Essays on the Impacts of Environment on Uncertainty Attitudes and Consumption Choices

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Dedication

I will like to dedicate this thesis to the Almighty Father (God) and my father Engr. Fidelis Olisemeke Izah.

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Abstract

This thesis comprises three essays on the impact of the environment (i.e. objects or conditions which surround people) on uncertainty attitudes. The first chapter reports an online experiment by mimicking screen colours frequently used in asset trading software platforms and evaluates the impact of the graphical interface on decisions in risk and uncertainty. The findings in this chapter provide empirical evidence that people's judgment in uncertainty depends on factors well beyond the traditional formulation of uncertainty through a set of state-contingent payoffs, and that the impact of these factors demonstrates disassociation between decisions in risk and in ambiguity.

The next essay shows that people's attitudes are sensitive to the inflow of information within their nation (environment). The announcement (a hike of interest rates) although positive and well anticipated, resulted in different reactions to the news. The media coverage prior to and after a monetary policy announcement creates different informed environment which affect people's aversion to ambiguity and risk. The effect is detectable by controlling for individuals' exposure to monetary policy news, and by disentangling precise news (after the announcement) and imprecise information (media discussions on change in monetary policy). These effects on individuals' attitudes are driven by the channels for receiving economic information.

The third chapter explores the expectation effects further by investigating the relationship between people's uncertainty attitudes and their allocation of marginal income to consumption. This essay shows that people increase their marginal allocation to expenses when the associated risk and ambiguity aversion is high. The main results show that the ambiguity aversion explains the increased marginal allocation to household and discretionary expenses and contradicts other theories.

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Chapter 1 Introduction

Decision Making Theories

Various theories have attempted to clarify people's decision-making processes. Amongst these is the most established and well-known theory, the expected utility theory. This theory assumes that individuals maximise their expected utility by making independent decisions based on thorough consideration of all relevant information (Riker, 1990; Young 1975). It is argued that the utility theory proposes a suggestive reasoning for how individuals should behave rationally when confronted with a decision on uncertainty issues (i.e. the difficulties that people encounter in forecasting the likelihood of future outcomes) (Fishburn, 1988; Von Neumann and Morgenstern, 1944). The theory further suggests that in making rational decisions, individuals maximize their personal gains to the best of their capability within certain constraints (Ackert and Deaves, 2010). The classic expected utility theory as formulated by Von Neumann and Morgenstern (1944) suggests that people make decisions with the goal of maximising their satisfaction, especially under conditions of risk and uncertainty.

Alternatively, behavioural scientists have tried to identify the principles that humans adopt in making decisions (Tversky and Kahneman 1979; Luce, and Fishburn, 1991; Wakker, and Tversky, 1993). For example, prospect theory applied to risky lotteries demonstrates that people exhibit several attitudes which are inconsistent with the proposal utility theory. This can be seen when people "underweight" outcomes that are merely probable and "overweight" those that are certain. This chapter focuses on the effect induced by exogenous factors (i.e. the environment) that creates either a higher or lower feeling of certainty.

Furthermore, expected utility theory indicates how people should behave when dealing with risky situations, rather than uncertain situations. Given that utility is an expression of the value of money for an individual, this reasoning can be applied when measuring the outcome of a particular financial prospect so that the expected utility of an asset with uncertain payoffs

provides the value assigned to it by an individual. This is such that a researcher can measure an individual's attitudes towards risk from the amount of money a person is willing to pay and how much risk they are willing to bear (Tversky and Kahneman, 1973).

Nonetheless, there are a number of scenarios where an individual's (decision-maker's) preferences run contrary to the projections of the expected utility maximization theory projects. This thesis builds on that reasoning by observing the consistency of individuals given that they can alter decisions when the context or format is altered.

Other theories suggest that an ideal decision maker would formulate logical representations of their preferences in deciding on outcomes under risk and uncertainty (Machina, 1982; Yaari, 1987; Tversky and Kahneman 2016). An example of this is prospect theory; specifically, Kahneman and Tversky (1979) attempt to provide illustrations of this by explaining the way people behave. The Allais Paradox (Maurice Allais, 1953; Ackerk and Deaves, 2009) shows that individuals are inconsistent in their preferences when alternative options are offered. Moreover, other studies (Tversky and Kahneman, 1981; 1984; 1986; Lanzi 2011; Jullien, 2016) have suggested the idea of framing, and have also shown that an individual's attitudes towards risk are inconsistent in their options when presented with the same problems in different frames. Studies such as Tversky and Kahneman (1979; 1991; 2013) and Levy (1992) have shown that individuals are more concerned about the gain and/or losses made than about the level of wealth involved. People are risk-averse when considering gains and risk-seeking when dealing with losses (Tversky and Kahneman, 1981).

These theories contradict the utility theory's suggestions by, demonstrating that individuals do not always make choices as proposed by the continuity axioms of expected utility theory. This thesis studies the impact of various aspects of a decision environment on individuals' uncertainty attitudes – in particular, risk (i.e. situations when the probabilities associated with possible outcomes are assumed to be known) and ambiguity (i.e. situations when

the probabilities are assumed to be unknown or unmeasurable uncertainty) attitudes (Ellsberg 1961; Tversky and Fox, 1995). The Webster Dictionary (2018) defines environment as the aggregate of social and cultural conditions that influence the life of an individual or community, and as the circumstances (such as announced changes in economic policy and media coverage thereof, as illustrated in chapters 4 and 5), or objects, or conditions (such as the colours used in the computer interface, in Chapter 3) by which a persons is surrounded and influenced.

Consequently, this thesis aims to show that within an organisation, the decision environment seems to matter for choices. For example, Tosi and Slocum (1984) show that certain characteristics within a firm's environment could have implications for the strategy, process and structure of the firm. The findings from other studies may provide a good basis to argue that the environmental context could be a determinant of decisions within the working environment (Dess and Beard, 1984; Fredrickson and Iaquinto, 1989; Fredrickson, and Mitchell, 1984). Therefore, the type of environment, in terms of its complexity, determines the level of analytical effort required to make decisions in such environments (Khandwalla, 1973: Hwang, and Norton 2015). This is further demonstrated by Moskaliuk et al (2017), who show how the working environment affects the levels of concentration and attention of workers. The impact of the working environment on decisions depends on factors such as the cognitive capacity of people (Moskaliuk et al 2017); the perception of the environment (Flavell et al 1985; Wapner and Demick 2002); and the impact on mood amongst other factors. These studies indicate that exogenous factors may play a role in decision making but do not show that there could be an impact in decisions pertaining to risk and ambiguity. Hence this thesis intends to fill this gap.

When applied to the work environment, there are several reasons to focus on decisions made in uncertainty. Firstly, the willingness to take risks is crucial for an organisation's success (e.g. MacCrimmon and Wehrung, 1986). People in organisations face various forms of risks aside from the well-studied financial and investment-related risks; for example, exclusion risk

(Derfler-Rozin et al 2010), whistle blowing (Mayer et al 2013), and risky or safe choices in creative tasks (Steidle and Werth, 2013). Response to these forms of risk is essential to performance especially for work in groups (Van Knippenberg et al 2000) and in situations of uncertainty, where decisions made reflect perception of risk on factors which could affect information processing, e.g. information search efficiency (Blay et al 2012). It is therefore important to understand when people are more or less likely to take risks. Secondly, little is known about the impact of the environment on people's attitudes towards risk and ambiguity. Thirdly, separating risky situations from ambiguity allows us to contrast these two dimensions of uncertainty.

1.1 Overview of Empirical Chapters

Chapter 3 begins by showing that the colour scheme used in the computer interface (which represents the visual and contextual aspects of a working environment) matter for decisions made under conditions of uncertainty. Trading screens are an integral part of the decision-making process in investment firms (Buck, 2014; Gary et al, 2017; Sellers et al, 2015) as they concentrate the information required for decisions on screens. This makes it relevant to investigate what effects, if any, the presentation of information on screens has on people's decisions. Potentially, the effects may be driven by light intensity, as dictated by the background colour (dark or bright) used on the screens. A relevant link between light and decisions is reported by Glimcher and Tymula (2017), who suggest that the intensity of sunlight and the duration of daylight to which people are exposed affects their economic choices. Knowing if these screen settings contribute to the decision-making process could help to enhance performance in the work place. Glimcher and Tymula (2017), suggest that the strength of the effect from illuminance (level of brightness) depends on personal characteristics, such as the age, gender and cognitive ability of individuals. This thesis adapts similar factors and controls for them within the analysis.

In Chapter 3, surveys are used within an experimental setup, in which individuals report hypothetical decisions in identical tasks, yet are randomly allocated to two different screens. One of these displays is kept in neutral colours as a typical survey screen would look (black font on white background) and the other displays the main features of a trading screen (black background with yellow, green, red and grey fonts).

This experiment is administered to ordinary United States resident who are not professional investors. Random allocation of individuals allows for direct comparison of averages across representative samples to indicate the effect of treatment factors, such as the difference between the control group (neutral screen colours) and either the colourful screen or the investment frame task in the neutral screen. This was done using subjects' reported choices in risk-acceptance tasks similar to those in Kahneman and Tversky (1979) and in the standard two-colour Ellsberg (1961) task.

There is also a major focus on ambiguity and risk aversion as this is mostly studied in reviews, such as Aloysius (2005), Constantinos et al (2016) and Dimmock et al (2015) amongst others. Although this thesis uses stated choices of subjects, there is no reason to expect differences in choices as samples are large enough and randomised. Thus, participants in each experiment were randomly assigned to either the control (white colour scheme and abstract wording of questions) or the treatment (dark colour scheme and/or investment framing of questions) groups. This design draws subjects' attention to the nature of the questions (decisions in uncertainty) thereby ensuring they are uninformed about the stimulus actually used.

The fourth chapter shows how the magnitude and quality of information within our environment can affect attitudes. Its focus is the impact of a monetary policy announcement and consequent media coverage on people's attitudes towards uncertainty. Typically, Central Bank announcements result in movements within the financial markets, as illustrated in previous studies (Rosa, 2008; Rosa and Verga, 2007; Demiralp and Jorda, 2004). These movements in

financial markets are a result of investors' perceptions of the Central Bank's information, which provides general data that could be interpreted by market participants either as signal channels providing indications of future policy changes or as co-ordination channels. This implies that the perception of information by participants depends on the nature of the information (i.e. timing communication and amount of information that is broadcast) from the Central Bank. A difference in interpretation of Central Bank communications would lead to different reactions to the announcement. Subsequently, Ehrmann and Fratzacher (2003) show that participants are unable to accurately predict Central Bank policies despite frequent communication which ought to minimize such discrepancies (Blinder, 1996). This implies that communication alone cannot explain differences in interpretation of information. Born et al (2014) explain the heterogeneous reactions and propose that when announcement are made, people are concerned about its content and the state of their nation's environment. This supports this chapter's proposed explanation that deviations in interpretations and expectations are either due to lack of clarity in informal forms of communication signals (verbal speeches, interviews and other forms of information about Central Bank activities) and/or too much information from media broadcasts which increase both general agitation amongst individuals and uncertainty in the economic environment.

Chapter 4 investigates the impact of the Central Bank policy announcement on people's uncertainty attitudes and shows why an announcement from the Federal Reserve (United States) on an anticipated hike in interest rates results in a change in people's attitudes to both risk and ambiguity. This chapter proposes that this announcement has two effects. Firstly, its declaration reduces uncertainty about future economic developments, an uncertainty which might have been higher in anticipation of the announcement being made. While uncertainty about future economic developments is unrelated to the decision tasks (lottery based questions and two Ellsberg box questions) which subjects are given in the survey, subjects' choices would reflect

their perception of certainty or uncertainty surrounding the information they pay attention to. Secondly, due to the unique nature of the particular announcement around which the experiment is designed i.e a first in a decade rise in interest rates, the intensity of media coverage was especially high, which could act as an additional stressor for people. Strain could come from media circulation of conjectures, unclear interpretations, discussions of potential risk and impacts in informal meetings, discussions about press releases and other unclear economic predictions about economic changes and their impact. These intensive policy discussions in the media add to the general agitation, which leads to people perceiving the economic environment as pessimistic with reference to the policy announcement. Consequently, this study proposes that strain caused by pessimistic opinions on future income or comments exhibiting high uncertainty could affect attitudes. Thus, individuals' attitudes towards uncertainty may be sensitive to information and the level of economic uncertainty within the environment which surrounds the decision task.

Hayo (1999) indicates that individuals are interested in economic issues and consequently in issues related to the Central Banks in their economy. Furthermore, Hayat and Farvaque (2011) also highlighted that individuals' awareness of macroeconomic fundamentals is not only influenced by their individual characteristics but also impacts their processing of information, perception and sentiments towards the information received and their attitude towards economic issues. This chapter anticipates that uncertainty would make it harder for individuals to make relevant adjustments in terms of consumptions and savings, when monetary policy changes in macro-economic fundamentals occur. For example, Masolo and Minto (2015) show how uncertainty surrounding debates on the potential actions of policy-makers, affects individuals' decisions to consume and/or save. This chapter accordingly demonstrates that change in uncertainty attitudes could lead to change in consumption choices.

Chapter 5 builds on the findings in Chapter 4 and investigates whether changes in attitudes could explain changes in consumption of the same subjects. It uses the same data from Chapter 4, alongside other variables such as answers to questions on expectations and perception of interest rate, price in general, and allocation of marginal income. This study proposes that shift in uncertainty attitudes may be associated with changes in consumption-saving attitudes. The study expects that people should not only be sensitive to news, but that this should reflect in their stated choices to consume or save. However, it is relevant to study whether these stated choices are solely a consequence of the effects of information inflow in the environment or are also a result of its effects on uncertainty attitudes. This study further presents empirical evidence demonstrating that marginal allocation of income to consumption is sensitive to uncertainty attitudes. This impact is channelled from imprecision and ambiguity in the information surrounding the announcement.

This could proceed from less certainty; however strains affecting people's ability to analyse information, could also influence their saving decisions. The results further show that a person's sensitivity to an announcement is determined by how attentive they are before or after it is made, creating either complete or incomplete information about future income, which is reflected in their stated allocations of marginal income. To show the effect of the announcement on people's attitudes and consumption decisions, the sample is further split into categories of 'attentive' and 'inattentive'. This reflects the difference not only in certainty, but also the effect on perception of information, due to the reception of incomplete data, and/or information processing being mitigated by the strain of processing excess information due to the intensity of media coverage on the policy announcement. Chapter 5 also shows that attitudes towards precautionary savings can be explained by attitudes towards aversion due to uncertainty generated from anticipations of the announcement.

1.2 Contributions

Chapter 3 contributes to the literature by providing empirical evidence to demonstrate that a "virtual" environment can have noticeable effect on people's attitudes towards uncertainty. Notably, attitudes to uncertainty are measured by decision tasks that are absolutely equivalent in all treatments. This implies that the virtual environment matters in making complex decisions, as it pertains to uncertainty. The effects of screen on uncertainty attitudes do not result from a direct impact on subjects' cognitive processes, which would be captured by changes in their mood, cognitive reflection scores and response times. Yet significant differences observed indicate that there are effects such as changes in proportion of uncertainty attitudes in spite of interactions with these and potentially other factors in the work environment. This chapter contributes to a body of literature emphasising that decisions under risk and ambiguity are processed differently by the brain from one person to another (Hsu et al 2005; Huettel et al. 2006).

The main contribution of Chapter 4 to the literature is additional empirical evidence on changes in people's attitudes, which are typically assumed as fixed and often seen as independent of external factors (LeRoy, 1973; Rabin, 2000; Ross, 1981; Ross, 2004; Rothschild and Stiglitz, 1971). More recent research shows that people's attitudes could shift in responses to information, as shown by Merzifonluoglu (2015), who examines the sensitivity of the sourcing strategies of firms to risk and demonstrates that firms change their strategies and risk objectives when more information on suppliers is provided. Furthermore, Cohn (2015) uses a field experiment to show that people's attitudes change with business cycles. Moreover, this chapter contributes to literature on the "certainty effect"; for example, Tiedens and Linton (2001) show that emotions affect certainty appraisal in people and leads to the use of heuristics in information processing. This chapter shows that information affects people's attitudes to uncertainty, as regimes marked by different levels of certainty show significant differences in attitudes. This

implies that information processing does not occur in isolation and that the environment does affect people's processing ability by influencing perception of information.

Chapter 5 presents further evidence on the importance of the environment in decision-making by demonstrating the effect of the Central Bank announcement on economic decisions, i.e. marginal propensity to consume. This chapter establishes that changes in risk and ambiguity attitudes, as detected in Chapter 4, have an economic significance in the sense that they affect consumption choices. Bonciani and Van Roye (2015) have shown that macro-economic shocks do affect the economy due to the uncertainty surrounding such changes. These effects may be reflected in people's decisions in pervasive economic phenomena such as convex marginal revenues and precautionary savings (Leland, 1968; Hartman, 1976; Bernanke, 1983; Abel, 1983; Kimball, 1990), which are prevalent when uncertainty in the economy is high. Chapter 5 contributes to literature on precautionary-savings and consumption by empirically demonstrating the psychological impacts of future income uncertainty on information processing. This impact is tested on marginal income and focuses on allocations to household and discretionary expenditure. This chapter further presents evidence which shows that announcement could create states of uncertainty which impacts the decision processing in people, and reflects in their perception of future income as a result of its impact on their attitudes towards consumption.

1.3 Findings

A key finding in Chapter 3 is that, while screen colours affect attitudes to ambiguity, they do not affect risk attitudes. Conversely, formulating the same choice questions as an investment task produces a significant effect on risk attitudes but leaves ambiguity attitudes unaffected. The latter exercise (investment task) also rules out any potential explanation of the effect of chosen screen colours (as in stock trading software) through inducing an "investment mode of thinking" in individuals. Thus this chapter shows that the way information is presented matters; although the tasks presented to participants are similar, the choices made indicates that there are differences in uncertainty attitudes. Similarly, Diacon and Hasseldine (2007) demonstrate that visual presentation of past information has a significant impact on the choices of individuals. However, the design of Diacon and Hasseldine (2007) differs from that of this chapter, as they show that decisions of individuals when selecting a fund to invest in correlated significantly with the format of a presentation on the funds' past performance. The presentation was the basis for deciding what to select as opposed to other relevant information which was not graphically presented. Essentially, the format in which the past performance of a fund was presented had a marked impact on the perceived risk and return of the equity fund irrespective of its fixed interest. Yet their findings support the idea that whether information is presented textually (in this chapter) or using graphs (Diacon and Hasseldine, 2007) the presentation format matters.

