (2), neither agree nor disagree (3), agree (4), strongly agree (5)]. It is also reported whether the means of the variables were significantly different from the neutral value (mid-point 3) based on a one-sample t-test.

The survey respondents estimated that the percentage of female participation on the trading floor is 12.97%. Additionally, participants strongly agreed there are not enough women in senior trading positions; and the most commonly reported explanation for this was the general underrepresentation of female professionals in white-collar industries. Also, the survey data showed that most women on the trading floor hold clerical positions. The means of these statements were significantly higher from the mid-point. On average, traders disagreed with the statement that "There are not as many female traders, because not enough women study mathematics and/or engineering", with a mean significantly lower than the mid-point. The first four variables were summarised under the title

"Women are underrepresented in better-paid positions". Table 39 shows the results of this analysis.

Overall, gender inequality was reported under an institutional framework focusing on job hierarchy within the modern financial institution. Lastly, gender stereotypes about women's quantitative skills were not supported by the data.

Table 39. Reasons for low female participation on the trading floor- wave 3 survey results

Variables	Mean	Standard Deviation
What is your best guess on the percentage of female traders on the trading floor? (percentage)	12.97%	9.07
There is low female representation at senior trading positions	4.14**	0.79
Women are underrepresented on the trading floor, as in most white-collar professions	3.47**	1.11
Most women on the trading floor hold administrative positions	3.41**	0.97
There are not as many female traders, because not enough women study mathematics and/or engineering	2.68**	1.12
Summary variable	**Mean**	**Standard Deviation**
Women are underrepresented in better-paid positions	3.67**	0.69

N=194, **Significantly different from test value 3 at 0.01 level based on a one-sample t-test (2-tailed)

6.5.2 What were the most common trading behaviours and characteristics?

The survey participants strongly agreed with the following statements; that they have good problem-solving skills, they are competitive when trading and that they are careful

in terms of financial risk. They also strongly agreed that they have good communication skills, they are fast in making decisions and that gender does not play a role in the job of trader. Lastly, they disagreed that they might show their ego when trading, they might be loud about their success, they find the floor intimidating and that they plan to leave the trading floor due to family responsibilities.

The primary data was summarised into four categories. First category was titled "I am careful and analytical when trading", while the second group was referred as "I am more of a risk lover and competitive when trading". The survey participants strongly agreed with both statements. The third category was reported as "I might show my ego on the trading floor" while, the fourth group was titled "I am thinking of leaving the trading floor". The survey participants disagreed with the last two statements. All means were statistically different from the mid-point, and the results are reported in Table 40.

Table 40. Gender differences and similarities- wave 3 survey results

Variables	Means	Standard deviation
I have good problem-solving skills	4.40**	0.53
I am competitive regarding trading	4.11**	0.79
I am careful in terms of financial risk	4.00**	0.71
I have good communication skills	3.99**	0.81
Gender does not play a role in the job of trader	3.90**	1.10
I am fast in making decisions	3.90**	0.82
I might show my ego on the trading floor	2.57**	1.09
I might be loud about my success	2.40**	1.02

Table 40. continued

Variables	Means	Standard deviation
I find the trading floor intimidating	2.19**	1.00
I plan to leave the trading floor due to family responsibilities	2.14**	0.95
Summary variables	**Means**	**Standard deviation**
I am careful and analytical when trading	4.12**	0.49
I am more of a risk lover and competitive when trading	3.81**	0.48
I might show my ego on the trading floor	2.48**	0.92
I am thinking of leaving the trading floor	2.16**	0.82

N=205, **Significantly different from test value 3 at 0.01 level based on a one-sample t-test (2-tailed)

6.5.3 Did men and women give different reasons about low female participation on the trading floor?

An independent-samples t-test was conducted to compare females' and males' opinions about low female participation on the trading floor. Also, a measure of effect size, Cohen's d (1988) was measured. Caution should be paid because the sample sizes between men (N_m=163) and women ($N_{F=}$45) were different as they reflect the female underrepresentation on the trading floor.

Female traders reported significantly higher agreement with the statement "Women are underrepresented in better-paid positions" (M=4.01, SD=0.71), compared to male participants (M=3.59, SD=0.64), t (206) =-3.55, p<0.01, d=-0.52. While, women (M=2.67, SD=1.22) and men (M=2.68, SD=1.08) did not differ significantly when they disagreed with the statement "There are not as many female traders, because not enough women study mathematics and/or engineering", t (206) =0.07, p>0.05, d=0.01.

In order to verify our results, we also conducted a non-parametric analysis of testing differences among the two groups, the Mann-Whitney U test. The null hypothesis was

that the samples were drawn from populations with the same mean of the ranks. The test rejected the null hypothesis, that male and female traders had the same mean of ranks when they expressed agreement with the statement “Women are underrepresented in better-paid positions” ($z=-3.61$, $p<0.01$). Also, the test failed to reject the null, that male and female traders had the same mean of ranks when they expressed agreement with the statement “There are not as many female traders, because not enough women study mathematics and/or engineering”, ($z=0.13$, $p>0.05$). Both Mann-Whitney U results agreed with the initial t-test analysis.

The data showed that female traders were more aware of the gender gap in finance due to institutional reasons (i.e. gender hierarchy within a financial institution). While both genders rejected equally the stereotypical explanation of low female representation, which is linked with women’s quantitative skills.

6.5.4 Were there any gender differences in the participants’ trading behaviour?

Women ($M=3.82$, $SD=1.33$) and men ($M=3.91$, $SD=1.03$) did not differ significantly when they reported that “Gender does not play a role in the job of the trader”, $t(206)=0.49$, $p>0.05$, $d=0.06$. There was no significant difference among women ($M=4.23$, $SD=0.48$) and men ($M=4.09$, $SD=0.49$) when they reported that they are careful and analytical when they trade, $t(206)=-1.74$, $p>0.05$, $d=-0.24$. There was not found a significant difference among women ($M=2.61$, $SD=0.91$) and men ($M=2.44$, $SD=0.91$) when they refused showing their ego on the trading floor, $t(206)=-1.09$, $p>0.05$, $d=-0.15$. There was no significant difference among women ($M=2.32$, $SD=0.91$) and men ($M=2.13$, $SD=0.80$), when they reported whether they are thinking of leaving the trading floor, $t(206)=-1.36$, $p>0.05$, $d=-0.19$. Lastly, there was no significant difference among women ($M=3.91$, $SD=0.56$) and men ($M=3.78$, $SD=0.45$), in terms of risk-loving and competition on the trading floor, $t(206)=-1.56$, $p>0.05$, $d=-0.21$.

Then we applied the non-parametric Mann-Whitney U test to verify our results. The test showed that there were no significant differences in the means of the ranks of men and women when they reported that “Gender does not play a role in the job of trader”, ($z=0.18$, $p>0.05$), when they refused showing their ego on the trading floor ($z=-1.05$, $p>0.05$), when they reported whether they are thinking of leaving the trading floor, ($z=-$

1.16, p>0.05), and lastly, when they reported risk-loving and competition on the trading floor (z=-1.60, p>0.05). The test though showed that there was a significant difference in the means of the ranks of men and women when they reported that they are careful and analytical when they trade (z=-2.00, p<0.05), as opposed to the t-test analysis.

The data showed that there were no statistically significant differences in terms of self-reported, trading behavioural characteristics among women and men. There was though a statistically significant difference based on the Mann-Whitney U test, according to which female traders were more careful and analytical in trading. There was also evidence that men and women on the trading floor have different perceptions of gender-related behaviours and challenges. Those are further discussed in section 6.7 Conclusions.

6.5.5 Diagnostic tests and linear regression analysis

The diagnostic tests for model specification, for normality of errors and homoscedasticity were performed for models 11 to 14, which are presented in table 41.

The Ramsey Regression Equation Specification Error -RESET- (1969) test was performed to test the model specification. In all models (11-14) the Ramsey Regression Equation Specification Error test suggested collinearity with the explanatory variables, therefore the gender linear regressions model did not generate meaningful results and we will not interpret them further. The normality of the residuals was tested by the Jarque-Bera (1987) test and for the models 11 and 14 we failed to reject the null hypothesis that errors followed a normal distribution 5% significance level (p>0.05). For models 12 and 13 the null hypothesis that errors followed a normal distribution was rejected at 5% significance level (p<0.05). Homoscedasticity was tested by the Breusch-Pagan (1979) test, which failed to reject the null hypothesis that errors' variance was constant at 5% significance level (p>0.05) for all models 11 to 14, hence the errors were homoscedastic. Lastly, strict exogeneity was ensured because gender may influence behaviour, but not vice versa.

Table 41. Gender regressions

	Model 11	**Model 12**	**Model 13**	**Model 14**
Dependent variable	I am careful and analytical when trading	I might show my ego on the trading floor	I am thinking of leaving the trading floor	I am a risk lover/ competitive when trading
Constant	4.09**	2.44**	2.13**	3.78**
Gender	0.14	0.16	0.19	0.12
R^2	0.01	0.00	0.00	0.01
F statistics	F(1,206)=3.	F(1,206)=1.20	F(1,206)=1.2	F(1,206)=2.
P	02	0.27	7	44
Diagnostic tests	0.08		0.17	0.12
Ramsey RESET test	Collinearity	Collinearity	Collinearity	Collinearity
Jarque-Bera test	Adj x^2=1.39 [0.49]	Adj x^2=5.66 [0.06]	Adj x^2=10.94 [0.00]	Adj x^2=1.41 [0.49]
Breusch-Pagan test	x^2=0.04 [0.83]	x^2=0.02 [0.88]	x^2=1.14 [0.28]	x^2=3.75 [0.05]

N=210, **p<0.01,*p<0.05, p values in []

6.6 Contributions of the survey

The quantitative findings collected during the wave 3 survey and analysed further with statistical techniques, contribute to the feminist literature by exploring the similarities among male and female financial traders. Particularly, both the male and the female survey participants agreed that they are competitive on the trading floor and tend to be risk lovers. The belief that the job of a trader requires some level of competitive character was initially reported in the wave 1 interviews and verified by the survey results. Another similarity between the two genders, which does not appear in the contemporary literature, was their disagreement with the more aggressive characteristics from both genders. Specifically, male and female traders equally disagreed that they may show their ego on the trading floor. Also, they equally disagreed that they are thinking to leave the trading floor due to family responsibilities. These results challenge two gender stereotypes on the trading floor. The first stereotype is that men are louder about their success and tend to show their ego. The survey results showed that male traders did not

identify themselves with these behaviours. The second stereotype is that women tend to leave the trading floor earlier than men to start a family, but the survey results showed that the female traders disagreed equally with the male ones.

Our analysis identified two gender differences which also contribute to the contemporary literature by providing supportive evidence. Firstly according to our findings, women traders are more aware than their male colleagues of the gender inequality in better-paid positions of financial institutions. This finding agrees with the wave 1 interview results and contributes to previous empirical evidence according to which the number of women diminishes in line with seniority (The Treasury Committee report, 2018). Secondly, female traders reported that they are more careful about the risk they undertake on their portfolios, and more analytical in their decision-making process than the male participants in alignment with the Lehman Sisters' Hypothesis (Van Staveren, 2014). This finding though results from the Mann-Whitney U test -which tests the difference among the means of the ranks of men and women traders-, while the independent samples t-test -which tests the difference among the means of men and women traders- did not show a statistically significant difference. In this case the Mann-Whitney U test is more appropriate for the survey Likert scale data, because the scores were ranked by order from 1 to 5 (strongly disagree to strongly agree).

The wave 3 survey contributions with regard to gender differences and similarities on the trading floor are summarised in table 42. The means of the survey statements are reported in parentheses. Note that in some cases the results show disagreement with the survey statement (when M<3).

Table 42. Wave 3 survey, gender similarities and differences among financial traders

Survey results-wave 3		New evidence/ existing in the literature
Gender similarities	**Gender differences**	
I show my ego on the trading floor (M=2.48**)		Contribution
I am thinking of leaving the trading floor (M=2.16**)		Contribution
I am a risk lover/ competitive when trading (M=3.81**)		Contribution
	I am careful and analytical when trading (M=4.12**) [based on the Mann-Whitney U test]	LSH: differences in risk aversion, moral ethics and leadership
	Women are underrepresented in better-paid positions (M=3.67**) [based on the Mann-Whitney U and the t-tests]	Empirical evidence on the "pyramid model"- low female participation in senior positions

**Significantly different from test value 3 at 0.01 level based on a one-sample t-test (2-tailed)

6.7 Conclusions of the survey

The wave 3 survey analysis provides empirical evidence aligned with the Lehman Sisters Hypothesis. No significant gender differences were reported in terms of trading behaviour, competition and risk aversion. It was reported though that female traders are more careful and analytical with the risk they undertake into their portfolios. In addition, as it was explained in the wave 1 interviews that female traders' risk precautions do not necessarily lead to fewer trade deals. According to the Lehman Sisters Hypothesis (Van Staveren, 2014) due to gender differences in risk aversion and response to uncertainty, in ethics, moral attitudes and leadership, higher female participation in financial decision-making would lead to a more sustainable financial environment. We conclude that a

trading characteristic such as spending more time to analyse and evaluate the risks would be beneficial under the scope of financial stability. As long as this characteristic is more common for female traders, we conclude that higher female participation on the trading floor, as well as in more senior positions, would have a positive impact on financial stability. This behavioural difference though is based on the Mann-Whitney U test results only and the survey sample is not representative, therefore further research is needed.

The wave 3 survey analysis does not only focus on risk-related gender differences but also investigates gender similarities on the trading floor. These similarities were revealed by the descriptive models methodology, which allowed the interviewees to express their opinions without the researchers' interference or influence. These beliefs were later analysed by quantitative methods that showed whether they were gender stereotypes or not. We found that two gender stereotypes were not supported by the survey analysis. Men did not report that they show more ego than women in trading and women did not report that they are planning to leave the trading floor due to family responsibilities more often than men. Overall, we conclude that the use of the descriptive models methodology could contribute further in the feminist studies by exploring whether gender stereotypes reflect different behaviours among women and men or if they are socially constructed and accepted by individuals. This can be tested when the survey statements are expressed in the first person initially and later tested for gender differences, which is also the analysis we followed in this chapter.

7. Conclusions and policy recommendations

7.1 Financial traders' decision-making under uncertainty: Conclusions

The rational agent model, the foundations of the mainstream economics, presents the individuals' decision-making as a mathematically developed approach of ranking preferences. Particularly, individuals' decision-making is described as a utility maximisation process, where the future is predictable and fundamental uncertainty plays no role (Von Neumann and Morgenstern, 1944). With regard to decision-making in finance, the established financial theory develops further the rational agent model and interprets the market instability as short-term deviations from the long-term equilibrium, driven by external and unexpected economic shocks (Markowitz, 1952; Ross, 1976). As a result, these equilibrium-focused frameworks fail to incorporate the impact of individuals' emotional changes due to uncertainty on their decision-making processes, such as surprise and fear.

On the other hand, according to the Keynesian theory, future economic events cannot be accurately forecasted by quantitative models due to the presence of fundamental and unmeasurable uncertainty (Keynes, 1936). Therefore, individuals continuously adjust their decision-making process to potential surprises and unexpected events, and as a result their behaviour cannot be predicted by quantitative methods. Given that probabilistic measurements in decision-making are rejected in Keynesian theory (Shackle, 1972), we need to allow insights from other social sciences, such as from psychology and decision-making studies, in order to gain a better understanding of how people think and react. Despite the fact that fundamental uncertainty plays a central role in the Keynesian and the Post-Keynesian economics, the contemporary literature lacks a definitive framework and a consensus about individuals' decision-making in an uncertain environment. This gap is covered by this research, by investigating financial traders' decision-making under uncertainty on the trading floor.

To answer this question we adopted the descriptive model approach from the psychological and decision-making studies, because it enables us to analyse individuals' behaviour as it takes place, and to understand how and why traders normally think in the ways they do, without making presumptions about their intellectual functioning (Baron,

2007; Morgan et al., 2002). Specifically, we reached thirteen UK-based financial traders whom we interviewed on the phone, in order to identify their opinion on decision-making under uncertainty, expressed in their own terms (wave 1 interviews). A year later we released an online survey (wave 3), answered by 210 participants, which was designed based on the responses derived from the wave 1 interviews, in order to ensure that it covered all the relevant topics of concern. Based on our qualitative and quantitative findings, we formed a descriptive model of financial traders' behaviour on the trading floor under uncertainty.

The wave 1 interview findings suggested that there is no evidence of full rationality in financial markets, as defined in mainstream economics. On the contrary, a variety of decision-making processes under uncertainty were revealed. Additionally, the wave 1 interview findings showed that fundamental uncertainty exists in financial markets and financial traders are aware of its impact on their decision-making. The relationship between traders' interpretation of uncertainty and its impact on their behaviour was analysed further, after the collection of the wave 3 survey data.