Similarly, Moskaliuk et al (2017) show the effect of the working environment on people's cognitive performance. Using 3D virtual environments, this chapter shows the impact of a work versus non-work environment in outdoor settings on people's concentration levels, attention and decision making. The chapter showed that respondents in a work context were faster, more attentive and had better concentration than those exposed to non-working environment features. The result implies that people are more efficient within a work environment than they are outside of it. Similarly, Chapter 3 also shows that visual features of

the working environment matter. Although minute, the impact could play a role in decision-making. The results suggest that participants' location also matters, as there is a variance between people's attitudes based on their exposure to different colour schemes within different locations (home, work or outdoor). The results of this chapter suggest that when people exposed to high levels of screen illumination (i.e. bright screen with black fonts), they become more risk averse in attitude than those exposed to dark screens and/or investment frame problems set. This means that the wavelengths of work screens could result in higher or lower concentration levels, depending on the preferences of users. The wavelengths could also affect individuals' decision processes and result in more averse attitudes when there is less light wave intensity and vice versa.

Finally, the results of Chapter 3 suggest framing sets of problems as investment induces less risk-averse attitudes, which suggest a less risky perception of the task for participation regardless of whether they were either at home or work. These findings are in contrast with studies by Rundmo (1996; 1998b), who demonstrates that there is a positive correlation between perceived risk within a work environment and the risk behaviour of people within that environment. This suggests that participants at home or at work may be influenced by their environment. Thus the environment (i.e. work or home) may result in less or more negative perception of risk resulting in lower or higher risk-aversion within these locations. Rundmo (1996; 1998b) also concluded that employee's evaluations of the status of health and safety measures were affected by their working conditions. Rundmo (1996) found that employees' understanding of risk and risk management was influenced by how they perceived the risk they were exposed to at work. This implies that the working environment could affect people's risk perception and behaviour. Chapter 3 has addressed this by looking at influences of the work environment on people's attitudes towards risk. The difference between this thesis and the studies is that my thesis looks at decisions in risky choices, while Rundmo's studies looked at

people's perception of risk in their working environment and the association of that perception with risky behaviour.

The results of Chapter 4 show that risk and ambiguity attitudes are sensitive to information with uncertainty, in particular uncertainty surrounding announcements on change in monetary policy. This is similar to findings by Fehr-Duda et al (2010), who show that people's relative risk aversion shifts with increase in the size of their investment stake. This shift is mainly driven by changes in weighting probability, which results in increased aversion for people who weight probabilities of high gains more conservatively.

The results of Chapter 4 suggest that, although the United States monetary policy announcement in December 2015 was generally interpreted by people as a positive signal, people were more averse prior to the announcement than after. This difference in attitudes, that is risk and ambiguity aversion, demonstrates the impact of an announcement which creates two environments: one in which the group is exposed to less certainty before the announcement and another group is exposed to more certainty after the announcement. The uncertainty surrounding information before the announcement results in higher risk and ambiguity aversion compared to after the announcement, once uncertainty about the bank's policy is resolved. The findings show that in addition to the prospect theory where increase in relative risk aversion is driven by a change in probability weighting of risk prospects here, increase in relative risk aversion seems driven by uncertainty in information, which has no direct impact on people's income.

Chapter 5 contributes to findings by Carroll and Kimball's (2006) study, which suggests that individuals save more when they know that the future is uncertain. Therefore, when there is high uncertainty, such individuals are prone to save more as a measure of caution. This phenomenon is referred to as "precautionary savings", when people save more in response to future risk. Nevertheless, my chapter proposes that uncertainty surrounding announcements not only affects people's attitudes towards risk, but also their attitudes towards stated expenditures.

Sinha (2016) shows that uncertainty in monetary policy affects behaviour in the market, and finds that an increase in interest rate uncertainty has a recessionary impact on the economy. Sinha (ibid) further shows the effects of a monetary policy uncertainty shock and shows that a surge in interest rate uncertainty increases households' precautionary savings. Uncertainty shocks are measured using a time-series of standard deviation derived from U.S. Treasury Futures. This chapter uses an announcement to show that monetary policy uncertainty not only affects attitudes, but that this effect in attitudes translates into the stated consumption preferences of individuals.

1.4 Implications

One implication of Chapter 3 is that a simple adjustment of a computer interface would suffice in achieving some reduction in risk and ambiguity-seeking. Further implications with regards to the work place design are also possible. The computer screen plays an important role in shaping our behaviour and making decisions, even though it is just a minor part of the surrounding [work] environment. But, more importantly, in many contexts the computer interface is, or is supposed to be, the only environment that surrounds subjects' decisions. For example, many experiments in economics, finance, management and psychology take place in a computer lab, where subjects must focus on their individual computer screens. In marketing, focus group participants would often see a video, drawing their attention to a TV screen, and aiming to minimise the impact of other environments. In these situations, as this chapter demonstrates, the impact of the interface, although often neglected, is even more pronounced. Results from experiments and focus groups with different and often unreported environments may be different, which would partly explain the heterogeneity of empirical findings with regards to ambiguity attitudes. This chapter demonstrates that what you see on a screen could determine your decisions in risk and uncertainty. Furthermore, the investment framing effects on people's attitudes suggest that the way trading terminologies are phrased could affect the behaviour of its participants: thus, further research is required to further investigate and test for better framing or terminologies that can increase risk-neutral and averse decision-making. Furthermore, this study shows that the type of task matters, and how people perceive the riskiness of a task matters, this explains why gambling companies make tasks or games easy and the amounts to bet low to increase participation in betting. Furthermore, gambling organisation design the screens to be colourful using a black background to induce riskiness, thus a good way to combat gambling would be the government insisting on redesigning screens to be monotone in colours with a bright screen background.

Furthermore, the findings of Chapter 3 could have implications for organisations in terms of recruitment. For example, when testing psychological attitudes of people during a recruitment process, abstract tasks do not necessarily reveal the attitudes they would manifest in the real environment but could provide an estimate related to other characteristics in people. For example, people could be prone to seeking more risk when presented with investment problems depending on their background or social values. People could also be less ambiguity-averse for complex tasks or when resolving other potentially complex issues within the organisation (when comparing risk attitudes in abstract tasks and in investment framing). Often, much attention is paid to creating a pleasant work environment in general, while 'small things' like computer interfaces remain neglected. This chapter shows that decisions are affected by these 'small things', such as the colours of a screen.

Chapters 4 and 5, show that the difference in uncertainty attitudes is sensitive to the economic environment, and that these effects on people's uncertainty attitudes lead to effects on consumption choices (Chapter 5). Thus, where a regime is marked by less certainty about the future, the stated consumption is lower, whereas stated consumption is higher in the regime where improved precision of economic forecasts occurs once uncertainty about the Central Bank policy is resolved. This shows that the sensitivity of individuals' attitudes to the uncertainty surrounding monetary changes causes them to require higher compensation for risk. Although the announcement was positively anticipated, this could suggest that the impact of uncertainty levels is associated with people's feelings due to having incomplete information i.e. some level of uncertainty of an occurrence and/or its impact on the economy, in particular on the individual's household income. This implies that news alone does not form communication, but how such news interacts with other factors in the environment does matter. The channels for communication, the timing, clarity of information, level of attention and people's perception of news all interplay within the environment and result in various interpretations.

Chapter 2 The work environment

The way employees perceive their working environment matters. The working environment affects people's creativity, and encourages employees to take risks, solve problems and interact effectively to initiate ideas (e.g. Amabile et al 1996; Oldham and Cummings, 1996; Shalley and Gilson, 2004). Findings from Bamberger et al (2008) indicate that individual performance in organisations may be dependent on factors which include physical workplace conditions. Simple changes to work space could help improve communication (Brockbank, 1999; May, 2008), transference of learned skills (Kupritz, 2002) and better performance.

In making decisions, several factors can come into play. Of these factors the most predominantly proposed by literature include mood, emotion and cognitive ability. These factors are known to either have direct effects on people's decisions or act as transient factors transmitting the effect of interacting variables on their choices. For example, cognitive bias arises as result of memory errors, inaccurate judgements and faulty logic (Evans et al 1983, Toplak and Stanovich, 2008). Additionally, cognitive bias can be caused by other variables, such as over-dependence on previous knowledge, omission of information, and confirmation bias (i.e. the act of viewing data such that you see what you aim to see rather than what the data really says, in a way much like data mining) etc. (Marsh and Hanlon, 2007; Stanovich and West, 2008). The next session provides an overview on several factors which literature demonstrates could affect people's decisions.

2.1 Decisions in an environment

The behaviour of individuals comes from the need to meet an expected outcome, which can be altered with factors such as past experiences, investment and group dynamics. Most of the variables discussed above are highly related to cognitive bias, which is another prominent factor that affects individual behaviour and attitudes towards risk. It is explained as thinking patterns or systems built based on prior observation. For example, it is reasonable to assume that the financial decisions which incorporate graphs and trends much like what managers applied in the study by Diacon and Hasseldine, (2007) may have also been based on cognitive bias. Furthermore, it can be seen that these variables act in a loop such that cognitive bias impacts other variables, and in turn can be affected other variables.

These factors can also impact the decisions of individuals especially with regards to risky prospects and investments decisions. The variables identified so far are not in the least exhaustive as more empirical studies show how other variables also impact on the decision of individuals. Although most of the variables have been discussed in isolation of others variables do interact with each other. They may either intensify or decrease the impact of other variables which could come from the person's initial wealth, information received, and emotional state, as well as the pleasure or fear resulting from taking the risk.

2.1.1 Information environment

The environment could also be a source of information for people, as studies from the financial sector show that a peer information environment could create a cheap source of information for firms (Matsumoto and Shaikh, 2017). Typically, getting information privately can be expensive; hence people rely on financial intermediaries for information as shown in accounting studies like Lang et al 2003; Gebhardt et al 2001; Horton et al 2013; Frankel and Li, 2004. Meanwhile in finance, studies have also shown how announcements from financial intermediaries are relevant market participants (Blinder et al, 2010; Lamla and Strum, 2008).

This study suggests that certain factors in the environment i.e. not the physical features, but rather factors such as inflow of information, forward guidance on future economic changes, people's interpretation of communicated information, expectations about the economy, etc are factors within an environment which could impact information and the perception of such information could matter for decision making. For example, Chapter 4 shows how the inflow of information, such as a Central Bank announcement which was anticipated by market participants as positive news, creates two environments with different levels of uncertainty before and after the announcement leading to different effects on people's attitudes.

Apart from getting information, paying attention to it could be a prominent yet scarce cognitive resource (Kahneman, 1973) which people require but sometimes lack and consequently have less processing power for information signals. As a result, where attention is low, people seem to process only information that is noticeable and easily accessible (Tversky and Kahneman, 1973; Hirshleifer, 2001). Hirshleifer and Teoh (2003) suggest that attentive individuals may also be unable to absorb information that is not readily accessible and noticeable due to the time constraints required to process some data. Consequently, people with limited attention will use simple decision rules that utilise the required information to make decisions within their jurisdiction (Peng and Xiong, 2006).

Furthermore, studies show that the value of information to participants varies based on their risk attitudes (Green, 1981), and attention (Gelanis, 2015; Blackwell, 1951; Laffont 1989) to information. For example, when people are risk averse providing more information does not result in a change in attitudes (Green, 1981). Nonetheless, more information could make people better off (Green, 1981; while a change in information could have different outcomes for people in which some benefit from it and are better off while others are not (Gottardi and Rahi, 2014). For example, when individuals are inattentive to information this unawareness could result in such information being of negative value (Gelanis, 2015). Other studies suggest that the value of

information also depends on how it is perceived. When information is excessive this could result in a negative perception of it and lead to avoidance of information (Lee et al, 2017).

2.1.2 The working environment

A study by Walter (2012), shows that the working environment could be an impediment to creativity in people. The study suggests that although culture and physical working environments affect the creativity of individuals, there are some features indirectly relate to the working environment which could impede creativity. Hence, knowing which factors in the working environment affect people could help employers to increase staff retention and development of high-quality work and life (Norfadzilah, 2016). Such knowledge could further aid the employer in resolving the issues of job burnouts, motivation or stress of employees to retain and increase their human capital productivity and organisation performance. Some studies (e.g Amabile et al 1996; Dul et al 2011; Hill et al 2003 ; Shalley et al 2004) have already examined how specific features of working environments influence work performance, resulting in suggestions for how best to design an office or work space. In a recent study, Moskaliuka et al (2017) investigates the effect of the working environment's features by testing the cognitive performance of people within different environments using experiments. The performance is measured using concentration and decision-making behaviours within these environments. The study makes use of a virtual 3D environment to frame the context (work vs. non-work) of the experiment. Moskaliuka et al (2017) hypotheses that, framing problems in the work context would increase concentration and attention levels, as compared with the non-work context. The study also looks at decision behaviour in terms of risk aversion, and anticipates less risk aversion (more risk seeking) in a work context as well as higher concentration and attention levels. The study finds that indeed the individuals within the work context did indeed vary in decision-making and were less prone to risk than their counterparts in non-working environments.

Furthermore, study also demonstrates how other features of the work place may affect people's perception of social closeness and its resulting outcomes. Huanga et al, (2014) shows the effect of comfortable temperatures on individuals' preferences regarding conformity. It demonstrates that people's decisions on product preference, stock price forecast and on the opinions of others are, affected by the temperatures they were exposed to either i.e. warm or cool. Individuals in warm temperatures show increased perceptions of social closeness to other decision-makers and thus consider these opinions as more valid than their individual opinions. Thus, people tend to follow the crowd's opinion in warm temperatures. Conformity is higher in warm temperatures than in cold temperatures.

A space in every work-environment could be designed in regard to the information needed for analyses and judgement. In Chapter 3 of this thesis, the author observes the framing effects of a simulated work screen based on the characteristics of a trading environment. Similarly, previous studies also illustrate how mood has been shown to have a significant role in impacting decision-making: for example McLain (1995). The perception of individuals can be impacted by a number of variables, of which, mood and cognitive reflections are some of the most studied variables as well as. As these variables form part of one's psychological behaviour, thus it is expected that factors which affect mood, cognitive performance and perceptions of human behaviour could impact on these variables as well.

Perception can be viewed as the cognitive process by which an individual selects, organizes, and gives meaning to environmental stimuli (Flavell et al 1985). People attempt to make sense of their environment, the factors and characters that it contains based on their perception of it. In a working environment, individuals can be bombarded by environmental motivations that impact their senses: sight, smell, touch and taste. Nevertheless, individuals can still determine which stimuli to focus on at a particular point in time (Leventhal and Scherer, 1987). This ability to focus allows each individual to respond differently and make different

choices in relation to what they choose to concentrate on. This therefore ensures that individuals tend to perceive the stimuli that satisfy their internal needs, attitudes, feelings and motivations, and thereafter make decisions on that basis in response to those stimuli (Likert, 1967). However, there is still a chance that an individual's perception is inaccurate and subsequently this could result in flawed decisions.

Individuals can misinterpret the stimuli they receive and make inaccurate and biased decisions. This is because; they interpret the stimuli in context with the situation and also in relation to similar events or occurrences that they have encountered. For example, in the studies by Mclian (1995), Rundmo (1996) and Rundmo and Hale (2003) risk perception and behaviours of individuals in a working environment, especially with regards to health and safety, are shown to affect their decisions. These studies also illustrate that the risky behaviour of an individual in a working environment is closely associated and correlated with the individual's risk perception (Rundmo 1996, 1998b). Although risk perception does not predict risky behaviour, an individual's perception of risk seems to be subject to their perception of their wellbeing. The association of a work place with risky behaviour in individuals indicates that one's wellbeing is not perceived to be at risk. Such an individual tends to act in line with that perception and vice versa. Furthermore, both variables i.e. risk perception and behaviour can be affected by similar variables such as job stress and environmental conditions. Subsequently, this chapter is focused on the individual's risky behaviour in a working environment while acknowledging that this is closely associated with their risk perception of the problem sets, which they are presented with. This chapter assumes that an individual's attitude towards risk will be an indication of their risky behaviour and perception which when observed in a simulated working environment will illustrate the effects of the frame presented by such an environment.

2.1.3 The physical environment and mood

There are different streams of literature that investigate the impact of mood on the financial market. This includes the branches of literature that analyse whether asset prices are related to seasonal affective disorder (see, e.g Kamstra et al 2003), the daylight savings anomaly (see Kamstra et al,. 2000), results of sports events (see, e.g Ashton et al, 2003; Edmans et al, 2007), or the weather (see, e.g Hirshleifer and Shumway, 2003; Saunders, 1993). As weather and seasonal affective disorder data are available on a daily basis and show sufficient variation, this paper focuses on weather and seasonal affective disorder related mood effects.

Prior research has already shown that sunshine influences markets. For example, Saunders (1993) shows that New York Stock Exchange index returns tend to be negative when it is cloudy in New York City. Hirschleifer and Shumway (2003) study 26 international stock markets and confirm that the weather in the city where the exchange is located will influence market returns. Kamstra et al. (2003) also show effects on stock returns caused by shifts in the length of daylight throughout the seasons. The relation between sunlight and stock returns arises because sunlight affects mood, and people tend to evaluate prospects more optimistically when they are in a good mood than when they are in a bad mood. Conversely, depression, like seasonal affective disorder (SAD), will reduce risk seeking and increase the general level of pessimism (Carton et al 1995; Molin et al 1996 ; Young et al 1997). Essentially, studies seem to suggest that good weather like sunshine induces positive mood states, while bad weather induces negative mood like depression (Schwarz and Clore, 1983). Positive mood states are associated with optimism, and negative mood like depression are associated with pessimism. If such mood misattribution extends to investments (that is, mood states influencing investors' decisions), stock prices will fluctuate in response to investors' mood states (Loewenstein et al 2001).

Bassi et al (2013) recently investigated the transmission channel between weather and decision-making under risk in an all-inclusive experimental study which shows that the weather influences individuals' decision-making by affecting their attitudes towards risk aversion channels. They also find evidence that this effect is mediated by the mood in a causal mechanism, such that altogether the weather affects the agents' mood and the mood affects the agents' risk attitudes. The results of Bassi et al (2013) also imply that it is the affect infusion model and not the mood maintenance hypotheses that drives the impact of mood on the risk aversion. Thus, "good weather" improves the mood and thereby reduces the risk aversion, which in turn stimulates risk-taking.

One transmission channel is that the weather has an impact on the mood or another intrapersonal variable, which in turn may generate individual cognitive biases (misestimating of probabilities and therefore of expected values or risk: see e.g., Johnson and Tversky, 1983; Wright and Bower, 1992). Another transmission mechanism is that the weather influences mood or another intrapersonal variable, which in turn has an impact on the individuals' risk attitudes (risk aversion). This chapter finds that different weather variables have a different effect on the various financial market segments. For instance, barometric pressure has a consistent impact on the corporate bond market, whereas cloud cover and humidity influence returns on the stock market.

This seems possible primarily because people's choice incorporates the fact that the affects people experience when making decisions influence their final decision. Schwarz and colleagues have developed a similar model which they term 'mood-as-information'. The mood-as-information model states that when people make judgments about an object, they depend on their feelings as diagnostic information about the object of judgment (Schwarz, 1990). Generally, people tend to make more optimistic judgments more positively when they are in a good mood and make more pessimistic judgments in a bad mood.

The relation between the financial market and seasonal affective disorder has been analysed by Kamstra et al (2003), Garrett, et al (2005), and Kamstra et al (2009). The correlation between the weather and the financial market (e.g. stock market returns) has also been the subject of empirical studies. Saunders (1993) found that the returns on the New York Stock Exchange were negatively related to cloud cover in New York City. Higher stock returns on sunny days were supposed to have resulted from the positive mood, induced by good weather, of floor traders and brokers. Some papers extended the literature by using additional weather variables: Krämer and Runde (1997) included cloud cover, humidity and barometric pressure. Keef and Roush (2002, 2005, 2007) investigated the influence of wind, temperature, rain, humidity, sunshine and cloud cover (Theissen, 2007). Dowling and Lucey (2005) evaluated weather effects using cloud cover, rain, humidity and geomagnetic storms: while Goetzmann and Zhu (2005) demonstrated other weather effects which included cloud cover, rain and snow. Other papers extended the analysis to market segments other than the stock market. For instance, Keef and Roush (2005) integrated fixed income securities into the analysis, by investigating government bonds and bank bills. While Kaplanski and Levy (2017) and Symeonidis, et al (2010) analysed the relationship between weather variables, seasonal affective disorder and stock market volatility (including the VIX index).

The presence of physical elements that limit unwanted exposure to other factors (e.g. other colleagues, distractions) enhance individuals' ability to concentrate at work which should be especially beneficial when jobs are complex and challenging (Oldham and Fried, 2016). However, studies on the impact of work-places are generally inconsistent with findings that support the argument (Block and Stokes, 1989) and others with little support (e.g., Sundstrom, Burt, and Kamp, 1980; Rafaeli and Sutton, 1987; Oldham, and Fried, 1987; Oldham et al, 2015).

The cognitive skills of individuals are associated with decision-making in the working environment. Some studies (e.g Amabile et al 1996; Dul et al 2011; Hill et al 2003 ; Shalley et

al 2004) examine how specific features of working environments influence work performance and provide suggestions on how to design a work space to enhance performance. For example, Moskaliuk et al (2017) shows that people's cognitive skills (i.e. attention and concentration) are associated with high performance as well as more risk seeking attitudes in a working environment. Cognition is a collective term for conscious and unconscious mental processes that are needed for perception, thinking, decision making, and action control (Wirtz, 2013). Attention and concentration are two relevant measures of cognition and cognitive performance (Wirtz, 2013). Attention is the ability to select relevant information and direct the mind actively to a relevant stimulus while ignoring distracting information, in order to be able to use this relevant information for perception, thinking, to control actions, and to interact with the environment (Castle and Buckler, 2009 ; Wirtz, 2013). Concentration is a state of being totally immersed in a thought or action (e.g Castle and Buckler, 2009). This mental state is influenced by external and internal cognitive, emotional, motivational, and social factors. Concentration can also be regarded as an individual factor in terms of the capability of an individual to concentrate (Wirtz, 2013).

Attention and concentration are preconditions for successful learning, problem-solving, and decision-making (e.g Duval, 2011; Schmidt, 1995 ; Wirtz, 2013) and are therefore relevant cognitive resources for successful knowledge work. Attention and concentration are work-related cognitive processes and thus performance should be enhanced when performed in a work-related environment. Typical work-related environments and work contexts such as traditional office settings are closely related to a work scheme that is, in turn, associated with work-related behaviours that demand cognitive resources (e.g attention and concentration). A work context can therefore facilitate the provision of work-related cognitive resources. This results in better cognitive performance by means of better attention and concentration capability. Thus, more study is needed on specific features of the physical context that enable employees with certain

job characteristics to effectively complete their work. Although mood and cognitive skills are suggested as mediators for decision making, there is evidence to suggest that mood does not matter for some tasks and organisations should recognize whether mood management is something to be considered in their particular setting. This may be done through different means than adjusting screens. Hence where attitudes are affected by screens, this may also translate into human relations, affecting trust or into ‘alertness’ at work. For example, Moore and Cain, 2007 show that a simple task performed by individuals is associated with people’s beliefs in their performance and that of others. This belief further affects the confidence to commit to entrepreneurial associations with people given their performance. Thus, people’s beliefs are affected by what they do (i.e. their interactions with their environment) and what others do.

2.2 Methodology

2.2.1 Experimental design

In social sciences, experiments are used to test and provide evidence about causal relationships. Compared to other research techniques, in experiments a situation can be isolated and simplified to allow for observation of causal relationship (Webster and Sell, 2007). Consequently, experiments can be used to build on the principles of a positivist approach (Cook and Campbell 1979). For example, this chapter provides evidence using experiments, which builds on prospects theory, a positivist theory proposed by Kahneman and Tversky (1979) to illustrate that subjects perceive decisions of gains and losses under risk differently. Kahneman and Tversky (1979) use experiments to demonstrate that people systematically violate the axiom of the expected utility theory. The experiments are conducted using students from the University of Michigan and the University of Stockholm and were administered as several forms of questionnaires, with different outcomes and probabilities.

Adapting this approach, I use experiments administered to subjects using online surveys, where subjects are randomly assigned to different forms of the questions or task with different formats (dark/bright screens in Chapter 3) or different situations (before or after a policy change announcement). The major drawback to this approach is the use of hypothetical problems and subjects' reported choices (Kahneman and Tversky, 1979). The use of hypothetical questions, such as lottery-type questions and the Ellsberg question, relies on the assumption that subjects know how they would behave in such scenarios and have no reason to disguise their true actions. Secondly, if people are accurate at predicting their choices, the presence of alterations or change in context would only show their choices in those scenarios.

In measuring risk preferences, economists and psychologists have developed a variety of experiments. However, the choice of method in measuring risk preference depends on the type of questions used (Charness et al, 2013). Measuring the extent to which people could take risks has

been well-explored by renowned theorists such as Savage, 1954 (subjective expected utility) and Kahneman and Tversky, 1979 (prospect theory). These studies in their measures of risk and uncertainty leave risk attitudes as a free parameter, since people could have different attitudes to risk. Consequently, in measuring risk, the approach depends on the type of questions being asked, which in turn informs the design on the type of experiment which would be appropriate. Traditionally, laboratory experiments have been used to measure risk attitudes: nonetheless, other methods such as field or natural experiments, elicitation and extra-laboratory approaches have also been considered as ways to measure risk attitudes (Charness et al, 2013).

2.2.2 Randomness and how to handle randomness

Experiments are embedded in other data collection methods. For example, Transue (2007) combines experimental logic with survey research methods to test abstract social science theory by applying it to real public policy issues. In testing social identity theory, he randomly categorizes his subjects into two groups in-group (i.e. the identity group to which they belong) and an out-group (i.e. the group to which they don't belong to). The use of random sampling in a phone survey of U.S citizens ensured that he had representative samples to test the social identity theory. In recruiting participants for my online survey, the subjects are randomly assigned to different surveys without prior knowledge of what treatment effect they will be exposed to. The grouping of participants randomly into different treatment groups ensures internal validity in the study.

This further enables me to determine how participants are affected by the isolated treatment effect across different studies. Comparing different groups across subjects provide unbiased results. Typically, comparison can be done in a number of ways (Field and Hole 2003): for this chapter, choices are compared using a between-subjects design in which the treatment and control groups are compared to identify the effect of the treatment if there is a difference in sample means. The treatment (i.e. the use of dark background screens with coloured fonts, or

investment framed question in Chapter 3) and the announcement effect (Chapters 4 and 5), are the simulations through which I try to identify the impact of environments if any on respondents' choices. Campbell (1957) considers an experiment internally valid when there is a significant difference between the treatment and control conditions, as this difference could be considered as a meaningful reflection of the causal relationship which exists between both variables. This approach is used by Raghunathan and Pham (1999) who, using three experiments, demonstrate that sad people tend to favour high-risk options, while anxious people favour low-risk options. The study does this by randomly grouping 53 students from Columbia University to one of three different scenarios: neutral, sad or anxiety state. These scenarios are administered using a questions with different questionnaire aimed at inducing a distinct affective state on respondents. Participants are given similar booklets on empathy to read before being exposed to a treatment, and then asked to perform similar tasks. The scores are computed for each group and compared.

An alternative to using a between subject design is within-subject design, in which the same participant is observed before and after being exposed to a treatment effect. The drawback of this method is that subjects could be influenced by unintended and uncontrollable factors. For example, in measuring people's attitudes toward a policy before and after it is introduced to determine the change in attitudes, it would be difficult to control for unintended effects, like subjects hearing attitude-changing news about the policy after the first measurement prior to the second one. Equally, simply filling out the survey pre-announcement may induce them to pay more attention than required to the policy change and produce misleading conclusions about the effect of the policy.

The use of within-subject or between-subject design has benefits and drawbacks. Typically, in designing a "within-subject" experiment, each individual is exposed to more than one of the treatments being tested, whilst a "between-subject" design exposes participants to one treatment only. One of the issues that could arise when applying a within-subject design is that

participants could provide answers to satisfy their perception of the experimenter's expectations; this is known as the "demand effect", resulting from interpretations of the experimenter's intentions and participants adjusting their behaviour accordingly (Rosenthal, 1976; White, 1977). Hence, a good way to control for the "demand effect" would be to apply the "between samples" design. By randomizing subjects across groups this effect can be controlled for. For example, Kahneman and Tversky (1979) administered questionnaires to students using a between subject design. However, according to Hershey and Schoemaker (1980), this design failed to meet its aim of being reflective in two of its three treatments due to the arrangement of loss and gain questions in the questionnaires: it presented the loss questions before the gain questions, while in the third treatment these questions were presented side-by-side. Consequently, the presentations of questions does not allow for adequate reflectivity within the first two treatments. In my study, I ensure that respondents are exposed to the right treatment before testing their risk and ambiguity preference to meet the aim of my study. Another issue to address would be the dependence of questions and tasks (Grice, 1966). In the surveys, participants are asked a total of three to five questions of which try to measure different types of risk and the answers required are independent of each other. This helps to reduce any bias from the type of questions asked and the way these questions are presented.

Other methods of experiments to consider include field, or natural experiments. Field experiments studies generally take place in their natural setting. This could include events that happen to a group of people and not others (Transue, 2007): for example, in Chapters 4 and 5 of this thesis, some participants indicated that they heard the news about the policy while others indicated that they did not. This natural occurrence provided a further split in the sample based on their attention to the Central Bank policy announcement. This allows for observation of the effect of announcements on two naturally generated samples. The experiments used in this thesis as earlier stated were administered as an online survey.

2.2.3 Surveys

The use of surveys could be valuable or worthless depending on the way they are applied by researchers (Warwick and Lininger, 1975: Krosnick 1999). Surveys are the most widely used data collection method in social sciences, which can provide reliable and valid data. Nonetheless, their popularity results in over-familiarity with the technique and result in misleading results when not used tactically. In this thesis, the use of surveys helps to facilitate the spread of the experiment. Like experiments, surveys are used within a positivist approach to collect information on beliefs and behaviours, thus making them compatible with experiments and appropriate for this research. For example, in studies by McLian (1995), Rundmo (1996) and Rundmo and Hale (2003), surveys are used as data collection through which the studies illustrate how employees' perception of health and safety affects their decisions, and demonstrate that risk perception affects the behaviours of individuals in a working environment.

2.2.4 Benefits of online experiments compared with lab experiments

In measuring people's perception of the economy, surveys are the most popular data collection tool. For example, central banks such as the European Central Bank and Federal Reserve still make use of consumer index surveys to measure the expectations of individuals within their country. Surveys are still in use today for measuring macro-economic factors such as interest rates, inflation rate (Blanchflower and Coille, 2009; Bryan and Venkatu, 2001; Curtin, 1996; Jonung, 1981; Ranyard, et al, 2008) and household consumption. For example, in the United States, the Reuters/University of Michigan Survey of Consumers (henceforth, Michigan Survey) has been measuring Americans' inflation expectations for more than 50 years (Curtin, 1996, 2006; Ang et al, 2007; Hafer and Hein, 1985; Thomas, 1999).

Given that both surveys and experiments are useful data collection tools for identifying people's perception and attitudes, a combination of both approaches should in theory lead to a maximization of the benefits of both methods whilst minimizing the limitations. For example,

the use of a survey allows for an increased number of respondents compared to traditional experiments and fosters internal validity, given that the samples are a good representation of the populations. The potential drawbacks from the experiment being run as a survey come from the influence of other factors, such as the locations of respondents when taking the survey. These factors are controlled for in the analysis, especially as all studies focus on the effects of the environment in decision-making. Furthermore, the survey consists of several waves from different samples, as opposed to using repeating experiments on the same sample. Whilst using the same respondents will allow for better interpretation of data, this was not feasible for this thesis. Consequently, the main method of analysis used is a between-sample analysis. Further details of how these limitations are reduced are covered within empirical chapters.

2.2.5 Convenience of online experiments

In terms of natural decision-making, online experiments could be advantageous as they cause less stress to participants and lead to higher participation numbers in the experiment (Vinogradov and Sharina, 2013). Online experiments may be preferred over lab experiments due to any of the following reasons: a higher number and variety of participants; natural setting with no pressure from the simulated lab environment; at a comparatively low cost. For example, a study by Kvaløy, O Nieken, P and Schöttner, A. (2015) uses a field experiment in a controlled working environment to show the increase in work performance when participants are monetarily incentivized and given a motivational talk, as opposed to using performance pay alone. Although online experiments conducted without monetary incentives are expected to produce biased results. Vinogradov and Sharina (2013) use an online experiment which adapts standard lab treatments to demonstrate that participants motivated via monetary incentives are not significantly different to participants motivated via altruism and curiosity.

The study gains from a representative sample and shows that the altruism of participants could provide similar value and non-bias in participants compared to providing them with a

monetary incentive. In this thesis, respondents in the first experiment are not provided with any monetary incentive. Similarly further recruitment via Survey Monkey also does not include monetary compensation, but allows participants to donate money to charities of their choice. Thus, the author expects that the altruism of participants was enough to motivate them to partake in the study and avoid any bias. Consequently, all the experiments in this thesis use have participants who are not monetarily incentivised, yet the results are similar to other studies conducted either with lab experiments or surveys. Subsequent chapters demonstrate the design of each study and the results. In Chapters 3 and 4, the use of questions about decisions in risk and ambiguity which do not have a definitive answer helps to ensure that respondents are under less pressure to provide an accurate answer to the task given, as compared to solving cognitive tasks, where the very existence of a correct answer creates a perception of being evaluated and results in an evaluation bias (Curley et al 1986; Trautmann et al 2008). Focusing on standardized and simplified choice tasks allows us to address this issue precisely.

Chapter 3 Work screens matter for uncertainty attitudes

3.1 Introduction

The process of making a judgment is not isolated from its environment. Some studies (e.g Amabile et al 1996; Hill et al 2003; Shalley et al 2004; Redman et al 2009; Dul et al 2011) explore how specific features of the environment influence outcomes in the working environment. The renowned channel for these effects on people's decisions comes from the interaction of features in the environment with transient factors in humans: for example, people's mood (De Martino et al 2006; Delgado-García et al 2010; Fehr-Duda et al 2011), affect (Blay et al 2012), emotions (Gross and D'Ambrosio, 2004; Fessler et al 2004), and stress (Lighthall et al 2009). Alternatively, features outside the working environment could affect people's decisions, as a growing literature suggests that weather (Baillon et al 2016; Symeonidis et al 2010) affects decisions. These effects seem to have further implications for the whole market, as studies (see Cao and Wei 2005; Hirshleifer and Shumway 2003; Saunders 1993) show the effects of weather (Kamstra et al. 2003), and the impact of outcomes of sport competitions (Edmans et al. 2007) on stock market returns. Despite a substantial interest in factors that affect financial and investment decisions, little is known about the impact of environment on decisions, such as attitudes towards risk and ambiguity.

The physical features in a working environment affect people's creativity (Walter, 2012), retention and development of high quality work-life balance (Norfadzilah, 2016). Some studies (e.g Amabile et al 1996; Dul et al 2011; Hill et al 2003; Shalley et al 2004) have examined how specific features of the working environments influence work performance, resulting in suggestions for the design of an office or work space to enhance performance. One feature of a typical investment management environment is the electronic trading screen, whereby several

investors are exposed to a standardized interface. In a working environment, individuals can be exposed to various factors, which could impact their senses (Leventhal and Scherer, 1987). However, effects from the environment are dependent on people's perception of factors within that environment (for example, sunlight, emotions, mood etc,) and its interaction with the cognitive process when people make choices (Flavell et al 1985). For example, studies (McLian 1995; Rundmo 1996; Rundmo and Hale 2003) illustrate how risk perception and behaviours of individuals within a risky environment affect their perception of health and safety and, consequently, their decisions. These studies illustrate that the risky behaviours of individuals in a working environment are closely correlated with people's risk perception (Rundmo (1996), (1998b). In this chapter, the focus is on trading screens as a feature of the working environment and how it may affect people's attitudes to uncertainty.