This research has developed and progressed the existing knowledge by defining the relationship between traders' interpretation of unmeasurable, fundamental uncertainty and their decision-making process. Specifically, the analysis of the wave 3 survey findings showed that financial traders interpret unmeasurable uncertainty in two different ways, which have different impacts on their behaviour. Particularly, financial traders may interpret uncertainty at macro-level (market-level) which is beyond their control, and as a result they choose to follow the market sentiments, because they lose confidence over their own judgment. They may also interpret uncertainty at micro-level (individual-level) to which they react by staying calm, by understanding the causes of uncertainty and by searching for further information.

The market-level (macro-level) interpretation of uncertainty is an example of the beauty contest paradigm (Keynes, 1936) in terms of decision-making. This research contributes to the Keynesian theory of decision-making under uncertainty by showing that when financial traders lose confidence over their own estimates due to fundamental uncertainty at macro level (market-level), they choose to follow the market's perception over future gains and losses. They follow the market's sentiments either by following other traders'

decisions and the market's animal spirits or/and by incorporating in their decision-making the expectations of the average opinion, as the beauty contest paradigm suggests (Keynes, 1936, ch.13). On the other hand, the individual-level (micro-level) interpretation of uncertainty focuses on individuals' difficulty to predict the future market states and to react accordingly. When financial traders interpret uncertainty as an obstacle to their own decision-making, and not as a macro-phenomenon that everyone faces on the trading floor, they seek for as much rationality as the situation allows (O'Donnell, 2015), by researching further about its sources. Lastly, despite the evidence that under uncertainty financial traders may become more risk averse, the absence of a definition that links uncertainty to risk aversion shows that further research is needed.

7.2 Financial traders' decision-making after the announcement of Brexit: Conclusions

While the "new" behavioural economics and the "new" behavioural finance do not depart from the equilibrium-focused models of the established literature, Post-Keynesian economists suggest that the "old", or non-mainstream, behavioural economics could potentially benefit from the pluralism and realism of the Keynesian and Post-Keynesian literatures (Davidson, 2011; Jefferson and King, 2010). The "new" behavioural economics examines why individuals' behaviour deviates from the rational expectations model and builds on the established view of the rational and representative agent models (Kahneman and Tversky, 1979; Camerer and Weber, 1992). On the other hand, the "old" behavioural economics builds on Herbert Simons' bounded rationality theory (1955; 1956), which challenges the rational expectations model, as well as on other theories that diverge from the equilibrium-focused analysis of the mainstream economics (Dow, 2008). Therefore, the "old" behavioural economics is the recommended area for pluralistic research with Post-Keynesian economics, because of their fundamental similarities. While Post-Keynesian economics underlines the importance of fundamental uncertainty in decision-making, "old" behavioural economics emphasises individuals' cognitive limitations in the same process.

An influential theory in the "old" behavioural economic literature is the Disaster Myopia Hypothesis by Guttentag and Herring (1986), which distinguishes measurable risk from unmeasurable uncertainty -similarly to the Keynesian and Post-Keynesian theories- and

explores their impact on individuals' decision-making. Particularly, Disaster Myopia is defined as the systematic tendency to underestimate shock probabilities, which increases as time passes since the last economic shock took place, and it occurs when investors are overconfident about their trading abilities. Given that during the wave 1 interviews none of the interviewees referred to the Brexit vote as a case of uncertainty and they did not consider it as a potential outcome of the referendum, the Brexit vote is identified as a case of an unforeseen and uncertain event. The investigation of traders' decision-making before and after the Brexit vote was a follow-up, analysis chapter and a focused example of financial decision-making under fundamental uncertainty, which allowed us to investigate the changes in financial traders' interpretation of uncertainty and in their decision-making over time; a few months before the Brexit vote (wave 1 interviews), soon after the EU referendum (wave 2 interviews), and a year later (wave 3 survey).

In wave 2, open-ended, phone interviews we repeated the same interview questions with the same interviewees (as in wave 1), without asking them initially about the Brexit referendum directly. That was purposeful in order to avoid confirmation bias and to test our hypothesis, whether the Brexit vote was an unforeseen event they had overlooked a few months earlier. Following the descriptive models methodology, we ran an online survey answered by 210 participants, which was designed based on the responses derived from the wave 2 interviews, in order to ensure that it covered all the relevant topics of concern about Brexit (wave 3 survey). Based on our qualitative and quantitative findings, we formed a descriptive model of financial traders' behaviour on the trading floor before and after the announcement of the Brexit vote.

This research has developed and progressed the existing knowledge by investigating the existence of Disaster Myopia on the trading floor (Guttentag and Herring, 1986), as well as by exploring the role of short-term expectations in decision-making, as defined in the Keynesian theory (Keynes, 1936). The first contribution to the contemporary literature of the Disaster Myopia Hypothesis is the investigation of whether the referendum outcome was interpreted by financial traders' as an uncertain event, and how financial traders' perception of uncertainty and their decision-making under uncertainty changed over time. During the wave 2 interviews, the interviewees consistently reported that they avoided undertaking risk on their portfolios before and after the Brexit vote. Indeed a few

were advised to avoid risk-taking by the financial institutions they were working for wave 2 interviews). On the other hand, the wave 3 survey participants stated their disagreement with all the risk aversion statements, with regard to their post-referendum decision-making. We may conclude that financial traders' opinion about uncertainty and risk aversion related to the Brexit referendum changed over time due to the time distance between the vote and the release of the survey, as suggested by the Disaster Myopia Hypothesis (Guttentag and Herring, 1986).

The second contribution of the follow-up, post-referendum analysis chapter is the investigation of the role of short-term and long-term expectations in financial traders' decision-making. Based on the wave 2 interview findings, we defined financial traders' short-term expectations as the Pound devaluation and the long-term ones as the belief that the market will equilibrate to the pre-Brexit levels. While the Efficient Market Hypothesis (Fama, 1969) suggests that the short-term expectations lead to short-term disturbance from the price equilibrium with an insignificant impact in the long-run; on the contrary, Keynesian theory suggests that short-term expectations drive individuals' investment movements and they have a significant impact on their decision-making (Keynes, 1936). The quantitative analysis of the wave 3 survey results showed that when financial traders reacted to the announcement of Brexit they incorporated into their decision-making only their negative short-term expectations, in alignment with the Keynesian theory of short-term expectations.

7.3 Gender differences and similarities among financial traders: Conclusions

Under the scope of financial stability and despite the fact that the rational agent model is gender-blind, gender may play an important role in decision-making in finance. There is supporting evidence that financial performance may be benefitted by greater gender diversity in financial governance (Francoeur et al., 2008; Campbell and Minguez-Vera, 2008). Also, the "new" behavioural economics explores the role of gender in financial decision-making by focusing on differences in preferences, women's greater risk aversion and lastly, on differences in financial strategies (Powel and Ansic, 1997). The scope of these studies though is financial performance, rather than gender equality.

On the other hand, feminist economics criticises gender inequality and the low female participation on the trading floor. One of the most influential theories, the Lehman Sisters' Hypothesis by Van Staveren (2014) suggests that due to gender differences in risk aversion and response to uncertainty, in ethics and moral attitudes, as well as in leadership, higher female participation in financial decision-making would lead to a more sustainable financial environment. Little attention is paid though on gender similarities in financial decision-making under uncertainty and the gender norms on the trading floor that lead to low female participation (Nelson, 2014; 2018). This gap in the literature is covered by this thesis as we investigated both gender differences and similarities among financial traders.

Initially we conducted open-ended, phone interviews (wave 1), which revealed financial traders' opinion on gender differences and similarities in finance. Then we released a follow-up survey (wave 3 survey), which was designed based on the responses derived from the wave 1 interviews and it tested the interviewees' beliefs on the relevant topics (Morgan et al., 2002). Based on our qualitative and quantitative findings, we formed a descriptive model of financial traders' gender differences and similarities.

This research has developed and progressed the existing knowledge by investigating both gender differences and similarities, as well as by challenging gender stereotypes that exist about men's and women's performance on the trading floor. The gender similarities and differences were revealed during the wave 1 interviews, and they were analysed further after the wave 3 survey release, by quantitative methods that showed if they were stereotypical beliefs or not.

During the wave 1 interviews, the participants suggested that male traders tend to be more competitive, risk lovers and they show more ego on the floor compared to their female colleagues. Our quantitative analysis showed that these beliefs were stereotypical. Particularly, the male and the female survey participants agreed equally that they are competitive on the trading floor and they both tend to be risk lovers. Also, male and female traders equally disagreed that they may show their ego on the trading floor. Another stereotypical belief that emerged in the wave 1 interviews was that women tend to leave the trading floor earlier than men to start a family. The quantitative analysis though showed that men and women equally disagreed about leaving the trading floor due to family responsibilities. Overall, the application of the descriptive models

methodology revealed more similarities than what was initially suggested by the wave 1 interviewees and the contemporary literature.