Since the move from floor trading to electronic trading, authors (Ates and Wang 2005; Aitken et al. 2004; Tse and Zabotina 2001; Blennerhasset and Bowman 1998; Frino et al 1998; Martens 1998; and Pirrong 1996) agree that trading electronically, which requires the use of work screens, has been beneficial to traders. The trading screen seems to be an integral part of decision-making in the market as investors rely on them for information (Buck, 2014; Gary et al, 2017; Sellers et al, 2015) in making decisions. Figure 3.1 gives an example of an electronic trading user interface similar to the screens used by most traders in financial markets. Users have options of choosing colour schemes for their interface, which could be text and graphics in red and green on a dark background, or an alternative background which depicts the common black-on-white design of printed books and computer text editing software used in other professions. Different screen backgrounds may potentially differently affect mood, ability to concentrate, and subsequently, decisions: yet this has not been investigated so far.

[Figure 3.1 here]

Research (Mohawk et al, 2012; Levi and Schibler, 2007; Bradshaw and Holzapfel, 2010; Wijnen and Young, 2006; Harvey, 2011) suggest that sensors in the eye transmit information about bright light to the brain and that such information influences neural senses known to affect humans sleep, mood, and cognitive abilities.

Alternatively, other research (Steidle et al. 2011) suggests that dark visual perception may lead to less focus as compared with bright light. This difference in perceptual and processing conditions could translate into different uncertainty for people. This chapter hypothesizes that this difference could result in different risk-taking attitudes. Thus, it is of interest to assess the impact of a difference in light levels from screens on people's uncertainty attitudes, if any. This chapter demonstrates whether the colour scheme of screens could influence the decisions of people: in particular, how these screens could matter for decisions in risk and ambiguity. As investors typically make investment decisions using information on electronic trading screens, it is important to study the impact of screen themes (i.e. background, font and graphs colour) on uncertainty. Additionally, the results could help us to understand whether people are more or less likely to take risk depending on which screens they are exposed to. A study by Glimcher and Tymula (2017) demonstrated how the intensity and duration of sunlight affects people within the financial market. The study showed that brightness which has an effect on the brains' neural activities mattered for risk and ambiguity preferences. However, nothing was mentioned about the impact or contribution of trading screens on people's attitude towards uncertainty.

This chapter examines the effect of electronic trading screens on people's attitude to uncertainty using three survey experiments. Subjects reported choices for *inter alia* lottery type questions, similar to those of Kahneman and Tversky (1979), and the two-colour Ellsberg (1961) ambiguity task. Participants were randomly allocated to either of two colour schemes of the trading screen: bright background and dark text (control) or dark background and colourful text

groups (treatment). A third group had a dark background colour scheme and investment phrased questions, accompanied with graphics which mimicked that of investment software. The use of the investment context is to put people in an "investment mood" of reasoning by explicitly framing lottery and Ellsberg-type questions as an investment task. This allows us to separate the colour effect from the 'investment framing' context effect. Furthermore, participants have no pressure to provide accurate answers; apart from questions requesting solutions to standard cognitive test, where the very existence of the right answer creates a perception of being evaluated therefore the choices made by participants should be free of evaluation bias.

The results suggest that both colour schemes and the type of task (abstract versus investment) matter for decisions, yet there are qualitative differences. Subjects facing investment-style questions tend to be less risk-averse, although no impact of dark colour schemes on risk aversion was detected. In contrast, ambiguity attitude is affected by both the task type and the different colour schemes, with significantly less ambiguity-neutral subjects in the control group (bright background). Whilst the investment task reduces the fraction of ambiguity-seekers, it is the dark colour scheme that reduces the fraction of ambiguity-averse subjects in the sample. It is not clear how effects from the environment are channelled in people. Research suggests that mood and cognitive abilities are the usuals means through which sunlight and cloudiness affects people's decisions. Thus, using the rest of this chapter, I demonstrate in more detail that the light intensity of electronic trading screen could matter. The next section presents the theoretical framework for this chapter showing which factors in an environment could lead to an effect in the human decision-making process. Section 3.3 presents the design of the experiments and describes the variables used to test for effects on subjects. In Section 3.4, the results are presented based on the hypotheses of this chapter and are further discussed in Section 3.5. The last session summarizes the main points highlighted in this chapter.

3.2 Theoretical Framework

Bright light is found to have an awakening, alerting effect, independent of the time of the day (Czeisler, 1986; Leproult et al, 2001; Jung et al, 2010). Studies have linked certain moods to daylight, sunshine (Persinger, 1975; Cunningham, 1979; Saunders 1993; Chang et al, 2008) and weather conditions (Klimstra et al 2011). This chapter hypotheses that differences in light intensities between sunny and rainy days may have an effect similar to that produced by difference between the light (black on white) and dark (green/red on black) colour schemes. The evidence on the effect of daylight illuminance on people is mixed. For example Watson and Funck (2012) show that on more cloudy days traders increase short selling (which could be considered as more risk-taking), while Bassi et al (2013), showed that on extremely cloudy days people are more risk-averse than on days with more sunlight. Baillon et al (2016) further demonstrates that cloudy days seem to impact the ambiguity attitudes of respondents, and the results suggest that cloudiness leads to attitudes which are consistent with ambiguity-neutrality. Similarly, cloudiness and length of night-time have similar effects on traders' decisions (Symeonidis et al. 2010) in the market, suggesting that there could be a potential effect of exposure to bright light on people's decisions. Steidle et al (2011) further emphasises that in the dark visual, perception is less focused than in the bright light, thus triggering a different perceptual and processing style in subjects. Dark visuals tend to elicit feelings of freedom from constraints which could lead to more people seeking more explorative processes and could lead to risky outcomes (Steidle and Werth, 2013). Potentially, this could also translate into differences in risk-taking for individuals exposed to different light intensities.

To test this, my study considers two variations in the presentation of an otherwise identical decision task: the colour scheme and the wording. For example, subjects may be asked to choose between a certain payoff of $50 and a lottery that offers $100 or zero with equal probabilities, or to choose between a financial asset with a safe return of $50 and a risky

portfolio that yields $100 or zero with equal probabilities. Independent of whether this is written black on white or green on black, in both cases the decision task is same. Hence, using subtle variations in colour scheme should not matter for preferences and decisions. Figure 3.2 demonstrate the mechanism through which work screens may affect people's choices.

[Figure 3.2 here]

Figure 3.2 summarizes the theoretical framework for this chapter. The two main hypothesised channels for the computer interface to affect uncertainty attitudes, are mood and cognition. As explained above, computer screens may affect these either by interaction with the level of illumination; or by generating emotions (possibly based on distaste for some colour combinations); or by making subjects associate themselves with a professional environment, which in itself may generate emotions (through its interaction with the cultural context) or a direct affect.

In this chapter, the author anticipates there may be an effect of a screen on people's judgements through mood, cognitive ability and/or framing effect. Subjects who are randomly assigned to different screen backgrounds would react to the screen they are exposed to either bright (control) or dark (treatment). Their choices would reflect the effect of difference in light intensities on their judgement. Literature seems to suggest the bright screens should improve concentration and reduce bias or heuristics, due to links with people's cognitive abilities and mood. The next section reviews factors which have been identified by literature, such as framing, cognition and mood/emotion, as affecting people's decisions.

3.2.1 Framing

Tversky and Kahneman, (1984) describes framing as presenting alternatives within a given decision task in various ways, which could result in different outcomes (Tversky and Kahneman, 1979). McLain (1995), demonstrates how framing a decision problem positively means that individuals lean towards being less risk-averse. Studies (Kahneman and Miller, 1986; Sanbonmatsu et al 1991; and Tversky, 1977) show that people make decisions using a reference point, and whatever affects or alters this reference could lead to alternate outcomes. Kahneman and Tversky (1979, 1984) suggest that frames presenting information in alternative forms could strongly influence willingness to take risk. In support, McLain (1995) demonstrates how framing information negatively potentially results in more risk aversion as negative frames emphasise situational threats to existing resources. Fong and Wyer (2003) extend the concept of framing from gain and loss into cultural, social and emotional frames. Within these contexts, i.e. social and emotional frames, risks may appear more salient, thus inducing a risk-averse behaviour.

This chapter uses "investment framing" as a means to get people thinking about investment decisions Moskaliuk et al (2017), discuss a similar concept of "context priming. People's perception of investment frames may also differ in reasoning (Briley et al 2001). Whether there are differences in cultural factors seems to reflect in the assessment of likelihoods of events in Weber and Hsee (1998). These differences in people's backgrounds could result in different perceptions as to how the investment frame is viewed. Some may view it as investment decisions ("professional"), which could seem more difficult or risky than an equivalent lottery choice ("layman task"). Alternatively, those who perceive it as a "professional" framework may exert more efforts to concentrate on the task, as this could place them in a formal frame of mind similar to the office effect on cognitive skills in Moskaliuk et al (2017). Furthermore, if people are within a society that encourages gambling, for example, lottery type games, this familiarity may impact people's perception of the lottery based question task and would reflect in their

choices as more risk-taking. Meanwhile, others who view question types as investments may find it riskier and consequently be prone to making risk-averse choices. It may also be argued that the colours themselves may make subjects perceive decision tasks as investment problems, especially if these are combined with charts and diagrams that resemble those used in financial decision-making.

3.2.2 Mood and Emotions

Apart from the effect of framing on people's choices, there may also be either a direct or indirect effect of mood and emotions. Research increasingly focuses on the role of moods and emotions in organisations and their effects on performance (e.g. Brief and Weiss, 2002; Elfenbein, 2007; see Kooij-de Bode et al 2010 for a fuller review). The impact of the mood can be seen, for example, in higher self-ranking by individuals of their life satisfactions on sunny days as compared with cloudy or rainy days (Schwartz and Clore, 1983), even though in effect there are no significant changes in their life and well-being.

To begin with, there are several factors that could impact people's mood and consequently the decisions made as a result of that impact. Studies like Saunder (1993) show that weather conditions (Cao and Wei, 2005), temperature and sports sentiments (Edmans et al, 2007), amongst other factors, can impact the mood of individuals as well as affect their decisions and financial performances. Furthermore, an individual's mood has been demonstrated empirically to have been influenced by situational and environmental factors (Watson, 2000). These influences can result in mood misattributes (Schwarz and Clore, 1983, Schwarz 1990; Clore and Parrot 1991). Individuals in a positive mood might rely on heuristics or gut instinct in making decisions. As emphasized by Drevets and Raichle (1998), mood has an effect on neural activities and may affect the quality of decisions made. Individuals in a depressive mood tend to be more risk-averse or conservative in making risky choices, as compared to in positive and

neutral moods. According to Schwartz and Bless (1991), moods have effects on information processing, motivation and use of decision heuristics in an individual's judgement. For example, a negative mood can increase the odds of an individual making decisions in a systematic format that has been commonly applied in similar situations when making complex decisions. However, when it comes to processing information, individuals in a reasonably positive mood might make use of a simple approach in analysing information (specifically in analysing persuasive arguments or evidence). The individuals in a negative mood would most likely analyse information with greater effort than those individuals in a positive mood (Bless et al. 1990). However, the choice of decision processes is distinct from elements of cognition, such as attention, concentration, understanding etc.

This effect on people's decision processes seems to translate into their attitudes towards risk. For example, Drevets and Raichle (1998) suggest that individuals in a depressive mood tend to be more risk-averse or conservative in making risky choices, as compared to positive and neutral moods. More so, Au et al (2003) report that traders in a good mood tend to be overconfident and make risky decisions. However, in the domain of negative affect, positive moods did not matter for decisions: rather, more negative moods were associated with less risk taking, and less negative moods led to a greater willingness to take risks (Delgado García et al. 2010). The inconsistency in outcomes is probably subject to other factors within organisations. For example, Nofsinger (2005) demonstrates that social factors in mood result in negative moods which leads to more willingness to take risk in investors, consumers and corporate managers.

Emotions differ from moods, as emotions tend to have a clear cause or object and last for shorter periods (Frijda, 1994, Elfenbein, 2007; Schwarz and Clore, 1996). Moods are typically of relatively low intensity and tend to last longer than emotions. Sometimes moods arise from after effects of emotions (Cropanzano et al 2003; Schwarz, 1990): nevertheless, there is a clear distinction between emotion and mood, which is useful at the individual level. Within this

chapter, emotions could be triggered indirectly by an exposure to either colour scheme, while mood, which has a more stable state, may or may not be affected as a result of this. Plutchik (1997) distinguishes between eight basic emotions: fear, anger, sadness, joy, disgust, surprise, trust, and (positive) anticipation. Of course, screen colours cannot affect all eight but if people do not like the combination of colours used, they may find it disgusting and feel angry. Similarly, they may dislike or enjoy the investment framing of the questions. It follows that the way information is presented, can potentially affect emotions, and through these, either mood (as a more general and object-independent state) or cognition. In Druckman and McDermott (2008), emotions could both significantly influence individuals' willingness to take on risks, and alter the impact of frames on risky choices. The role of emotions thus interacts with framing, as it depends on the problem domain (e.g. financial/investment decision), and the specific type of emotion being studied.

Johnson and Tversky (1983) argue that specific emotions could affect people's risk assessment: positive emotions (e.g. happy state) trigger optimistic risk assessments, while negative emotions (anger, anxiety etc.) lead to more pessimistic risk assessments. For example, Nguyen and Noussair (2014) show that positive emotions as detected by the software registering facial expressions, are found to be positively correlated with greater risk-taking. And Wright and Bower (1992) found that happy participants thought that positive events were more likely and negative events were less likely (compared to a control condition) while sad participants thought that negative events were more likely and positive events less likely (compared to a control condition). Similar results are reported by Hsee and Weber (1997). Furthermore, positive emotions were found to make people less focused, while negative ones improved concentration levels in Blay et al, 2012. Duque et al (2013) report faster decision times from subjects who viewed a happy movie as compared to those who watched a sad film. Megias et al (2014) demonstrate that drivers are affected by emotion-laden billboards: specifically, risk-taking is

lower, speeding-up is reduced and responses are faster after seeing negative pictures. Induced emotions such as sadness seem to increase risk aversion over gains, and anger decreases loss aversion (Campos-Vazquez and Cuilty, 2014).

Some studies infer that emotions could be channels for other factors to affect people's decision process. Baillon et al (2016) hypotheses that mood could be the channel for which sadness, raises ambiguity-neutrality in people. Daniels (2003) links cognition with emotion through positive illusions. With a direct link to cognition, Taylor et al (2017) show that positive emotions, such as happiness, induce a coping mechanism in people exposed to a stressful situation which enables a better response to cognitive behaviour therapy. This implies that interactions between emotions and cognitive skills could enhance people's ability to deal with stressful situations, which may result in people becoming more risk-neutral or maintaining their risk-averse attitudes.

3.2.3 Cognitive Skills

Cognition generally refers to mental processes associated with thinking, reading, learning, remembering, reasoning, and paying attention; attention and concentration are preconditions for successful learning, problem solving, and decision making (e.g Duval, 2011; Schmidt, 1995; Wirtz et al, 2013). The literature on the role of cognition in organisational, managerial and entrepreneurial decision-making is vast (e.g. Daniels, 2003; Pillai, 2010; Chaston and Sadler-Smith, 2012, and references therein); my focus here is on the link between the environment and decisions which could be via emotions, mood or cognition.

Based on the cognitive reflection hypotheses, people with better cognitive reflection ability are more likely able to check faulty intuitions and reduce decision biases (Fredrick, 2005; Campitelli and Labollita, 2010; Liberalli et al, 2012). So far, the evidence demonstrating a link between cognitive reflective skills, risky decisions and ambiguity aversion is mixed. There are studies which suggest that risk attitudes are related to cognitive skills, such that individuals who

perform well cognitively seem to be less risk averse (Benjamin et al 2013; Burks et al 2009; Dohmen et al 2010) and young individuals who have more cognitive skills are less risk-averse (Bonsang and Dohmen, 2015). Other more recent studies for example, Booth and Nolen, 2012; Borghans et al, 2009; Eckel et al, 2012; Sutter et al, 2013; Taylor, 2013 indicate within their findings that the relationship between risk attitudes and cognitive reflective skills is insignificantly correlated. Regarding ambiguity averse attitudes studies like, Borghans et al (2009) and Dohmen et al (2010) did not find any noteworthy correlation between ambiguity aversion and cognitive skills, while Rustichini et al (2012); Sutter et al (2013); Dean and Ortoleva (2015) found correlation between some non-cognitive skills and attitudes to ambiguity.

Given these mixed views, this chapter is of the opinion that cognitive reflection skills are correlated with the risk and ambiguity attitudes of individuals. Higher CRT (cognitive reflection test) scores predict better performance in various cognitive tasks, including reduced framing effects, less discounting of delayed rewards (Cokely and Kelley, 2009; Frederick, 2005) and probability matching (Koehler and James, 2010). Risk-seeking, or –aversion, is significantly affected and even reversed when subjects are forced to make decisions under time pressure (Kocher et al. 2013; Saqib and Chan 2015; Young et al. 2012); the effect is possibly due to a simplification of decision rules under time pressure (Dhar and Nowlis, 1999; Ordóñez and Benson, 1997; Payne et al 1996). High cognitive abilities, as detected by the cognitive reflection test (Frederick, 2005), are negatively correlated with risk aversion (e.g. Oechssler et al 2009; Dohmen et al 2010). If cognitive abilities are affected by the environment, this should translate into uncertainty attitudes, too. For example, in a recent paper, Moskaliuk et al (2017) show that people's attention and concentration are higher in an office environment, leading, in particular, to more risk seeking.

Apart from cognitive and emotional effects on people's decisions the environment or aspects of the environment seem to affect people's perception. These include weather (Frühwirth

and Sögner, 2015), room temperature (Huang et al, 2014), and day-light (Kamstra et al, 2003). The physical environment is also known to affect people's judgement either directly or indirectly. In terms of an indirect effect this is channelled through mood, such that an effect on mood leads to an effect on decisions. For example, Huang et al (2014) shows how ambient temperatures lead to increased perceptions of social closeness towards other decision makers, such that individuals rely on the decision from others as validation for preferences towards products and stock price forecast. Moskaliuk et al (2017) shows that simulating aspects of the work place can lead to increased concentration and less risk aversion as opposed to a non-work place environment. Thus, the environment could either directly or indirectly play a role in our decision.

Weather effects on decisions

Taking this a step further, studies show how the climate environment could affect perception. For example the weather and the seasons could have an effect on people's judgement. A study by Kathy et al (2006) shows that lunar phases are associated with stock market returns in 48 countries. The study demonstrates that lunar phases seem positively associated with the mood of investors. This might be why stock returns are lower on days around the full moon than on other days.

In stock market research, environmental factors such as the weather have been known to affect investors' decisions through mood misattribution i.e. that investors' decisions are somewhat affected by their feelings. These feelings can be induced by transient factors such as the weather, seasons and environmental sentiments, such that people who are in a good mood as a result of good weather, make optimistic judgments about equity thus showing less risk averse attitudes. Thus, the weather also seems to affect investors' decisions either directly or through

mood. Johnson and Tversky (1983) show that weather could impact the mood of individuals and lead to cognitive bias in judgements. This leads to wrong estimations and expectations of risk.

Alternatively, weather could influence mood or other variables that could affect the risk attitudes of individuals. For example, humidity and cloud cover could influence the mood of individuals and thus impact stock market decisions. This was demonstrated by Bassi et al, (2013) who demonstrates how weather influences individuals' decisions by affecting their risk attitudes. The study shows that good weather improves the mood of investors and reduces risk aversion. Similarly, Frühwirth and Sögner (2015) also look at the weather effect on the financial markets by observing its effect during earnings announcement. The study finds that the weather could influence mood during an announcement of positive earnings but not for negative earnings. This seems to suggest that good weather like sunshine influences the markets. For example, Saunders (1993) show that the returns for NYSE index tend to be negative when its cloudy in New York City. On an international level, Hirschleifer and Shumway (2003) show that the weather of most cities where an exchange is located does affect the market returns. Thus, sunlight seems to be associated with increased stock returns as sunlight tends to raise the mood of individuals, leading to optimistic attitudes (Kamstra et al, 2003).

There seems to be different streams of literature which investigate the impact of mood on the financial market. This includes analysis of asset prices in relation to seasonal affective disorder (Kamstra et al, 2003), daylight saving anomaly (Kamstra et al, 2000) and sports sentiment. This chapter simply looks at the effect of weather as channelled by the working environment rather than on mood. Thus, this chapter expects that when the work-place creates a less strenuous environment and the weather is positive, this could lead to more risk aversion.

This study proposes that the brightness of screen may impact people, given that sunlight or the absence of sunlight does matter for people's judgments. Consequently, this chapter further proposes that the effect from the screen, especially the bright screens with black font, could

produce higher illuminance, which could impact people differently in comparison to subjects who are exposed to a screen with dark background. This is such that even when subjects adjust their screens to increase the brightness on a dark ground, the overall effect should still be similar to having less illuminance as compared to a bright-screen background.

Effectively, this study anticipates that the effects of the bright a and dark screens should differ. However, the way in which they may affect people is subject to their perception of illuminance and its effect on their decision processing. Furthermore, given that subjects choose to take the survey from wherever they are located, this study anticipates that slight or minor adjustments to screen settings such as increasing the level of brightness or reducing it, should not affect the overall impacts of screen wavelength massively. Moreover, subjects were told the survey was for five minutes. This short period is used to keep subjects motivated to tolerate the conditions they are exposed to, in order to provide the effects as appropriate and thus, allow the study to test its hypotheses below.

3.2.4 Hypotheses

Hypothesis 1 (control versus treatment/dark-screen with colours)

Average risk-taking and ambiguity-aversion of subjects exposed to dark screened background with bright coloured fonts are not equal to the averages of those exposed to a white background with black fonts.

Hypothesis 2 (treatment 1 versus treatment 2)

Average risk-taking and ambiguity-aversion of subjects exposed to dark screen background with bright coloured fonts are not equal to the averages of those facing investment framed tasks.

Hypothesis 1 answers the question whether the colour scheme of a computer interface affects decisions with uncertainty. Hypothesis 2 allows us to differentiate between the professional framing effect and the colour effect. If the effects (if any) of the screen colours are indeed due to the investment framing effect, there should be no difference observed between the two treatments.

Hypothesis 3 (Uncertainty attitudes and interactive factors such as mood/cognition)

Hypothesis 3 identifies the channels of any potential effect: Individual risk-taking and ambiguity-aversion are affected by individuals' mood and/or cognitive skills. See figure 3.3, which shows the control and treatment screens which subjects are randomly assigned to. Averages of attitudes from each group is compared using Mann Whitney U test.

[Figure 3.3 here]

3.3 Experimental design

To test the hypotheses stated above, this chapter conducts three online experiments with stated choices in standard situations involving risk and uncertainty. The objective is to identify differences, if any, in subjects' decisions, induced by the graphical interface. The two online survey platforms used are Qualtrics.com and Surveymonkey.com. Both are increasingly popular in academic research (recent examples would include Bursztyn et al 2014 using Qualtrics to study social influence on financial decisions: and Wiswall and Zafar, 2015, who resort to Survey Monkey to collect data for their analysis of the effects of beliefs about the future on college course choices). This section presents the experimental design and then explains the recruitment procedure and discusses incentives. The survey is deliberately designed to be short, with relatively short questions, to keep subjects motivated.

3.3.1 Experiment 1

Subjects are randomly allocated to either a treatment or a control group. The control group sees questions in black on a white background, with no graphics included. The treatment group faces questions of the same nature, some identical to the control group, some formulated as investment tasks. The colour scheme for the treatment group employs a combination of green, red, grey and yellow on the black background. These colours are used on the fonts and graphs (see figure 3.3), as the questions in the treatment group are accompanied with examples of various charting software of the graphical interface. Subjects are explicitly advised that this is for illustration purposes only and does not relate to the substance of questions. Apart from that, the treatment group is given a time pressure stimulus of the following form: "The experiment should not take more than five minutes of your time with the average full completion time of two minutes and 43 seconds. We will record the time you spend to answer the questionnaire from the moment you click the "Next question" button below." This stimulus is implicit subjects are not

required to compete with others, yet they can be intrinsically motivated to do so. An additional pressure is created by making the initial experiment description lengthier for the treatment group.

The experiment consists of four parts presented to subjects sequentially without interruptions. Part 1 asks subjects to evaluate their current mood on a five-point non-verbal scale. A face with a smile is shown: by using the slide bar, subjects can change the expression in this face from a smile to a frown. Subjects are also asked about the environment where they are physically present (home, work, public space, library, or other) and how productive they are in this environment, using a five-point scale from "very productive" to "very unproductive". From the experimental design perspective, the objective of Part 1 is to expose subjects to the particular graphical interface (especially the treatment group) for some time before proceeding with the decision questions.

Part 2 evaluates subjects' risk attitude. The questions presented to the treatment group have the same task as for the control group yet are formulated in terms of investment decisions. For example, the treatment group would be asked: "Assume you are a portfolio manager; your portfolio currently has a 50/50 chance of yielding you either $100,000 or nothing, what is the LOWEST PRICE at which you would be willing to sell this portfolio now?", while the control group faces the question: "Consider a lottery ticket with a 50% chance of winning $100,000 and 50% chance of getting nothing. What is the LOWEST amount of money you would prefer to this lottery ticket?". Subjects are given a drop-down of five options, ranging from $60,000 to $40,000 with a difference of $5,000 within each interval. This question is repeated twice, thus questions 4, 5 and 6 are the same type of question, with different options on the drop-down menu. The options range between $60,000 to $20,000. The questions in of Part 2 are summarised in Table 1. Apart from Part 2, all other questions are absolutely identical between the control and the treatment groups.

Part 3 consists of two ambiguity attitude questions which replicate the standard Ellsberg (1961) experiment: "Consider two urns with 100 balls in each. Urn A contains red and blue balls in an unknown proportion. Urn B contains 50 red balls and 50 blue balls. You would get a prize if you draw a ball of the designated colour. From which urn would you draw urn A or B?" The designated colour is red in question 8 and blue in question 9. For the third experiment, cognitive based questions and risk questions are reduced to just one of each measure.

Part 4 is the final section, in which participants answer additional demographics and working environment questions and repeat the question on subjects' current mood, similar to that in Part 1, in order to measure the impact on mood.

[Table 3.1 here]

3.3.2 Experiments 2 and 3

To distinguish between the impact of wording (investment framing in Part 2 in Experiment 1) and the presentation (colour scheme used), a second experiment is conducted, in which subjects are randomly assigned to either a control or one of the two treatment groups.

The control group faces exactly the same questions and colour scheme as in Experiment 1. One treatment group (Treatment 1- "dark screen") faces the same questions as the control, but in the traditional colour scheme (as treatment in Experiment 1). The other treatment group (Treatment 2, "investment") faces the same colour scheme as the control group, but investment-framed questions in Parts 2 and 3, as in Table 1.

In Experiment 2, ambiguity attitude questions (Part 3) are placed before risk-attitude questions (Part 2). The main reason for this was that in Experiment 1, due to a higher drop-out rate in the second half of the survey, the number of responses to Part 3 was lower than to Part 2. If subjects perceive questions in Part 3 as more difficult, answering them earlier when motivation is still high should raise the overall completion rates. This change was made for all three subsamples in Experiment 2 and 3 and therefore does not affect the cross-subsample comparison.

In Experiment 3, the ambiguity question is also placed first as in Experiment 2. In addition, to that Part 2 is reduced to one question on willingness to accept risk, as well as a single question on willingness to pay for risk. However, rather than having three questions based on willingness to accept a lottery, the study uses one question to collect the certainty equivalent and then asks five cognitive skills-based questions. In Part 3 for those exposed to dark screen backgrounds, the cognitive questions are identical to questions in the control group, while within the investment group cognitive questions are phrased as investment-based questions as seen below.

[Table 3.2 here]

3.3.3 Recruitment, randomization and incentives

In Experiment 1, the author made an effort to achieve a diverse participation. This study proposes that the recruitment of participants via Facebook, could explain why there is a higher proportion of young subjects in the pilot. In other to avoid this difference in age groups, Survey Monkey was used in subsequent recruitment as it ensures that samples are very representative with respect to age, gender and income of the total population of the United States. The use of Survey Monkey also helps to maximize the effect of intrinsic incentivization, although it does not employ personal plea and invitation of friends and friends of friends (and so on) as was used in the pilot. Survey Monkey does reward charities chosen by subjects for sponsorship, but the subjects themselves are not renumerated. Thus, to keep participants motivated the study uses less questions with no more than 15 in total. Furthermore, potential subjects were informed that the survey will not take more than five minutes, which helped to recruit more participants and encourage them to send the invitation further. As suggested by Crawford et al (2001), more participants would take part in a survey if they know it is rather short. In addition, potential subjects are informed that they would have to answer 15 questions, and that there were no right or wrong answers.

In the invitation post (or email) participants received a link to a survey on Qualtrics. This basic survey consisted of one screen with a brief description of the experiment, identical for all participants, and a request to confirm willingness to participate by clicking the "Continue" button. This button was linked to an algorithm programmed to automatically and randomly further redirect subjects to one of the two differently styled surveys on Qualtrics, as described for the control and treatment groups above.

Participants of Experiment 1 were explicitly told there would be no remuneration. Their main incentive to participate was based on their friendly relationship with the person who sent them the invitation, and an interest in the survey for Experiment 1. Vinogradov and Shadrina (2013) show that these non-monetary intrinsic incentives can provide results close to those obtainable in a lab, in particular with questions similar to those used in the current paper. Moreover, participants could opt out of the survey at any point in time and were not forced to answer questions asked, which removes incentives to misreport their actual decisions and beliefs. The drop-out rate of over 30% from the control and treatment groups, had an impact in measuring 'change in mood' or difference in mood, measured by taking the difference between the first question on mood (question 1) and the last question in the survey, also on mood. This is why Survey monkey was used to ensure a higher number of subjects would participate, irrespective of anticipated high drop-out rate.

In Experiment 2, participants were recruited by Survey Monkey from a database of subjects who gave an earlier consent to take part in surveys. Subjects were allocated to groups by randomizing the links to one of the three surveys sent in the invitations by Survey Monkey, controlling for similarity between the resulting subsamples in terms of their demographic composition. Survey Monkey incentivizes subjects by promising to donate to a charity of their choice. In a special control question, subjects confirmed that they took part in the survey mainly because they wanted to donate to the charity, wished to help researchers collect necessary data

and were curious to see what sort of questions they would be asked. Although different incentives may, in general, lead to different reported and actual choices, our design is based on randomly assigning subjects to control and treatment groups, across which incentives are identical. Conclusions are based on the differences between these groups, if any, thus leaving the incentives factor aside.

3.3.4 Data

Information about participants comes from Parts 1 and 4 of the questionnaires. The variables used to test the impact of the stimulus are mainly from Parts 2 and 3.

3.3.4.1 Participants

This chapter received 340 responses in Experiment 1, 735 in Experiment 2 and 852 in Experiment 3 with average (across treatments) completion rates falling between 60% and 82%. Summary statistics are in Table 3.3 below. The differences between the two experiments are attributable to the methods used to recruit subjects. Interestingly, there were remarkably more male participants in Experiment 1, perhaps because they are more active in social networks. The samples in Experiment 2 are more balanced. There is little difference between the control and treatment groups in each experiment, which is important for our setup.

[Table 3.3 here]

In Experiment 1, slightly more participants were assigned to the control group due to the randomization method chosen. This distribution is comparable with the outcomes of flipping a coin and tossing a die in Altman and Bland (1993). The disparity cannot be attributed to self-selection as at the randomization stage, all subjects see one and the same screen with a brief description of the experiment. In Experiment 2, additional surveys were sent out with a link to either control, or to one of the treatment groups, depending on the response rates in each of the groups, and on the distribution of subjects in them according to gender, age and employment

status. Anecdotally, one participant commented that although the invitation email stressed the importance of having more male subjects in the survey, surprisingly there was nothing gender specific in it. This example of targeted recruitment explains the balanced nature of the samples in Experiment 2 yet has no effect on our results as at the point of accepting the invitation, subjects do not know if they would be assigned to a control or a treatment group.

3.3.4.2 Variables

Variable mood comes from answers to question 1 in Part 1 and a matching question in Part 4. The two measurements allow us to compute the change in mood during the experiment. This is done in order to measure the effect of the neutral and treatment environment on the participants and is calculated by taking the difference in mood to indicate if individuals were positively affected (i.e. they enjoyed the survey) or negatively affected (i.e. they left the survey after starting the experiment session). This also included individuals who concluded the survey but did not like the features in the treatment group. The mood before and after taking the experimental session also helps in understanding the influence that could come from partaking in the experiment (i.e. a measure of the framing effect of the work environment). The mood question simply asks respondents to indicate using the emoticon scale how they feel before and after the experiment. Each scale goes from five to one where five is good, and once is bad.

The main focus of analysis is on decisions in Parts 2 and 3, which are driven by subjects' risk and ambiguity attitude. Questions 4, 5 and 6 measure the Certainty Equivalent (CE), i.e. the certain amount that makes a subject indifferent between playing the lottery and obtaining this amount for sure. This measure can be transformed into risk premium (RP) as shown in equation 1 below:

$$RP = \text{Expected Value (from question)} - CE \text{ (from response)} \quad (3.1)$$

As usual in the literature, Questions 5 and 6 are used to refine the measure found in question 4. Figure 3.4 is a standard graphical interpretation of CE (certainty equivalent) and RP

(risk premium), presented here for a comparison with the other measures of risk attitude used in this study. Lower CE corresponds to a higher RP and thus signifies a higher level of risk aversion.

[Figure 3.4 here]

Question 7 fixes the certainty equivalent and identifies the lottery that makes subjects indifferent between the risky and the safe option. The outcomes of the project are fixed: to ensure that respondents provide the lowest probability of success that the subject would be willing to accept, the elicited variable may be referred to as "reservation probability" (R_Prob). Figure 3.5 depicts two lotteries with probabilities of success 50% and 40%. Depending on subject's preferences (utility function) one of the lotteries would correspond to the fixed CE (in the figure this is the lottery (10; 50%)). Reservation probability is also linked to the risk premium as it determines the expected value of the lottery a subject chooses:

RP = Expected value (from response) – CE (from question). (3.2)

[Figure 3.5 here]

Higher R_PROB is associated with a higher risk premium and hence indicates higher risk aversion. Although questions 4 and 7 implicitly measure the same parameter, risk premium, they operate with different values of the prize (amount generated by investment) and risk (subjects effectively choose acceptable risk in question 7), therefore these absolute risk premia are not directly comparable. As subjects' preference for risk, may change across different domains. For example, a person may be risk-averse for gains and risk-seeking for losses because they perceive them differently. Hence, for this study it is acknowledged that paying for risk and accepting risk may be perceived differently by subjects, and thus these domains are not compared directly. Instead, by denoting with *p* the probability of success (either given by the question or chosen by

the subject) and W the amount generated by the lottery or the investment project in question, if successful, the relative risk premium is computed (see, e.g Eeckhoudt et al 2005, p.18) as

$$RRP = \frac{RP}{pW} \qquad (3.3)$$

which gives a basis for comparison between risk attitudes demonstrated in questions 4, 5,6 and 7. This chapter does not compare the risk premium directly, rather, it observes the impact of the work screen on both measures of risk premium. The risk premium for both measure, were not compared directly because although subjects may have similar preference for risk, this may change across different domains. For example, a person may be risk averse for gains and risk seeking for losses because they perceive it differently. Hence, for our study we acknowledge that paying for risk and accepting risk may be perceived differently by subjects, and thus do not compare these domains directly. In both measures of risk, the reference point of individuals differs. Willingness to accept (WTA) risk shows the risk an individual is willing to take on for a guaranteed amount, but this risk level can change when individuals have to give up some wealth as measured by willingness to pay for risk.[1] A question (8) was initially asked in the pilot experiment and Experiment 2 which measured the mean reservation probability i.e. the lowest probability a person would prefer amidst five options provided with different lotteries and expected payoffs. However, due to the introduction of new variables i.e. cognitive measures and the restrictions on the number of questions that can be asked, this variable was dropped. Furthermore, the measure seems to behave similarly to the willingness to pay for risk measure i.e. question 7. It was originally included as a robustness check on the risk measures.