With regard to gender differences, we found that female traders were more aware of gender inequality in finance and their low representation in better-paid positions. Moreover, women reported that they are more careful about the risk they undertake on their portfolios and that they are more analytical in their decision-making process than the male participants, in alignment with the Lehman Sisters' Hypothesis (Van Staveren, 2014). A trading characteristic such as spending more time to analyse and evaluate the risks would be beneficial under the scope of financial stability. As long as this characteristic is more prominent among female traders, we conclude that higher female participation on the trading floor, and particularly in senior positions, would have a positive impact on financial stability.

7.4 Policy recommendations

7.4.1 Financial regulation and uncertainty

Central banks and financial regulators should be aware of the impact of uncertainty on financial professionals' decision-making, which should be incorporated in policy-making. During periods of fundamental uncertainty, financial traders lose confidence over their own judgments and they tend to follow the market movements, driven by animal spirits and other agents' decisions. This may lead to systematic mistakes and therefore, regulators should provide a framework of how they are willing to anticipate financial instability. Particularly they should focus on the short-term impact of these changes, as it is the financial traders' short-term expectations that influence their decision-making.

A changing financial regulatory framework is identified as a source of uncertainty, because its future impact on the existing trades cannot be foreseen. Changes in financial regulation have an impact on liquidity preference as well, because agents tend to delay important investment movements until they are aware of the new rules. This forces financial traders to move from long-term to short-term investments, in order to remain flexible towards the changing regulatory framework. This finding suggests that Bank of England should signal or provide a framework of the ways the post-Brexit financial regulations will adjust to the British law, and discuss with the main market participants the extent and the impact

of these changes. Particularly, the post-Brexit loss of passporting rights by British financial institutions is the main concern of market professionals. That would lead to the loss of job positions in the City, due to the fact that the major banking firms will move their headquarters to the EU based financial centres.

Asymmetric regulation among the different functions of financial markets was also identified as a source of uncertainty, due to the probability of a domino effect, starting from a crisis in a less regulated financial area. Especially during periods of economic growth and as confidence rises in financial markets, banks adopt a riskier investment behaviour, which leads to speculative finance and in the long-run to financial instability (Minsky, 1992). Hence, the less regulated financial areas become more attractive over periods of economic expansion due to the lower standards of supervision. Financial regulators should be aware of the impact of the Disaster Myopia, which turns individual financial traders and financial institutions into riskier and overconfident agents, driven by their unrealistic optimism. To conclude, this research suggests that there is a need for further and more symmetric regulation in the financial areas that are suspected for a potential crisis, due to undertaking higher risks over periods of economic expansion.

7.4.2 Policy recommendations and gender biases

Over the last years, banking institutions have adopted employment programmes, targeting highly educated women in the UK (Interviews wave 1; Santander Women in Finance programme, 2019; E2W Women in Financial Services programme, 2019). Even though the participation of junior, female professionals have improved in the banking sector, the top decision-making positions remain mostly occupied by men. Specifically, the trading floor remains the financial area with the lowest percentages of senior female employees. Whilst, research and sales departments within banks have a better representation of women employees, the trading floor remains the least attractive working environment for female professionals. The first policy recommendation focuses on providing equal career opportunities for male and female market professionals across all workstreams within financial institutions. Banking management should provide a sustainable and secure workplace for female professionals and adopt policies that would encourage women to pursue a trading career.

During the wave 1 interviews, it was suggested that female traders in their early thirties often undertake maternity leave for at least a year, which may prevent them from future promotions. The UK paid maternity leave might last up to six months, while the paid paternity leave is limited down to two weeks (Gov.uk, 2019), which forces women to undertake the role of the main house and family carer, with a disproportionately negative impact on their professional careers. As a result, female traders in their thirties often choose to move into sales departments, which offer better working conditions. The second policy recommendation, regarding the role of gender in finance, suggests a better balanced parental leave scheme in the UK, which would encourage male professionals to undertake paternity leave.

7.5 Limitations and future research

Based on the survey data analysis there was no significant relationship between the two definitions of financial uncertainty, as described by market professionals, and their attitude towards risk. One reason might be that none of the definitions of uncertainty incorporated the notion of risk, hence no impact was found on traders' risk aversion levels. We suggest that there is a need for further research on the relationship between fundamental uncertainty and risk aversion. There is also a need for further research on the role of gender in other financial areas, such as sales, research and legal departments. Lastly, a comparative analysis with control groups from different financial divisions could potentially highlight the social norms around gender within the banking institutions.

One limitation of this research is the non-representative sample of the survey participants. Nevertheless, our survey sample provides useful contributions to the contemporary literature. The international background of participants allows us to test for differences among traders of UK and non-UK financial markets. It does not take into account though the cultural differences and the differences in labour legislations across countries, especially when we examine the role of gender in finance, e.g. the parental schemes. To overcome this, a case study across a number of financial institutions within the same country is suggested for future research, because it could provide more focused results.

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Appendix A: Factor analysis

The varimax and oblimin rotations in factor analysis suggest that the statements “There is uncertainty when you do not know how to react” and “There is uncertainty when you cannot predict the market movement” share a similar pattern in their responses, which is interpreted as “There is uncertainty when you cannot predict and react accordingly”. The statements “Uncertainty cannot be avoided” and “Complex financial innovation may cause uncertainty” are also grouped together, and they are summarised by the new variable “There is always uncertainty in the system and cannot be avoided”. The varimax rotation in factor analysis categorises all the sources of uncertainty into one new variable.

The varimax and oblimin rotations in factor analysis suggest that traders’ reactions to uncertainty fall into three categories. The first category includes the statements “Under uncertainty I search for more information” and “Under uncertainty I try to identify what causes it”, in which both cases traders are seeking for more information about the root of uncertainty. Therefore, this category is interpreted as “Under uncertainty I try to understand its causes”. The second group includes the variables “Under uncertainty I might exit the market”, “Under uncertainty I set targets for losses and profits” and “Under uncertainty I simplify my trades”. All three of them show a more careful approach towards portfolio risk, hence, they are summarised under the title “Under uncertainty I become more risk averse”. The last category includes the statements “Under uncertainty I take into consideration other traders' decisions” and “Under uncertainty I rely on financial modelling”, which reflect traders’ loss of confidence in their own judgment. This category is titled “Under uncertainty I follow others’ decision making”.

The varimax rotation in factor analysis categorises the sources of uncertainty with regard to Brexit into one group. All statements show that Brexit remains an event of uncertainty, and the summary variable is titled “Brexit still creates financial uncertainty”.

The varimax rotation in factor analysis categorises the traders’ reaction to uncertainty into one group. All statements reflect traders’ risk avoidance both before and after the EU referendum. Therefore, a summary variable is created under the title “After and before Brexit I minimised my risk”.

The varimax and oblimin rotations in factor analysis suggest that traders’ beliefs about the future impact are categorised into two groups. The first group consists of the following statements; “Brexit will lead to further Sterling Pound devaluation”, “The market became

more sensitive to uncertainty after the EU referendum", and "After Brexit, UK companies might lose their EU passporting rights". While the second group is consisted of "After Brexit, EU financial regulation has to be adjusted by the British regulator" and "In the long-run financial markets will equilibrate at the pre-Brexit levels". The first category reflects traders' beliefs about the future impact of Brexit in the short-term and it is titled "In the short-term there will be a negative impact on the British economy", while the second category shows their opinion about the long-term impact, and its title is "In the long-term the market will equilibrate".

The varimax rotation in factor analysis suggests that the reasons for low female participation on the trading floor should be categorised into two groups. The first group only includes the statement "There are not as many female traders, because not enough women study mathematics and/or engineering". The second group includes the following statements; "Women are underrepresented on the trading floor, as in most white-collar professions", "Most women on the trading floor hold administrative positions", and "There is low female representation at senior trading positions". The second group captures the social and institutional explanations of female low representation and it is titled "Women are underrepresented in better-paid positions".

The varimax and oblimin rotations in factor analysis suggest that there are five categories of traders' behavioural characteristics. The first category, which shows traders' human management and analytical thinking skills, is titled "I am careful and analytical when trading", and it consists of the following statements; "I have good problem-solving skills", "I am careful in terms of financial risk", and "I have good communication skills". The second category includes more aggressive characteristics regarding trading, and its title is "I might show my ego on the trading floor". This category includes "I might be loud about my success" and "I might show my ego on the trading floor". The third category of behavioural patterns reflects the participants' unwillingness to work on the trading floor in the long-term, and it includes the statements "I find the trading floor intimidating" and "I plan to leave the trading floor due to family responsibilities". This category is labelled as "I am thinking of leaving the trading floor". The fourth category includes statements that show competitive and risk-loving skills when trading, such as "I am competitive regarding trading", "I focus more on long-term views", and "I am fast in making decisions".