Questions 9 and 10 jointly identify subjects' ambiguity attitude from their responses i.e. when choosing one of two options i.e. option A is an urn with equal probability of getting a white or red ball while option B presents a urn with unknown distribution. Subjects are deemed ambiguity-neutral if they choose A in question 9 and B in question 10 or vice versa. Subjects are

[1] This question 8 was dropped for experiment 3, consequently this chapter only focus on reservation probability (willingness to pay for risk) and Risk premium (question 6) as a measure of willingness to accept risk

ambiguity-averse if they choose B in both questions, and ambiguity-seeking if they choose A in both questions. Although these measures of ambiguity attitude are not perfect (e.g an ambiguity-neutral subject, who believes that urn B has the same composition as urn A, is indifferent and can equally choose A or B in both questions and thus would be falsely classified as ambiguity averse or ambiguity-seeking), they give a fair indication of the average ambiguity attitude in the sample. For our purposes, it is important that the same measure is applied to the control and the treatment groups to see the difference between them. The fraction of each type of subjects' ambiguity and risk attitudes will be measured across groups.

The risk attitude of individuals was measured using the risk premium calculated from question 4 to 6 as stated above in Parts 2. Based on the options indicated by respondents in responses to the questions in Table 3.1, the researcher was able to measure the risk attitude of individuals. Using the options for classification, individuals who indicated $60,000 to $50,000 in the first two questions and also selected $40,000 and $35,000 from the drop-down menu were risk-averse, while individuals that indicated the third options were neutral and other were risk-seeking. These values are considered as the certainty equivalent for each individual, which was further deducted from the expected value of the risky prospect ($50,000) to give the risk premium for each individual. From this variable the risk-averse attitude dummy variable for individuals was calculated, where '1' indicates individuals with a positive risk premium and '0' indicates risk seeking and risk neutral individuals. This study follows in line with literature to study the effects of framing environments on the risk averse attitudes.

Another dependent variable is risk-averse behaviour for willingness to pay based on question 7 in section 2 of the survey experiment. This question asked respondents for the level of risk they are willing to pay for, given that they had $1,000. Hence, individuals indicated the percentage/probability of risk they are willing to pay for. These values ranked from 5% to 100%

where the dummy variable for risk averse behaviour indicates ‘1’ for values between 50% to 100% and ‘0’ otherwise.

Other variables in the model include an age-binary variable which indicates ‘1’ for individuals from 35 and below, ‘0’ otherwise. There is also a continuous variable time spent, which is the amount of time the individuals spent on the survey. There are other variables in the model which are dummy variables derived from the location question in section 1 of the survey questions. The question asked for participants to indicate the physical location where they partook in the study. From the answers, dummy variables were created with ‘1’ indicating that respondents were at home, work or outdoor when taking part in the survey or ‘0’ otherwise.

In Part 3 of Experiment 3, respondents were asked five cognitive reflective questions after the risk and ambiguity questions. From the answer given by respondents, variables such as “Cog5” the sum of answers given by the respondent to all five cognitive questions was created. As well as “Cog-high”; a dummy variable indicating the individuals in each sample with high performance in cognitive skills within each group. This value is based on the number of cognitive questions answered correctly. Another variable “Cog-standard” indicates respondents’ performance on the three standard cognitive questions as used in study by Sinayen and Peters (2015).

Another key variable is the treatment variable, a binary variable which takes ‘1’ for observations from a treatment group and ‘0’ for those in the control group. These variables are inputted into a difference in means test, where groups are compared against each other for differences in average, to indicate a treatment effect if differences are significant. For example, if the treatment factor influences the risk-averse and ambiguity attitude of individuals within the groups the difference in these sub-categories should reveal this effect if any.

3.4 Results

Using non-parametric independent t-test (Mann Whitney U test) analysis, this chapter tests the difference between the control group and each treatment group within each experiment, testing difference in means or averages of risk premium and proportions of risk and ambiguity attitudes. The Mann-Whitney U test is one of the most common tests used in related research for ordinal variables to test for differences between groups (MacFarland et al, 2016). This study used the non-parametric test as the variables are ordinal (i.e. participants choose an option from \$60,000 to \$20,000 in 3 similar lottery questions in Experiment 1 and 2, and from one question in Experiment 3). Thus, by comparing the average of these ordinal variables to test for a difference in means the study can isolate the effect of the work screen on each variable tested. Binary variables which indicate the presence of an uncertainty attitude, for example '1' if risk averse and '0' otherwise are also tested for significant differences across groups. The study assumes that sample groups, i.e. control and treatment groups, are independent as participants were randomly allocated within each group. Thus, testing two independent groups would require both groups of risk premium quantities of control group *x* and treatment group *y,* to be arranged in order, such that it aligns with the probability 1 if $P\ (x_i = y_i) = 0$. Where U counts the number of times y precedes x; such that the null hypothesis $P(U = U') = \alpha$ where if $U, < or > U'$ There is significant then the groups are significantly different. And T represents the sum of the ranks of the *y*'s in the ordered sequence of *x*'s, while *m* signifies the number of *y* variables and *n* the number of *x* variables hence (Mann and Whitney, 1947):

$$U = mn + \frac{m(m+1)}{2} - T \qquad (3.4)$$

The next sections show the difference in mean output focusing on risk and ambiguity attitudes. Subsequent sections provide findings which illustrate the factors which interact with people's decision processing, and the effects of these factors on these judgements, if any.

3.4.1 Risk attitude

In Experiment 1, the result in Table 3.5 mostly indicates that there is significantly (p-value < 0.01) less risk-aversion (a proportion of risk averse is 0.30 compared to 0.645 in the control group) in the treatment group than in the control group. This refers mainly to the measure of risk-aversion derived from the certainty equivalent elicited in question 4. This is supported by results in Table 3.4 which shows lower risk premium in the treatment group ($6,591 significant at p-value < 0.05) compared to the control group $11,687). The investment framed treatment groups also shows lower average risk premium ($7,358 in experiment 2 and $4,776 in experiment 3). These results seem to suggest that the treatments of investment frame result in less risk-averse attitudes. Moreover, the difference in R_Prob between the control and the treatment group also indicates less risk aversion in the treatment group, yet this difference is only significant at p < .05, given that consistency in subjects' answers is controlled for (i.e. subjects are risk averse across willingness to accept risk and willingness to pay for risk). This could suggest that the insignificant result in Experiment 1 (control group reservation probability is 22.56 and 25.52 for treatment) is possibly due to the relatively low number of observations that meet both completeness and consistency criteria.

However, Experiment 1 does not allow one to judge whether less risk aversion in the treatment group is due to the interface used or to the investment-style framing of the questions. Experiment 2 sheds light on this, and although there are no significant differences in answers between the dark screen interface treatment and the control group, the significant differences between the investment framed groups and the control group suggest that the risk premium is significant, i.e. there is lower risk aversion due to investment treatment.

[Table 3.5 here]

Table 3.5 also shows analysis on the fractions of risk-neutral and risk-averse subjects across treatments in the two experiments. Although Experiment 1 does not reveal significant

differences at p-value < 0.01 or p-value < 0.05 between the control and the treatment group, Experiment 2 confirms the above result. Whilst there is no impact of the colour scheme on the relative size of risk-neutral and risk-averse subjects, there is a significant reduction in the fraction of risk-averse subjects, and an increase in the fraction of risk-neutral ones, once subjects are exposed to the investment-style questions.

3.4.2 Ambiguity Attitude

The fractions of ambiguity-averse, seeking and neutral subjects are also presented in Table 3.6. In all treatments this chapter finds about 67-78% ambiguity-averse subjects, which is consistent with other studies using the Ellsberg task (e.g. 77% in Einhorn and Hogarth, 1986; 61% in Kühberger and Perner, 2003; 63% in Trautmann et al 2008; 65-69% in Vinogradov and Shadrina, 2013). Significant differences are detected in experiment 2[2], where both the colour scheme and the investment framing raise the relative number of ambiguity-neutral subjects, yet differently affect the fractions of ambiguity-seeking and ambiguity-averse subjects. Investment-style questions significantly reduce the fraction of ambiguity-seeking subjects and have no effect on ambiguity-aversion. At the same time, placing subjects in front of a dark-screened colour scheme on the display, with neutral questions, reduces the fraction of ambiguity-averse subjects, leaving the fraction of ambiguity-neutrals unaffected.

[Table 3.6 here]

It appears that presenting people with risky prospects as investments makes their decisions less likely to be driven by optimism, and at the same time raises their average propensity to take on risk. This implies that when people think about investments although it might elicit the need to be rational, it could also elicit the need to take more risk in hope to get higher returns, as people may focus more on expected returns than risk. To an extent, this can be explained by a conscious attempt of people to 'think rationally', leaving emotions and psychological attitudes aside. In contrast, the colour scheme of the computer screen affects the sub-conscious part of decision-making, leaving risk-attitude unchanged. In our case, more dark-

[2] In Experiment 1 controlling for consistency in risk-attitude answers results in a sharp reduction of the number of valid observations. Relaxing this control, there are 126 and 78 observations in the control and the treatment group respectively. On this increased number of observations, the difference in fractions of risk-neutral and risk-averse subjects from question 4 becomes significant at $p < .05$ and $p < .01$ correspondingly, with more risk-neutral subjects in the treatment group, and more risk-averse in the control. This is in line with the findings from Experiment 2 reported in Table 4. Differences in ambiguity-attitude fractions remain insignificant.

screened interface leads more people to a less cautious behaviour (the fraction of ambiguity-averse subjects decreases, raising the fraction of ambiguity-neutrals and not affecting the ambiguity-seekers). This latter interpretation is due to the common view of ambiguity-aversion as 'pessimism', with subjects perceiving possible negative outcomes as being more likely than positive ones. The result could imply that gambling screens, when made brighter with fewer colours (one or two) would make gambling less attractive to people, and consequently induce more rational decisions-making. This is because dark screens with various colours are considered more relaxing than a bright screen with just black or blue colours only. In gambling and betting sites, the screen background is usually dark, with colourful digits and figures. From this study, this screen setting encourages less ambiguity aversion, and could result in more ambiguity neutral attitudes towards gambling. Therefore, the screen settings for gambling encourage risk taking, and so governments could intercede by ensuring that the settings are adjusted to a brighter background with one or two colours only, especially blue colours, which could then hinder risk taking, and increase more rational and averse decisions.

3.4.3 Exogenous factors and risk premium

To complement the above analysis, estimates of the impact of treatments on risk and ambiguity attitudes is calculated by using the respective dummies for risk-aversion in WTA (willingness to accept) and WTP (willingness to pay) for risk, as dependent variables in a regression analysis, while controlling for factors like gender, age, social status (employment and/or household income), knowledge of statistics, and physical location. The latter allows us to judge whether the type of environment in which subjects take our survey affects attitudes, on top of the stimulus applied in our experiments. These factors are called exogenous, as the experimenter has no control over them, unlike mood and cognitive skills that may be influenced by the stimulus applied in the treatments.

For Experiment 1, there is only one treatment group, hence all the data can be pooled, and a dummy treatment (= 1 for observations coming from the treatment group, and 0 otherwise) can be introduced. In Experiments 2 and 3 the control group is combined either with the investment framing group or with the dark screen interface group, giving the treatment dummy the respective interpretation in each case. In regressions with the dark-screened treatment, no significant effect of treatment on risk-aversion was detected, confirming the observations from Table 3.6, for which reason the results are not reported.[3]

[Table 3.7 here]

Using a probit model, we test for the effects of individual characteristics which includes age , gender, location, and employment status on uncertainty attitudes. The model also analyses whether the investment can explain the difference in risk-averse attitudes across the two measures (i.e. willingness to accept and willingness to pay for risk) of risk employed in this study. The probit model tests for factors that explain risk attitudes, in particular risk-averse attitudes, as this allows for comparison with most literature. To test whether the investment frame does drive risk attitudes, we test for this effect on using pooled data and testing on the investment treatment only. The dependent variable in the probit model measured using the binary variables of risk-averse from willingness to accept risk based on response to question 4 to 6 (RA WTA) and willingness to pay for risk based on responses to question 7 (RA WTP). Using other binary independent variables such as the various treatment where 'Treatment' as '1' and '0'otherwise, 'Low income' (<$75,000 per annum), 'Home' which indicates if subjects where either at home or not, "young" for subject who are below 45 years, 'Male' gender, 'Stats good' indicates good knowledge of statistics, and from the seven categories on employment, 2 categories where combined, these are paid and unpaid volunteering was combined with paid and unpaid internships to form for a sixth group. The groups were combined due to low numbers

[3] The only significant control variable was sex in Experiment 3: men are less likely to be risk-averse (p = .01). The same effect is reported in Table 3.7.

within each group. Of the six groups, only five groups were included in the model, representing under-graduate students, post-graduate students, employed, unemployed, and self-employed. A similar probit model (equation 5 below) using this same independent binary variable is estimated using ambiguity-averse binary variables for only Experiments 2 and 3 only. This is because the study hypothesis that investment frame main be the driver in Experiment 1, thus using the colour scheme only would allow for clarifications on which treatment drives the differences in attitudes.

$$\text{PROBIT}(p) = \text{Intercept} + \beta X \qquad (3.5)$$

Table 3.7 summarizes the results for the subsamples with the investment treatment. The result shows which factors affect risk-averse attitudes from the willingness to accept risk measure RA (WTA) and, risk-averse from willingness to pay for risk RA (WTA) within every experiment. Each group combines all observations in the control and treatment groups. This probit regression test for treatment effects in Experiment 1 and investment framing effects is shown in Table 3.7. A similar test was done using colour scheme as a binary for treatment, but this was not significant across all groups. The results from the regression support the difference in means test and show that investment framing affects risk-averse attitudes, but the colour scheme does not. As in Table 3.7, investment framing of questions significantly reduces the probability that subjects exhibit risk-aversion. This holds in all experiments (with a caveat, as before, that the treatment in Experiment 1 contains both the investment framing and the colour components) and for all measures of risk-aversion. Other factors have no systematic significant effects (controlling for marital status in Experiment 2, where this data is available, does not change the result; being married has no significant effect on risk aversion, other coefficients are unchanged). For example, the dummy home (which is created by grouping the five categories of location into two i.e. home and not-home, to control for the effects of not being in a work environment, thus categories like outdoors, were included under home, with the assumption that these environments have more distractions compared with other work environments such as the

library, office space, or workplace). Note that the physical location (dummy Home) has little impact on reported risk-aversion, supporting our conclusion that the environment does not affect risk-attitudes.

Since both types of treatment affect ambiguity attitudes (as in Table 3.7), these dummies are included in the analysis of the factors that affect ambiguity-aversion and ambiguity-neutrality. Moreover, as indicated by the preliminary analysis in Table 3.7, subjects' physical environment plays a role in the detection of the impact of treatments on ambiguity attitudes. To control for this effect, the interaction term Treatment × Home is included in the regression. The rest of the analysis is as above; only Experiments 2 and 3 are considered, See Table 3.7 for the results.

Consistent with results in Table 3.6, the regression analysis in Table 3.8 shows that the dark screened computer interface reduces ambiguity-aversion and increases ambiguity-seeking, while the investment framing treatment mainly raises ambiguity-neutrality and reduces ambiguity-seeking. [4] In Experiment 2, the impact of the investment framing on ambiguity-neutrality is mainly observed in the subsample of subjects taking the survey from home (positive and significant interaction term; removing the interaction term results in a positive (0.508) and significant at $p < .01$ coefficient for treatment, confirming the effect in this sample on average). The impact of the physical environment (Home) is not robust: once the interaction term is removed (either on itself or jointly with the treatment dummy), variable Home becomes insignificant for any ambiguity attitude in all treatments. In contrast, the effect of lower-than-average income is robust: subjects with lower household income are less likely to be ambiguity-averse and more likely to be ambiguity-seeking

[Table 3.8 here]

[4] An associated change in ambiguity-seeking is implied by little change in either ambiguity-neutrality (for dark-screened treatment) or ambiguity-aversion (for investment treatment) in Table 3.8, and is confirmed in a separate estimation of the same regression with ambiguity-seeking dummy as dependent, not reported here. These effects on ambiguity-seeking are robust to exclusion of the interaction term Treatment × Home.

By separating the pooled datasets into treatment and control group, the study observes the significant behavioural factor for each group in different environments. For the first measure of risk-averse attitude (WTA) the tables seem to indicate that in the investment frame respondents' probability for risk-averse behaviours are increasingly driven by age (where young individuals are more risk-averse in accepting risk and less risk averse in paying for it, a result supported by finding in Bonsang and Dohmen (2015), who show that age variations explains risk attitudes where young individuals with more cognitive skills are less risk averse) as well as positive mood and physical working environment such as being at the work place or a work area in the home. All these factors, besides time spent, seem to increase the marginal likelihood of being risk averse (WTA). These factors seem to be significant drivers for the investment frame, but not for the dark-screen frame, even though the interaction is in the same direction.