This category is titled “I am more of a risk lover and competitive when trading”. And the last category only includes the variable “Gender does not play a role in the job of trader”.

Appendix B: Wave 1 and 2 interview representative quotes

Financial traders’ interpretations of uncertainty wave 1 interviews, and quotes

Beliefs-opinions	**Number of participants**
Uncertainty is the unknown, when you do not know how to react and cannot predict the market movement	6 participants
“The unknown, when you do not know what is coming, when you do not have information what is causing the movement, and what is coming next, and hence that creates uncertainty.” (Female trader with more than ten years of experience) “From a financial markets’ perspective it is a great time of uncertainty. We are coming every day and we have a traders’ meeting, and you got all of the arguments why the market could go higher or lower on this particular day. But to be honest, you have absolutely no idea what is going to happen and you are under the pressure to make money.” (Male trader with more than ten years of experience) “Nothing is certain on the markets, so based on this if you look now to zero, you do not know what the market is going to be on plus ones, in one minute or second. That is constant uncertainty that you have to manage”. (Female trader with more than ten years of experience) “Uncertainty would be a situation where all that is possible to happen may happen. Of course, there are several degrees, it is not like black and white. It would be clear that the higher the impact of an event, the higher the uncertainty would be about it.” (Male trader with less than five years of experience)	
There is always uncertainty in financial markets	6 participants
“Uncertainty is what is driving the market. It is the basis of the financial markets, you cannot go around it. As a trader, it is your daily job to	

address and adapt to uncertainty, or the environment, to adjust your behaviour." (Female trader with more than ten years of experience) "I would say there is always uncertainty on the trading floor. I do not talk about the efficient market hypothesis, because the market is not always efficient." (Male trader with more than fifteen years of experience)	
Complex financial innovation can cause uncertainty	6 participants
"I think the danger (of financial innovation) starts when there is too much of it, it is not clearly understood, the structures are not transparent, people rely on ratings rather than a true, clear understanding of the risk. It is used as getting risk off the balance-sheet, which should still be on it." (Female trader with more than ten years of experience) "You do not necessarily have the whole picture of risk in a financial product (security). It involves mathematics and models, sometimes it is like a black box that you do not really control." (Female trader with more than ten years of experience)	
Uncertainty rises when news is released	3 participants
"Uncertainty is when you are waiting for some data to be released. There is an impact on how the market moves every time the data is released and the period after, this is uncertainty. Every time some negative news came out, even if nothing happened, just the headline would cause a huge market reaction." (Female trader with more than five years of experience)	
Uncertainty is the absence of liquidity in the market	2 participants
"On a macro level, when we entered into the financial crisis, the first thing that happened was that the market was completely dried up with liquidity, there was no depth. The response was not exactly fear, but it was tremendous uncertainty." (Female trader with more than ten years of experience)	

Sources of financial uncertainty, wave 1 interviews and quotes

Beliefs-opinions	**Number of participants**
Non-systematic factors, i.e. natural disasters, political decisions, terrorist attacks, big accidents	6 participants
"The Japanese earthquake which happened a few years ago. The guys trading the US dollar/Yen in London were doing shifts so someone could be there 24 hours. Even if you had the most properly hedged position ever, these events make every book bleed money." (Female trader with more than five years of experience) "An unknown risk in 2001 was 9/11. Every risk is known, if you make a list long enough, you will eventually put on the terrorist attack. At that point it was an unknown risk, there was no one back then thinking it was going to happen." (Male trader with more than ten years of experience)	
Macroeconomic phenomena-fundamentals	5 participants
"This January while all the European fundamentals were really good, but not amazing, you had uncertainty everywhere else, in the US (the oil exposure), in China (floating down the economy), in Syria (the refugee crisis), and I think uncertainty affected the European markets." (Male trader with less than five years of experience) "You look in the economy, i.e. in Australia the interest rate is too high, it is a bit of a bubble, while interest rates in the world are really low and they are going to fall at some point. In that situation, you want to trade long bonds and that would be a fundamental view put into a trade. You are working on economic factors." (Female trader with more than five years of experience)	
Change in market expectations about future events	4 participants

"It is not that people necessarily do not like investing in a stock, a sector, a country, or a market. But they might believe that interest rates are very low. They may decide to buy a stock which has a big dividend. Or they might decide to not invest to the stock market at all. They might decide the best place to make some return is commercial property. They might think that in the stock market the earnings or earnings' expectations are too high, so they might pull their money out and put it in a safer haven." (Male trader with more than twenty years of experience)	
Continuous news release	4 participants
"When the headline first hits the market, you see it on your newsfeed, there is an element of uncertainty because you are not always sure how to read them. For example, in China at the moment they are devaluing the currency. You might not be an expert in Chinese effects or their policies." (Female trader with more than ten years of experience)	
Rogue trading	4 participants
"The rogue trader came from the back office, he knew how to go around operation. So probably they -the bank- stopped the pathway from people moving from operations into the front office room role. It was seen as too risky." (Male trader with more than fifteen years of experience) "A couple of headlines, four years ago, about a guy in UBS who basically was booking, he was trading using firm's money and hiding the trades. Because he knew how all the technology worked and he built a loss about two billion dollars, which is a lot of money. Uncertainty can be something like an operational risk, by the people who work in the bank" (Female trader with more than ten years of experience)	
Human element and cognitive limitations	3 participants

"At that level of uncertainty, you might misread it, you might buy the mark, you might sell the mark, and you might panic. You are only human at the end of the day, there is a human element." (Female trader with more than ten years of experience)	
Absence of counterparty's good reputation	2 participants
"If you are investing in BNP bank you know they are not going to go bust, because if there was a chance they would go bust, the French government would step in. As opposed to investing in some small private bank, money lending operation, something like internet based, you have much more uncertainty. They are not well developed and you are not sure what they are doing with your cash." (Male trader with more than fifteen years of experience)	
Market volatility	2 participants
Greed and competition	2 participants
Changing financial regulatory scheme	2 participants
"We do not know what regulations will be in the future, that is a big uncertainty for the banks. The fact that regulators might introduce new rules, which will impact all the trades that have been done. If today a transaction is attractive under that framework, if the framework changes and the structure hasn't matured, it might not be attractive anymore." (Female trader with more than ten years of experience)	

Financial traders' decision making under uncertainty wave 1 interviews and quotes

Beliefs-opinions	**Number of participants**
Market expectations should be taken into consideration other agents' trading decisions should be taken into consideration	5 participants
"It is not about what you think, it is about what other people think about the market. You have to take this into account. You have at	

some point to realise what other people do, and start acting accordingly. I think everyone is trying to see what others will do in a certain situation. If you are in a situation that you do not know what is going on, you are very keen to change your views. You would see people changing their views very fast." (Male trader with less than five years of experience)	
Choose to exit the market and close my deals	4 participants
"If we are not sure if it is going to be attractive, we prefer to pass on the trade" (Female trader with more than ten years of experience) "The best position to have is no position. Any trade we had, we closed it straight away. That was after losing a lot of money already." (Female trader with more than five years of experience)	
It depends on the type of trade	4 participants
"You have some traders who are technical based, and you have others who are more reactive. I think it depends if they are short-term or long-term traders. It depends on their goal, what trades they have on." (Female trader with more than ten years of experience) "I think it very much depends on the product you trade, some products are more liquid than others. If you trade something quite liquid, when bonds go up or down, then you can probably afford to be more flexible. If you trade something illiquid you have to go with your long-term view and hope it works." (Female trader with more than five years of experience)	
Rely on financial modelling	4 participants
"Uncertainty is when you do not know what is going to happen. The best estimate if you have done statistics, is to run some models and have lots of simulations. I cannot position my book to an unknown risk, because I do not know what is going to happen, so how could I react to something that I do not know? The best	

thing I can do is to know my risk, run my risk scenario and see how my book is going to behave in scenarios A, B, C" (Female trader with more than ten years of experience)	
It depends on the traders' personality	4 participants
"Different traders have different levels of risk tolerance." (Female trader with more than five years of experience) "It is on individual's base, you cannot say in general it would be like this or that. It is personality driven" (Female trader with more than ten years of experience)	
Try to remain calm and rational, search for more information	3 participants
"The best way to respond is to remain calm. Do not react suddenly before having extra information, because you cannot make the right judgments. The best thing to do is to try research what is going on, but not react without knowing the full information." (Female trader with more than ten years of experience)	
Hedge more	3 participants
"The wise thing you would do is to adjust what you have done, or hedge yourself, or you could hedge before." (Female trader with more than ten years of experience)	
Staying passive, waiting for more information Try to identify the reasons of the uncertainty	2 participants
"It is very important that you understand all the factors, all the reason you can think of, and other people can think of." (Male trader with more than ten years of experience)	
Follow the company's strategies	2 participants
"There is a collective action that takes place. There are big teams working around you. Obviously, there are processes in place, which make sure beforehand that if something bad happens on the trading floor you know how to react. You need to be careful and focused at that time, and there will be some kind of collective	

decisions when this takes place." (Male trader with more than five years of experience)	
Set upper and lower limits of losses and profits, respectively	2 participants
"I would plan a trade and have certain targets or limits in place; where I would have profit, where I would step out of the trade." (Female trader with more than five years of experience)	
Simplify trades' maturity and structure-liquidity preference	2 participants
"It is shortening the maturity, simplifying the structure. The flexibility to change one parameter in the future, with the counterparty's consent, without having to rid of everything. Another reaction is that all trades used to be long-term in Europe. Now people try to restrict maturity and do shorter transactions" (Female trader with more than ten years of experience)	
Search for another professionals' advice	1 participant
Recall similar experiences from the past	1 participant