This is not the case in the second measure of risk, where the individuals pay for risk. In the simulated environment (dark screen background), cognitive skills of individuals, the mood changes, and physical environment all reduce the probability to be risk averse (WTP). This is in contrast to the investment frame where gender and time spent increase the probability for risk-averse attitude. Thus, the simulated environment seems to interact with the individuals more when they make decisions with regards to willingness to pay for risk but not when accepting risk. The study can conclude that different measures of risk are affected by different factors given the different treatment effects on respondents' psychological reasoning

3.4.4 Season effect

Previous studies show that daylight and good weather affect economic activity and the stock market performance (e.g Saunders 1993; Hirshleifer and Shumway 2003; Kamstra, Kramer, and Levi 2003; Lo and Wu, 2010). This effect is possibly channelled via mood (Bassi et al, 2013). If good weather (more daylight) induces good mood, people make optimistic judgments and show less risk aversion. Thus, this study assesses whether the measures of mood

work in line with literature when the seasons are considered. Given that the study was conducted at the different seasons of autumn (November) and spring (April), we can presume that if there are seasonal effects then they should reflect in differences between stated choices. This is ascertained by comparing differences in means (using the Mann Whitney U test) of binary variables which indicate positive mood i.e. Mood up (given that the mood difference is positive), negative mood and average impact on mood.

The difference in means test presented in Table 3.9 shows the difference in averages of samples collected in November against samples recruited in April. The result suggests that the mood variable does not reveal any significant seasonal variation, see "Mean mood at start" in Table 3.9. Equally, the results only indicate marginally significant difference between November and April in the experiment-induced mood change in the control group (0.0996* significant at p-value < 0.10), but not in the treatment 1 (dark-screen) or the investment treatments. However, our mood variable captures the interaction between the season effect and both treatments: more subjects report improvement in their mood after the experiment in April (0.1687) than in November (0.0796).[5] It appears that the colours and pictures chosen for the dark screen treatment, and the wording of questions in the investment treatment produce more effect on subjects' reported mood than the black-and-white control condition. The mood variable thus successfully captures the effect of the season on the way – positive or negative – subjects perceive the visual impact factor. Mood response to treatments is consistent with the above theories of season effects on the mood: in April, with more daylight, subjects are more likely to perceive the colour scheme positively, and thus report an improvement in mood, while in November the opposite happens.

[Table 3.9 here]

[5] Symmetrically, as there is no difference in mean mood reported, the November experiment generates more mood deterioration than April (not reported in the table).

The output shows impact of daylight, regions and investment frame effects on risk premium of people within the sample. As literature suggests it seems that more daylight has a positive impact on individuals in the treatment group. This is probably due to higher daylight in April, as Bassi et al (2013) suggest that increased daylight is associated with optimism or positive mood. Hence, the positive mood of these individuals could have been from the daylight effect as well as treatment effect, leading to a less risk-averse attitude as individuals tend to be less risk-averse when feeling optimistic or in a positive mood. This impact on mood differs for individuals within the colour treatment, as the colour effects seem stronger than the season effects within this sample. The working environment, as Moskaliuk et al, (2017) suggests, leads to more concentration and affects decisions: the study suggests that working environments leads to more risky decision-making. However, our study shows that the individuals within the colour treatment have higher risk premium than those within the investment frame.

This suggests that the colour frame, like the non-working environment simulation in Moskaliuk et al, (2017) leads to less risky decisions. The results also seem to suggest that the screen may have a stronger effect than the weather on non-professional investors. This chapter does not discount that, weather conditions could affect individuals' mood and then affect their decision. However our study shows that the working environment could have a direct impact on individuals, such that transient factors seem to have little or no impact on individuals' drives as may have been expected. Uncertainty attitudes show no consistent response to seasons, although a significant increase in risk-aversion in both treatments in April is observed, as compared to November.[6] This treatment-season interaction effect cannot be directly compared with the above-mentioned increase in risk-seeking due to good weather and long days (Lo and Wu, 2010), because, as reported above, there are no observed season effects on the average reported mood. However, in both treatments the April experiment produces higher fractions of subjects

[6] The season effect on risk attitudes is robust to the regression analysis controlling for gender, region (south or north), age (below 25 versus 25+), income, physical environment, etc. (not reported here, available on request).

reporting an improvement or deterioration of mood. These fractions are roughly equal, and significantly larger than in November. If there is deterioration in mood, this seeming to have a stronger effect on risk attitudes than an improvement[7] in it, then, on average, an increase in risk-seeking due to improved mood should be overcompensated by an increase in risk-aversion due to its deterioration. Hence, there is a need to further investigate whether these differences are significant or not.

[Table 3.10 here]

Consequently, a probit model similar to equation (5) above, was run to analyse the factors explaining uncertainty attitudes when all samples are pooled into one. Table 3.10 shows a probit regression with binary variables ambiguity averse, risk averse (WTA) and risk averse (WTA) as dependent variables. Other independent binary variables include gender (male), age (young i.e. < 45), location (binary variables for work, home where included, leaving out a third group which indicates other location such as the library or outdoors), low income (i.e. those who receive < $75,000 per annum), and a variable testing for the south regions (i.e. regions that have more sunlight) effects on uncertainty attitudes.

The result support previous results above and indicate that ambiguity attitudes are lower due to exposure to dark screens (-0.408 significant at p-value <0.01) and investment framing of question explains less risk averse attitudes for willingness to accept (-0.748 significant at p-value ,0.01) and willingness to pay for risk (-0.508 significant at p-value <0.01). Dark screens do not significantly explain more risk aversion. The season variable *November* seems to suggest that periods of less sunlight may result in less risk-averse attitudes (-0.298 significant at p-value <0.05 and -0.285 significant at p-value < 0.10) for the willingness to pay task. This contradicts literature, as sunlight is synonymous with optimism (Kamstra et al 2003) or more risk-taking attitudes. However, a possible explanation could be that in a different domain people may prefer

[7] This conjecture is consonant with the stronger effect of losses than gains in the prospect theory of Kahneman and Tversky (1979) and can be captured similarly to the asymmetric effects of positive and negative emotions in Fong and Wyer (2003).

risk, i.e. paying for risk would mean expecting a higher outcome rather than lower. When the investment frame interacts with *November,* the interactive variables suggest that a more risk-averse attitude. The interaction of Treatment 2* November is used to provide insight into whether the effects result more from investment framing or the season. Thus, where this is significant it would suggest that investment framing results more in risk-taking attitudes despite the lower sunlight effects.

3.5. Discussion and Conclusion

Typically, the usual suspects for changes in attitudes would be moods or cognitive skills of subjects, yet this study has shown that brightness of screen and investment framing explains the measures of uncertainty attitudes apart from mood and cognitive skills. Although there is a weak influence of mood on risk-aversion, neither treatment has any significant effect on mood. Cognitive abilities, as measured by the response times and a cognitive reflection test, also demonstrate some association with uncertainty attitudes, but cannot explain the impact of the interface colours on ambiguity aversion and the absence of such on risk attitudes. This may be as a result of the measure of mood using a five-point scale, from "bad" to "good", which may not capture the nuances of mood or subjects' psychological states that are responsible for attitudes towards uncertainty. Rather, the question asked has alternative interpretations. Alternatively, the social norms and values of people could affect their reaction to the treatment variables, i.e. the screen colors, investment frame and cognitive reflective test. For example, Chiavi, E. (2002) shows that the right colors should be used in the work place to encourage better performance, stating that red and orange colors should be encouraged because they are active and warm, while green and blue should be applied moderately because blue symbolizes water and calm, while green symbolizes nature (Völker and Kistemann, 2011). Both colors are metaphors of our sensual, emotional and meaningful experience of water and nature. Lengen, C. (2015) further shows that people's perception of a place is related to their social and cultural backgrounds.

Thus, the colors of the work screen could affect individuals differently given their symbolic meanings associated with their cultural values. This would mean that individuals could find different colors relaxing and others active and ascribe a different perception to it from what was anticipated. However, given the data there is still enough evidence to suggest that despite mood, which may have been affected by screen and cognitive reflective skills, the level of illumination either directly or by interacting with mood and cognitive ability results in significant differences to uncertainty attitudes.

The findings above indicate that there are significant differences in uncertainty attitudes dependent on the screens which people are exposed to. This seems to suggest that people's judgement can be affected by factors other than mood, emotion and cognition as suggested by literature. It shows that when a decision problem is presented differently people's attitudes could be affected by the difference in contextual adjustments or level of screen illumination. Although the groups are separated and the decisions are across different groups, there is evidence to suggest that the interactions result in different outcomes for the same problem sets. As suggested, for example, by Tversky and Kahneman, 1979, 1981; Rundmo (1996), (1998b), McLian (1995) and Zhang et al (2014), individuals try to make rational decisions, but those decisions are arrived at through interactions with other variables such as mood and cognitive reflective skills. The study has demonstrated this by presenting different groups of individuals with identical problems in different working environments, in this case a neutral and a dark-screened a simulation of the traditional trading environment. The study can conclude that the difference in behaviour is a result of the framing effects of the difference in working environment. Furthermore, this study proposes that the differences in groups may be as a result of a stress factor that stimulates a cautious attitude in individuals, such that they behave in a similar manner as they would in a negative mood or stressful environment, as similarly indicated in Kamakura et al (2005) findings. This study further proposes that the higher level of ambiguity

aversion when using a bright screen compared to dark screen could be as a result of stress from higher levels of brightness as opposed to lower levels in the dark background. Kamakura et al (2005) indicates that individuals who are overwhelmed with information either make no decisions or use shortcuts in making decisions. Evidence of this is seen in this research, as respondents whose motivation was affected by the overwhelming graphical interface dropped out of the study. The treatment group from Experiment one has the highest drop-out rate. Nonetheless, the dropout rate is only an indicator that something about the treatment group causes people to drop out: it does not identify what factor precisely causes high drop-out. Thus, there is not enough evidence to suggest that investment frames make the environment more stressful for individuals as proposed by Juliusson et al, (2005). Nonetheless, the study does show significantly more risk- and ambiguity-neutral individuals in the investment frame as compared to the control group. This may suggest that there are other factors that could explain subjects' perception of the investment questions which is not included in the survey, such as preferences for playing the lottery or gambling. The results of this study suggest that, irrespective of the value of bets brightness illicit more concentration and consequently more aversion. Hence, the government could intervene but ensuring that screen settings are made less relaxing, i.e. bright screens and less colours imagery could make gambling less entertaining and result in more rational decisions. Furthermore, this chapter has shown that changes in the colours and format of the computer interface can generate a noticeable reduction in ambiguity aversion, despite subjects being exposed to a variety of physical environments.

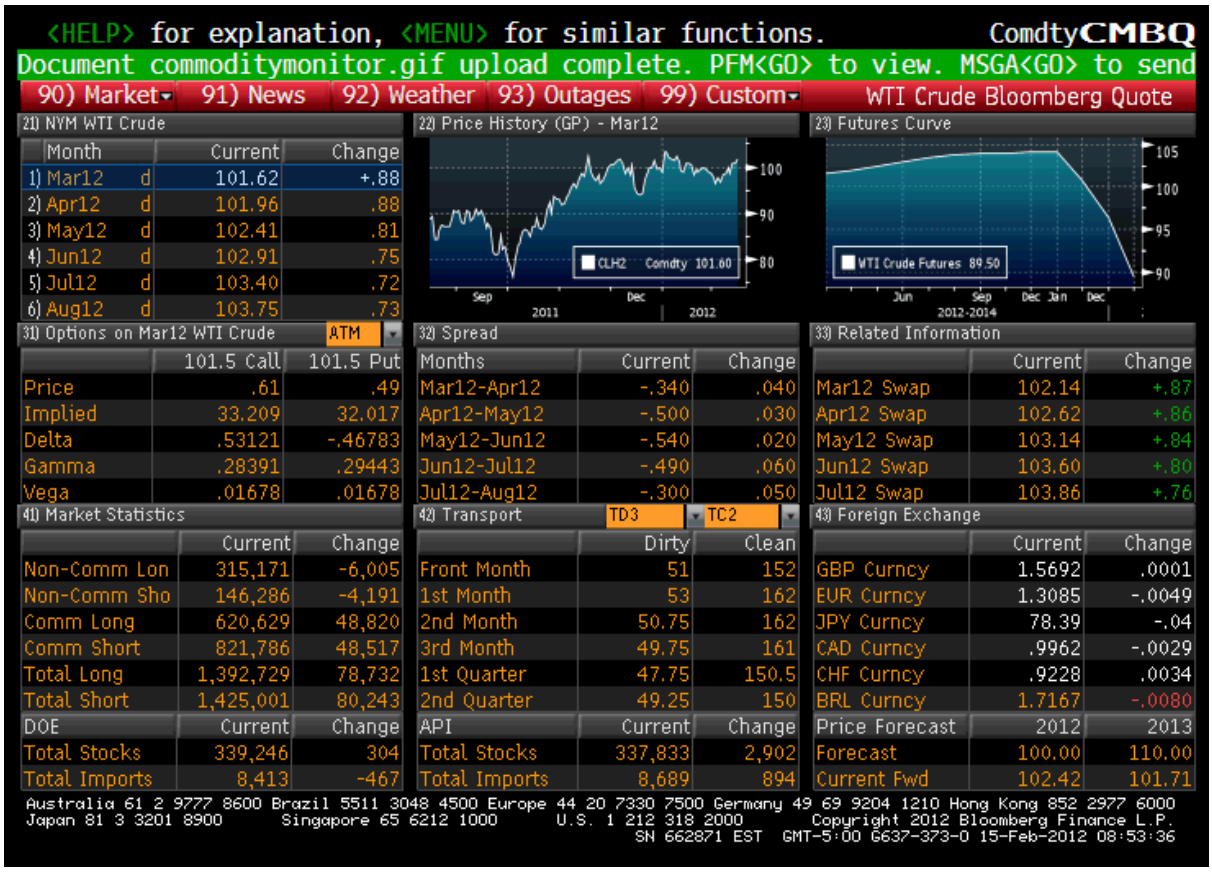


Figure 3.1: A typical interface of a trading platform (Bloomberg): black background; text in red, green, grey and yellow, packed with information in a tabular and graphical form. Source: http://www.investopedia.com/university/how-to-use-bloomberg-professional-service/currencies-commodities.asp

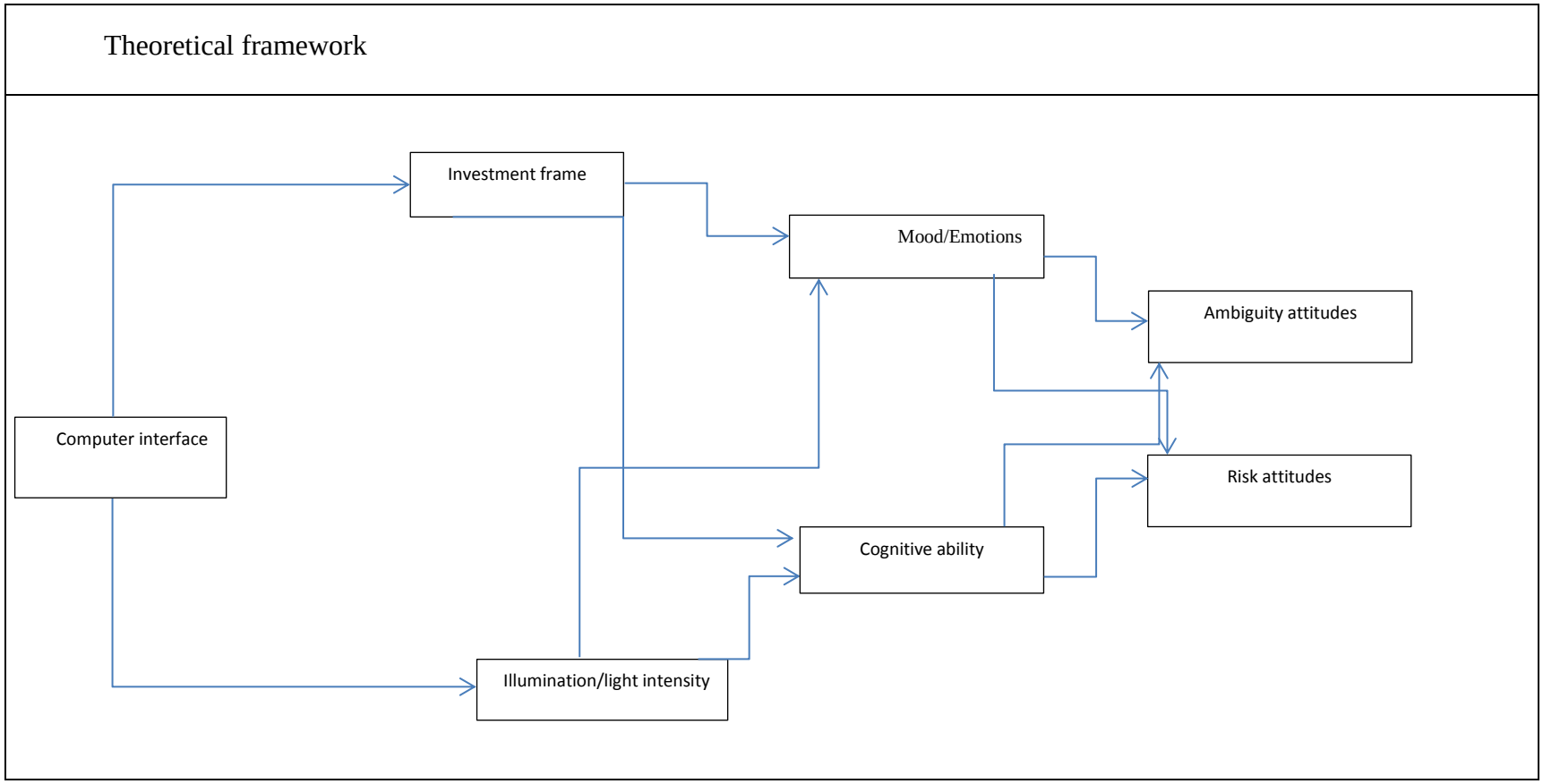


Figure 3.2: summarizes the theoretical frame work, as features of the electronic screens i.e. the level of light intensity or the contextual priming could affect people's attitudes either directly or through factors such as mood, emotions , cognitive ability.