Regulator's decision-making under uncertainty

Beliefs-opinions	**Number of participants**
Using past experiences in order to shape new regulations	6 participants
At a first-time-to-happen event regulators' reaction might be delayed	6 participants
"For example, in the crisis of 2008 regulators were aware that banks were not keeping enough capital on their balance sheets and they were using financial innovation for speculative purposes, i.e. securitisation. That means that regulators did not experience anything similar before. The regulators by 2010-12 were trying to re-regulate the banking sector, in order to avoid similar crisis in the future." (Male trader with more than five years of experience)	
They should be more proactive	6 participants

"They are normally coming after the event, after the crisis occurs, and they overregulate. In reality the regulator should be already there and have a process already in place, it is clear how to respond to these things. As I said, regulators are very reactive, rather than proactive." (Female trader with more than ten years of experience)	
Asymmetric regulation is a source of uncertainty	4 participants
"Banks are now regulated, but real money clients, asset managers, pension funds are not regulated. The interest should be aligned across the different sectors, from a regulation's point of view. Banks are worried about another financial crisis triggered in another sector, for example in the pension market or the insurance market." (Female trader with more than ten years of experience) "Regulation here (the UK) is different than the regulation in the US. So first you need one regulator." (Female trader with more than ten years of experience)	
They tend to have long-term views	3 participants
"The regulators are more of a long-term. They would react to something that is a large event, for a long period of time, if it can be prevented. What regulators are doing now is the result of what they have seen over the last decade. The regulators are not proactive, they are reactive. They look to large events, such as the 2008 and they think what could have prevented it." (Female trader with more than ten years of experience)	
Regulation should remain in place to protect the ones who do not benefit from financial profits	3 participants
"The regulators force a set of rules to protect the taxpayer, the household which has a bank account for instance, and people who are not into financial market. Ultimately when you have a crisis, who will pay the bill? We have seen, in the past, people queuing	

in the bank to take their savings because it was not safe. You do not want those people to pay for the ones who are doing wrong things. I think regulation is needed and regulators are doing the right job in the right direction." (Female trader with more than ten years of experience)	

Regulation and uncertainty

Beliefs-opinions	**Number of participants**
Shadow banking is linked with higher levels of uncertainty	6 participants
"I think uncertainty plays a role in every part and space of finance, and shadow banking is speculative finance. If anything, it plays more of a role." (Male trader with more than ten years of experience) "Yes, there is uncertainty, especially in shadow banking sector because they can do a lot more without regulators' supervision." (Female trader with more than ten years of experience) There is a relationship between uncertainty and the absence of regulation. 5 participants "Too much deregulation takes away the limits, takes away the upper and the lower level in the distribution. If I know that the maximum risk a bank can take is three times its balance sheet, it is a lot but at least it is a limit. When the banking regulator relaxes this limit, or takes this away and leaves it to the market, then when we have an uncertain event, the market will read it as a potential catastrophe for every single participant. Which is what happened with Lehman Brothers back in 2007-2008." (Male trader with less than five years of experience) "The less regulation, the more place for speculative behaviour, and speculative behaviour without control. And the more we see that, it follows greater levels of subsequent volatility and	

subsequent market disruption. So, if it is going to be greater disruption and volatility, it clearly means more uncertainty." (Male trader with more than ten years of experience)	
There is no relationship between uncertainty and the absence of regulation	3 participants
"No matter what regulation, markets will find a way to become volatile or uncertain in a situation. I do not think we should rely on regulation to solve this. It is something we should accept that markets will be doing." (Male trader with less than five years of experience)	

Interpretations of uncertainty with regard to Brexit

Beliefs-opinions	**Number of participants**
Brexit was not expected to happen	8 participants
"The general consensus was that the result would had been no to Brexit. But despite this consensus, there was a negative decision unfortunately, and because of this bad day the stock market basically collapsed." (Male trader with more than five years of experience) "A good example recently would have been the Brexit. Obviously, the outcome was highly uncertain because the polls were quite close. Even the market was expecting that the vote would go for remain, and it was pricing accordingly." (Male trader with more than fifteen years of experience)	
The market did not forecast correctly the outcome of the elections	4 participants
"It was and it continues to be uncertain. It was uncertain beforehand as well. It was so uncertain, that the markets were incorrectly reading of the polls. Which is why you had substantial movements. The day before, the pound-dollar was 1.48 I think, and then dropped to 1.32, it was one of the biggest one-day	

moves. It was the uncertainty, the very surprising outcome that was driving volatility." (Male trader with more than ten years of experience)	
Brexit is still uncertain because of the future agreement between the UK and the EU	3 participants
"Brexit actually happened, but it hasn't really happened yet, because we do not know if it is a hard or a soft Brexit. If it is a hard Brexit it is going probably to take more than five years, five to ten years before the financial industry settles down. It is one thing the immediate reaction, that the pound lost value. But long-term, when is the sector going to feel comfortable in the UK economy?" (Female trader with more than ten years of experience)	

Sources of uncertainty with regard to Brexit

Beliefs-opinions	**Number of participants**
Lack of information about the future Absence of a framework with regard to the future agreement between the UK and the EU	5 participants
"The lack of knowledge basically, when they are going actually to execute. It was not known at that time, it is believed now it is going to be early 2017, and again there is no specific date, if and when it is going to be triggered. Following that, there will be more uncertainty about what kind of trade agreements there will be, what is going to happen to migrants etc. "(Female trader with more than ten years of experience) "Brexit is uncertain because it is unclear what it means to be out of Europe, in terms of trade, in which ways we interact with Europe, where the currency is going to be, it is unclear. We are moving to unknown. I think there would be less uncertainty if there was a framework. There is even uncertainty whether the	

article 50 will be triggered." (Male trader with more than ten years of experience)	
Expectations about future economic events	2 participants
"I think the reason why the pound depreciated straight away to 1.3 was because there was uncertainty whether it would weaken further." (Female trader with more than ten years of experience)	
A possible domino effect of negative economic and political phenomena after leaving the EU	1 participant
"There is also a long-term impact, and once one impact happens it will trigger another situation, and you cannot really foresee that. You can try to do your guesses, like if this happens that also happens, but you cannot know beforehand. That makes the situation uncertain, a chain effect of events." (Female trader with more than ten years of experience)	
There is no previous experience of an EU-member country exiting the union	1 participant
"There is very limited amount of data, of a historic vote as well. It was the first vote for a country to leave the EU." (Male trader with more than fifteen years of experience)	

Financial traders' decision-making after the Brexit referendum

Beliefs-opinions	**Number of participants**
After the Brexit vote, financial traders remained passive, not knowing what to do, and trying not to make mistakes	5 participants
"The immediate reaction was probably more of a shock. Everyone was paralysed. So my response was probably quite passive. More about observing on what others were saying, what the different reports were suggesting." (Female trader with more than ten years of experience)	

"When there are as many unknowns as Brexit, the immediate reaction of risk managers and regulators is to say 'do nothing effectively'." (Male trader with more than ten years of experience)	
After the Brexit vote, financial traders shortened the maturity, simplified their trades and avoided risk-taking	4 participants
"It made me less certain about taking risky financial positions. I was very cautious afterwards, about making long-term decisions, when there is no clarity. I believe people had little risk on, and they knew that there would be high volatility." (Male trader with more than ten years of experience) "About two-three weeks beforehand, people were encouraged to hold no positions. That reflected the uncertainty about which way the vote was going to go. When you have no position, you do not have exposure." (Male trader with more than twenty years of experience)	
After the Brexit vote, financial traders did not keep any position, and exited the market	3 participants
"Holding no positions. If you look at market volumes going into the vote, they were quite low across most of the market." (Male trader with more than twenty years of experience)	
Before Brexit, financial traders hedged their positions	3 participants
"I was working for a desk which managed mostly pension money, we had adequate hedging strategies, just in case of a harder fall. We protected ourselves by 80% of what we would lose, if we had not put in place the hedging strategies." (Male trader with more than five years of experience)	
It depends on the type of trade	3 participants
"It really depends on your strategy. For some markets did not affect much. For people trading German government bonds or US treasury, Brexit is not going to have that big influence on that. But for other things, currencies, UK equities, European, it had a big	

impact." (Male trader with more than fifteen years of experience) "All market players know this is a major event that gives fear into everybody. They know this has an impact on liquidity, it makes them even more conservative in their choices. They will only trade the most liquid instruments in relatively small size. There is a negative impact on all participants, looking for not necessarily safety, but for liquid instruments." (Male trader with more than ten years of experience)	

Regulators' decision-making after the Brexit vote

Beliefs-opinions	**Number of participants**
Financial regulators intervened actively	4 participants
"Most people do not know that the regulator reacted very early. In our bank, we knew that the Brexit happened on a Friday, and then on Monday everyone was called in the room and was told that they have come together with the whole banking society of London, and they were discussing with the regulators. All the banks in the financial industry were working together with the regulator on what could be done. I would say that the UK regulator was quite proactive on it. They were not very open to the public about what they were working on. They were working with organisations on a confidential basis." (Female trader with more than ten years of experience) "If you mean regulators from the Central Bank aspect, I would say they took a lot of liquidity measures, to make sure that the market was liquid, and there would not be any liquidity problems, because investors were liquidating the assets they were holding." (Male trader with more than five years of experience)	
Not aware of a financial regulators' reaction	2 participants
Financial regulators did not react to Brexit	1 participants

Financial regulators need to adjust the current EU financial regulatory framework, with respect to the British laws	3 participants
"There will have some laws that will need to be translated out of the European law, into the UK law." (Female trader with more than ten years of experience)	
Financial regulators should not react at all to Brexit	3 participants
"I do not know if the regulator should intervene to the market for something which is political. Because this is a political question asked to the British citizens." (Female trader with more than ten years of experience)	
Financial regulation should be reduced after Brexit	2 participants
"My feeling is that regulation in general should be reduced and particularly around events like Brexit. I am not saying anything drastic. There is this concept of making banks have manageable risk exposures, in a reasonable size, which is absolutely fine. But I feel it shouldn't be micromanaged as much as it does." (Male trader with more than ten years of experience)	
Financial regulators should preserve the right of EU passporting for the UK-based financial institutions	1 participant

Brexit's future impact on the British economy and markets

Beliefs-opinions	**Number of participants**
Further Sterling Pound devaluation; short-term effect	6 participants
"In the short term, what we experience right now is the mechanisms readjusting itself to the new reality, and rather to a new possible outcome of the new reality. Which is small contraction of the economy and drop in the demand for pound sterling." (Male trader with less than five years of experience) "I think the next couple of years there will be some uncertainty. Obviously, currency has been hit hard. There was some initial	

volatility, on the actual day and the weeks surrounding, as it was not expected. I think you will see periods of volatility within the next couple of years, when announcements will be made." (Female trader with more than ten years of experience)	
The market became more sensitive to uncertainty	5 participants
"Following up from the Brexit decision, the atmosphere is a lot more paranoid about unknown risks. Suddenly, the European crash tests that we recently had, and a potential referendum in Italy coming up next month, the small coup in Turkey, all of these things are seen as potentially larger than they would be on their own. Brexit has created an atmosphere of sensitivity and fear about the risk undertaken." (Male trader with more than ten years of experience) "The US elections coming up, the interest rate decisions, the global markets are pretty elevated from a risky perspective as well. It is very hard to know what the effect of Brexit is, because many things are interconnected. Let's assume that Trump gets elected, that would be a disaster for the markets, and the markets will go down." (Male trader with more than ten years of experience) "Brexit is a political thing. Politics are the source of uncertainty everywhere. You just get less of them in developed markets. You also have the Turkish coup, you have local fighting in areas of former Soviet countries etc. You are just not used into that in developed markets like the UK to have political shocks, such as Brexit. You can make a similar argument if Trump gets elected, that is a political shock." (Male trader with more than fifteen years of experience)	
The legal framework has to be adjusted by the British regulator UK-based financial institutions might lose their passporting rights	4 participants

"I think the main question for financial institutions is whether they will allow what they call passporting. Lots of US headquarters are based in London so they can trade with EU financial institutions. If passporting is not allowed, because of Brexit, then if these firms have headquarters only in London, then they can only trade London. They will need to have another headquarter somewhere within Europe, to be able to trade with any European financial institutions. If a lot of financial institutions move out of London, in another headquarter European city to be able to continue trading with Europe, lots of people will also move out of London, they will lose a lot of taxes etc." (Female trader with more than ten years of experience) "If London is not part of the EU any more, these passport rights are stripped away. Many companies might have to move to an EU-based country. Where I work, we have offices in Germany or France, because in London you cannot do passporting anymore." (Female trader with more than ten years of experience)	
In the long-run financial markets will equilibrate at the pre-Brexit levels	3 participants
"When the volatility will settle down in the markets, I do not think it is going to make a huge difference as we see now, it will go back to what it looked like before Brexit. (…) Overall I think it will recover, and it will find a new steady state" (Female trader with more than ten years of experience) "Personally, I am optimistic. I do not think Brexit is going to play in the worse possible way. It depends on how well the negotiations go." (Male trader with more than ten years of experience)	
Hard Brexit is identified as a possible future outcome	2 participants
"I think Brexit is going to be quite hard on the UK market and will have a quite long-lasting effect, five to ten years. Also, if it is a hard Brexit, lots of financial institutions will need to find an EU entity to	

be able to operate abroad, they will need to transfer enough people and assets to those cities, and then the UK is going to lose lots of skills. If companies move in Paris, Frankfurt, Dublin or Luxembourg, then London is not going to be as strong financially as it was before." (Female trader with more than ten years of experience)	
Not able to predict	2 participants
"To be honest, I do not know. Whatever the impact of Brexit is on markets, it is going to be hard to disentangle because markets are so interconnected those days. The US elections coming up, the interest rate decisions. Also, we have global markets, pretty elevated from a risky perspective." (Male trader with more than ten years of experience)	

Female representation on the trading floor

Beliefs-opinions	**Number of participants**
It is quite unusual	8 participants
"There are not normally that many women on the trading floor. In my experience, I was always intimidated, it was me in a room with 25 men. Most women I know, certainly are more junior levels." (Female trader with more than five years of experience) "More than the 50% of female traders I would say they are junior. The number of senior female traders is going to be very low, to the point that I cannot think of a female trader directing." (Male trader with more than ten years of experience)	
It is still very low, but it has been improved Most female traders are junior	6 participants
"You do not see as many women as men. But definitely I think you will see more women than you did a few years back." (Male trader with less than five years of experience)	

"I think it has changed a lot. I started ten years ago, and from then until now the number of women has increased, especially in the more junior positions. All the junior programmes are trying to get half of the people to be women. The participation of women on the trading floor is increasing, but it is still lacking at a senior level." (Female trader with more than ten years of experience)	
It is very common	1 participant

Reasons for low female participation on the trading floor

Beliefs-opinions	**Number of participants**
Trading floor is intimidating for women	5 participants
"I was always intimidated, it was me in a room with 25 men. In the morning meeting, I was a little bit scared to open my mouth a lot of the time. And you get shout down a lot by a guy. Most women I know, certainly are more junior levels, tend to keep themselves and head down, trying to do a good job. Once you get more senior, you get more confidence to speak out." (Female trader with more than five years of experience)	
Not enough women study maths and engineering	2 participants
"Trading and structuring are more technical roles, and traditionally they attract people with engineering or mathematical background, which I think statistically have more males in undergraduate studies. This is translated to more men going to the business." (Female trader with more than ten years of experience)	
Trading is a less attractive role to women	2 participants
"I do not know why there is less women on the trading floor than for instance in operation. Maybe the job marketing hasn't been done properly. Trading might not be as appealing as law, or	

accounting or medicine to women." (Female trader with more than ten years of experience)	
Due to behavioural differences between male and female traders	2 participants
With trading, there is the personality aspect. The style of it is a little bit aggressive. It is a little bit ruder day-to-day and it is exclusionary for those that are different. And it is more likely that men will be like that rather than females. (Male trader with more than ten years of experience)	
Due to family-planning women leave the floor earlier than their male colleagues	2 participants
"A man has a wife back at home, he has the responsibility for his family, and he does not have a choice. He has to be the breadwinner. Whereas for a woman, to me my incentive to do that job was never to be the breadwinner (my husband works). I work as hard as men. And when I said I was burning out and getting tired after 10 years of doing it, I was able to walk away from it. Whereas I think when men would like to walk out, because a lot of them would be as much burned as me, but they cannot." (Female trader with more than ten years of experience)	
In most white-collar professions women are underrepresented	1 participant
"Because women are underrepresented everywhere unfortunately. In most white-collar professions, women are underrepresented. And private banking, the world of finance, is no exception. As a matter of fact, I think we have one of the worst representations of women there." (Male trader with less than five years of experience)	

Gender similarities among female and male financial traders

Beliefs-opinions	**Number of participants**

Dominant characteristics, such as aggression, risk-taking, competitive nature and an ambition-driven personality	7 participants
"Traders in the fast markets, tend to be similar in the sense that they are focused people, they think very quickly, they do not mind taking on challenges, they have shorter-term spam, and they are very aggressive and intense. It is the same whether male or female. They can be very firm and dominant people." (Female trader with more than ten years of experience) "The competitive nature, to be a winner, to be right, to be successful. This is certainly for traders, whether male or female." (Male trader with more than twenty years of experience) "The main similarity among men and women in finance is how driven they are, how much they care about succeeding. One thing people in finance have in common is that they are very motivated, competitive, and often quite intelligent people. (…) Ambition driven competitiveness, is definitely a thing they have in common. I think those are the key similarities, strong, competitive, ambitious character." (Male trader with more than ten years of experience)	
Intellectual characteristics, such as logical thinking, analytical and problem-solving skills	5 participants
"In structured trading, again I would not say there are any massive differences, but there are not many females in structured trading. In my experience, they tend to be very logical and analytical, they tend to be cool-head and intellectual, but also they need to be able to evaluate rapidly the risk and the award of a certain situation." (Female trader with more than ten years of experience) "Both have analytical approach to risk and pricing, both have reasonably good interpersonal skills, both have worked hard up to the point where they are. I guess the point is that a junior trader is an analytic, calm but assured risk taker. And a senior trader is	

the above, but it is more aggressive in an interpersonal situation. Both men and women can do the first role, it is just that the proportions are much skewed" (Male trader with more than ten years of experience)	
Gender does not play a role in the job of trader	3 participants
"I do not think there are any major differences or similarities. Everyone was unique and they had their own way of doing things." (Female trader with more than ten years of experience)	
Similar educational background	3 participants
Not aware of any similarities	1 participant

Gender differences among female and male financial traders

Beliefs-opinions	**Number of participants**
Female traders are more thoughtful in terms of financial risk	8 participants
Female traders focus more on long-term views	2 participants
Male traders are changing their opinion more often than their female colleagues	1 participant
Men are faster in making decisions	1 participant
Men are loud about their success	1 participant
"I do believe that women are more conservative. Not necessarily that they take less risk and therefore they make less money or have less profitable trades. I just think they are more careful in the risk they might take. When they take a big risk, they will really consider it. They will do a lot of research, put limits in place. Even if a woman and a man are making ten million in a year, the man would have huge swings in a day. I have never seen a woman that caused huge swings in a P&L." (Female trader with more than five years of experience) "I would say they (female traders) are more of long-term thinking, they would take longer to think about and make a decision.	

Whereas men are better in making quicker decision, whether this is right or wrong, they are just more confident in making quicker decisions." (Female trader with more than ten years of experience) "In my experience, I would say that there are perhaps some male traders that are probably more gung-ho. I would not say aggressive, but I would say a bit more willing on taking a gamble and sort of think about it later. Sort of ego of potentially wining. The female traders I worked with, would be more thoughtful when they were making decisions." (Male trader with more than twenty years of experience) "What I have seen so far is that men can change their views quite fast. What made me an impression, is that all the women traders I've seen stand by their views more firmly than men. I do not know if this is a good or a bad thing but it is there." (Male trader with less than five years of experience)	
Women have better communication/social skills	3 participants
"A strength for a woman is that she normally gets more long-term relationship with the people she works with, she is loyal and there is a long-term thinking." (Female trader with more than ten years of experience) "In my experience women tend to be better in conflict resolution, they are doing better in communication and team spirit." (Male trader with more than ten years of experience)	
There are no significant differences	5 participants
"I do not think there are so many differences when I compare myself to my peers. Everyone has a unique personality. I think each person has his one style of trading, either it is a man or a woman." (Female trader with more than ten years of experience)	
It depends on individuals' personality	5 participants
Men deal better with stress and losses	2 participants

Women deal better with stress and losses	
"A strength for a guy is that they often might finish a difficult day, but tomorrow they come in equally happy and they just deal with it." (Female trader with more than ten years of experience) "By definition a female on the trading floor has managed to crack it. And that means she would have the character to overcome problems, the stress, maybe the pressures of the job, better than men." (Male trader with less than five years of experience)	
Men's ego on the trading floor is a weakness	2 participants
"Ego and aggression, these are definitely the weaknesses (for men). Sometimes they seem insensible because they are stubborn, they want to show reliability, and they do not want to say 'I am wrong'. Generally, weakness can lead to excess greed in finance, and might result in bubbles." (Male trader with more than ten years of experience)	
Due to self-selection bias, female traders are equally aggressive as their male colleagues	1 participant
"Certainly, trade is male-dominated, so women who are trying to do well, to get into trading and try to succeed in it tend to be reasonably aggressive, probably overly aggressive. Because if you are a woman, and everyone else is men in a team of traders you need to prove yourself." (Male trader with more than fifteen years of experience)	
Men find it difficult to report to a female manager	1 participant
Women's emotional awareness is a weakness	1 participant

Gender roles in finance and career path differences

Beliefs-opinions	**Number of participants**
There are no concrete roles among female and male financial professionals	4 participants

"It is a meritocracy generally speaking. No one stays in the job unless they perform well, whether a man or a woman." (Male trader with more than fifteen years of experience)	
There is some level of inequality on the trading floor	8 participants
There is higher female representation in sales departments	6 participants
"In sales, communication skills or coordinating relations are required, and typically those roles would be given to females. Generally, in areas with communication and sales, the idea is that women are more than men." (Male trader with less than five years of experience) "Generally speaking, in sales they hire good looking women. That is the reality. Because they know their clients are predominantly males, who like dealing with women, because selling is a softer skill. Sales is more customer facing. That is why appearance, likeability and all those things matter." (Male trader with more than fifteen years of experience)	
Women on the trading floor hold almost exclusively administrative positions	3 participants
"Most women on the trading floor are in administrative roles. Most women would be personal assistants, there were not any male personal assistants." (Female trader with more than five years of experience) "Women usually would take a back-office job, the best-case scenario would be analysis, and in majority would be secretarial, administrative, supporting roles." (Male trader with less than five years of experience)	
There is better female representation in research departments	3 participants
"I would say there is a better balance between male and female in research than there is in trading, but not necessarily more women than men." (Female trader with more than ten years of experience)	

Legal departments attract more women	2 participants
"In finance industry, you see more women working on the legal side of things, and more men working on the actual investment decision-making." (Male trader with more than five years of experience)	
There is low female representation at senior, better-paid positions	5 participants
"Typically, there are not many women seniors because they would drop out to have kids. The managers are all men. Also, when a woman takes maternity leave for a year, she will not get that promotion, she goes back and has to restart again. Suddenly you are following behind your peers and you are getting paid less." (Female trader with more than ten years of experience) "I do not think it is the case of actively paying men more. I think it is the case of men getting promoted a lot faster and hence they get paid better. Because women reach an age of having children and they go off. This is where the payment difference is." (Female trader with more than ten years of experience)	
Maternity leave can be an obstacle to women's professional development	1 participant
Recruitment programmes support women's professional development	2 participants
"The managers in banks are aware about the benefits of hiring women in senior positions, and they are trying hard to overcome these challenging issues." (Female trader with more than ten years of experience)	
There are no differences in career opportunities and payments	5 participants
"In terms of payments I am not quite sure, I would say it is based on grade, it is called equal opportunity, each grade has its salary, and it is not depended on being male or female. In job	

opportunities, usually there is no difference." (Female trader with more than ten years of experience)	
There are differences in career opportunities and payments	2 participants
"I am sure if you look in payments there are many differences. I have read over the past in articles that women traders in investment banks are getting less money than men." (Male trader with more than twenty years of experience)	
Not being aware of any differences in payments	2 participants
"I do not know enough about how much people are getting paid, it tends to be quite secretive." (Male trader with more than ten years of experience)	