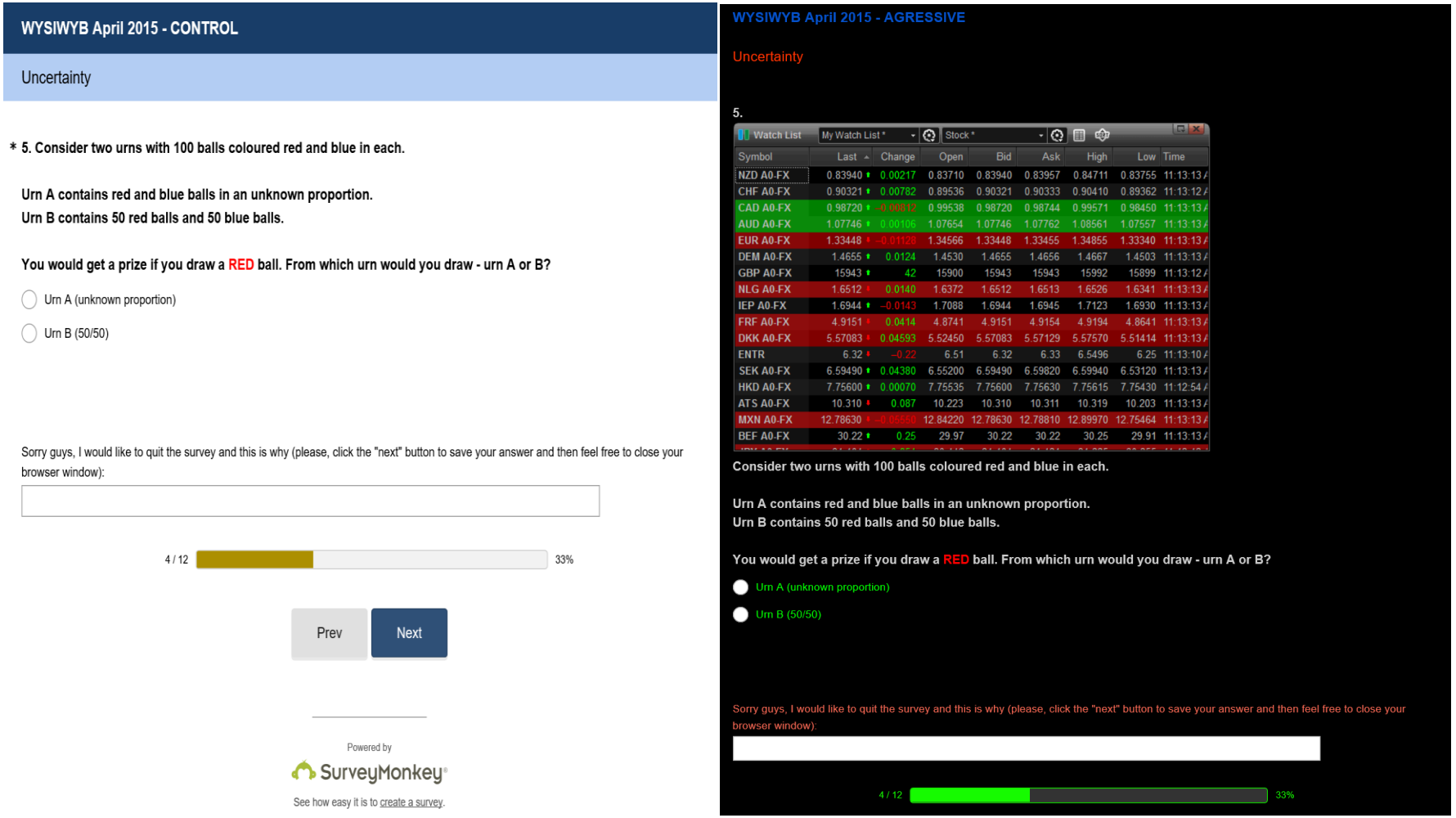


Figure 3.3: "Control" (left) versus “Treatment” (right) interface.

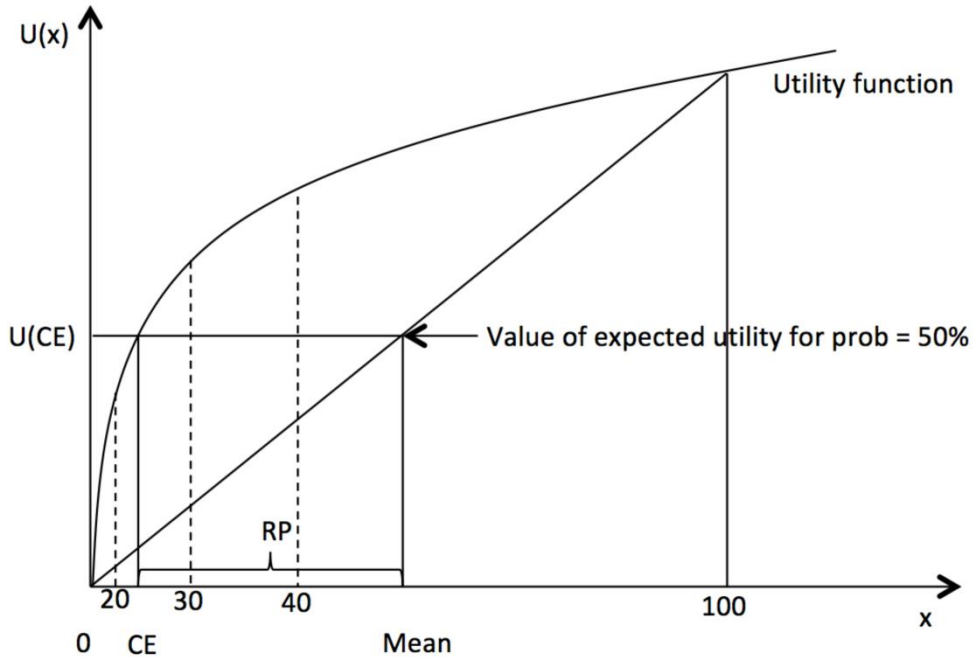


Figure 3.4: Certainty equivalent (CE) and risk premium (RP) from questions 4-6.

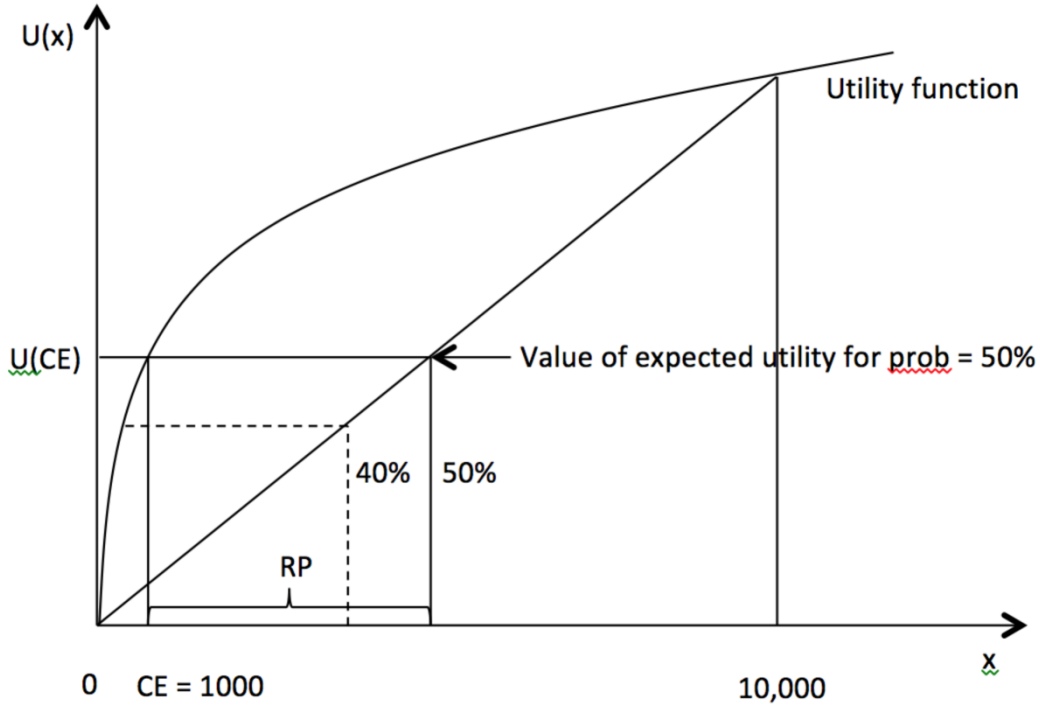


Figure 3.5: Risk premium (RP) from question 7 for a subject with a reservation probability R_PROB = 50%.

Table 3.1. Risk and ambiguity attitude questions (Parts 2 and 3 of the questionnaire): neutral versus investment framing.

Questions 4, 5 and 6 lottery questions	
Control and Colour treatment question	Consider a lottery ticket with a 50% chance of winning $100,000 and 50% chance of getting nothing. What is the LOWEST amount of money you would prefer to this lottery ticket? We assume that you would also be happy to swap the lottery ticket against any amount higher than the one you indicate.
Investment	Assume you are a portfolio manager. You have a portfolio that currently has a 50/50 chance of yielding you either $100,000 of pure profit or nothing (your profit from this portfolio will be zero). On the following scale, what is the LOWEST PRICE at which you would be willing to sell this portfolio now? We assume that you would also prefer to take a chance with this portfolio if you receive any offer below your price.
Question 7	
Control and Colour treatment question	Assume, you have $1,000 What is the LOWEST CHANCE of winning $10,000 that you would prefer to this sure payment of $1,000? We assume that you would also prefer a lottery ticket with a higher chance of winning this amount than the one you indicate
Investment	Now you are a fund manager and need to allocate your own $1,000. You can invest in a project that yields $10,000 if successful and zero if unsuccessful. An alternative would be to keep your money safe at zero return. What is this project's LOWEST probability of success you would accept for your investment? We assume you would also be happy to accept projects with a higher probability of obtaining a payoff of $10,000.

Question 8: This was dropped from Experiment 3	
Questions 9-10 (COLOUR = RED in question 9, and BLUE in question 10)	
Control and Colour treatment question	Consider two urns with 100 balls in each. Urn A contains red and blue balls in an unknown proportion. Urn B contains 50 red balls and 50 blue balls. You would get a prize if you draw a COLOUR (blue in question 9 and red in question 10) ball. Which urn would you draw from, urn A or B?
Investment (only used in Experiment 2)	Imagine, you are an investor about to take part in financing one of the following two enterprises. Both enterprises consider expansion to one of the two markets, which we will label Blue and Red. Expanding in any of them would be profitable but the profitability can be different. You are not the only investor therefore you cannot influence these enterprises' expansion strategies. Enterprise A has some expansion plans but you do not know anything about them. Enterprise B is equally likely to expand in either of the markets. Your estimate is that expanding in the COLOUR market is more profitable. Would you invest in enterprise A or enterprise B?

Table 3.2. Cognitive reflective questions: Part 3 of Experiment 3

Control and Colour treatment question	Investment
A bat and a ball cost $1.10 in total. The bat costs $1.00 more than the ball. How much does the ball cost? (in cents)	Your portfolio consists only of stocks and bonds and costs $1.1m in total. Stocks in your portfolio cost $1m more than bonds. How much do bonds cost? (in $m)

In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake?	In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake?
Jerry received both the 15th highest and the 15th lowest mark in the class. How many students are in the class?	Jerry received both the 15th highest and the 15th lowest mark in the class. How many students are in the class?
A man buys a pig for $60, sells it for $70, buys it back for $80, and sells it finally for $90. How much has he made?	An investor buys a share in a mutual fund at $60, sells it at $70, buys back for $80, and sells it finally for $90. How much has he made? (in dollars)
Simon decided to invest $8000 in the stock market 1 day early in 2008. Six months after he invested, on July 17, the stocks he had purchased were down 50%. Fortunately for Simon, from July 17 to October 17, the stocks he had purchased went up 75%. At this point, Simon has: (a) broken even in the stock market, (b) is ahead of where he began, (c) has lost money	An investor decided to invest $8000 in the stock market early in 2008. Six months after he invested, on July 17, the stocks he had purchased were down 50%. Fortunately for him, from July 17 to October 17, the stocks he had purchased went up 75%. At this point, this investor has:(a) broken even in the stock market, (b) is ahead of where he began, (c) has lost money

Table 3.3 Summary statistics.

	Experiment 1		Experiment 2			Experiment 3		
	Control	Treatment	Control	Treatment 1 (Dark Background)	Treatment 2 (investment)	Control	Treatment 1 (Dark Background)	Treatment 2 (investment)
N responses	188	152	228	243	264	280	245	327
Completed	126	78	126	220	228	240	202	202
Female subjects, %	30	25	54.5	56.5	57	53.5	56.4	53.5
Age, %								
24 and below	19	14	6.7	7.2	7.2	11.3	5.4	8.5
25 – 34	51	40	13.9	15.3	19.4	19.2	16.8	16.9
35 – 44	18	21	23.4	21	16.5	14.2	15.3	17.4
45 – 54	9	18	20.6	15.7	23.6	14.6	18.3	14.4
55 and above	3	7	35.4	40.8	33.3	40.8	44.1	42.8

Table 3.4. Mean risk attitudes in subsamples (only complete and consistent observations).

	Experiment 1		Experiment 2			Experiment 3		
	Control	Treatment	Control	Treatment 1	Treatment 2	Control	Treatment 1	Treatment 2
	(a)	(b)	(a)	(b)	(c)	(a)	(b)	(c)
CE	38,313	43,409	32,390	30,084	42,642	25,567	29,130	45,224
(a) - (b)	-5,096**		2,306			-3,563**		
(a) - (c)			-10,252***			-19,657***		
RP	11,687	6,591	17,610	19,916	7,358	24,433	20,870	4,776
(a) - (b)	5,096**		-2,306			3,563**		
(a) - (c)			10,252**			19,657***		
R_Prob	22.56	25.52	62.63	64.52	42.26	61.17	63.45	42.69
(a) - (b)	-2.96		-1.89			-2.28		
(a) - (c)			20.37**			18.48**		
N obs	123	77	228	239	265	240	200	201

Note: Values are significant at *= $p < 0.1$, **= $p < 0.05$, ***= $p < 0.01$.

Table 3.5. Fractions of risk-averse and neutral subjects (only fully completed questionnaires with consistent risk-attitude answers).

	Experiment 1		Experiment 2			Experiment 3		
	Bright	Treatment 1/2	Bright	Treatment 1	Treatment 2	Bright	Treatment 1	Treatment 2
	(a)	(b)	(a)	(b)	(c)	(a)	(b)	(c)
# of Observations	107	60	219	201	244	206	173	176
Risk-averse(WTA)	0.6449	0.3000	0.6941	0.7222	0.4344	0.6796	0.6185	0.2898
a-b	0.3449***		-0.0282			0.0611		
a-c			0.2596***			0.3898***		
Risk neutral(WTA)	0.2243	0.3333	0.1598	0.1528	0.2664	0.1845	0.2312	0.2955
a-b	(-0.109)*		0.007			-0.0467		
a-c			(-0.1066)***			(-0.1110)***		
Risk-averse (WTP)	0.71	0.45	0.69	0.74	0.53	0.69	0.71	0.53
a-b	(0.2586)***		-0.04205			-0.0110275		
a-c			0.1628***			0.1601***		
Risk neutral (WTP)	0.14	0.20	0.20	0.20	0.31	0.15	0.14	0.31
a-b	-0.06		-0.0028			0.0117571		
a-c			(-0.1065)***			(-0.1621)***		

Values are significant at *= $p < 0.1$, **= $p < 0.05$, ***= $p < 0.01$.

Table 3.6. Fractions of ambiguity- averse, neutral and seeking subjects (only fully completed questionnaires with consistent risk-attitude answers).

	Experiment 1		Experiment 2			Experiment 3		
	Control	Treatment1/2	Control	Treatment1	Treatment2	Control	Treatment1	Treatment2
	(a)	(b)	(a)	(b)	(c)	(a)	(b)	(c)
N obs	107	60	219	201	244	206	173	176
Ambiguityaverse	0.7009	0.7333	0.7534	0.6435	0.7336	0.7864	0.7225	0.7216
a-b	-0.0324		0.1099**			0.0639*		
a-c			0.0198			0.0648		
Ambiguityseeking	0.2336	0.2000	0.1535	0.1866	0.0547	0.1474	0.2284	.08523
a-b	0.0336		-0.039			(-0.081)**		
a-c			0.0964**			0.0507**		
Ambiguityneutral	0.0654	0.0667	0.0787	0.1308	0.1750	0.0777	0.0636	0.1932
a-b	-0.001		(-0.0521)**			0.0141		
a-c			(-0.0945)***			(-0.1155)***		

Values are significant at *= $p < 0.1$, **= $p < 0.05$, ***= $p < 0.01$.

Table 3.1. Factors affecting risk-aversion (Treatment = investment framing).

	Experiment 1		Experiment 2		Experiment 3	
Dependent	RA (WTA)	RA (WTP)	RA (WTA)	RA (WTP)	RA (WTA)	RA (WTP)
Intercept	0.049	0.782	0.416	1.518***	.418***	1.258***
	-0.457	-0.516	-0.372	-0.428	-0.124	-0.151
Treatment	-1.005***	-0.545***	-0.746***	-0.372**	-0.998***	-0.241*
	-0.198	-0.204	-0.125	-0.145	-0.127	-0.145
Home	.369*	0.008	-0.043	0.079	-0.141	-0.066
	-0.215	-0.236	-0.161	-0.182	-0.129	-0.147
Young	0.258	-0.337	-0.036	-.507*	.488**	0.028
	-0.314	-0.351	-0.267	-0.282	-0.213	-0.249
Sex=M	-0.067	0.149	0.088	-0.072	0.081	-.399***
	-0.228	-0.256	-0.128	-0.145	-0.126	-0.145
STATS_Good	-0.314	0.048	0.082	-0.089		
	-0.191	-0.205	-0.13	-0.147		
Student_PG	-0.031	0.477	0.645	- [(a)]		
	-0.391	-0.447	-0.488			
Student_UG	-0.187	0.523	-0.052	-0.374		
	-0.506	-0.602	-0.426	-0.457		
Employed	0.421	-0.132	-0.031	-0.277		
	-0.384	-0.431	-0.339	-0.388		

Self-employed	0.288	0.109	0.046	-0.066		
	-0.406	-0.426	-0.385	-0.456		
Unemployed	0.936	0.014	-0.236	0		
	-0.692	-0.722	-0.354	-0.413		
Income <75K			0.105	-0.188	0.031	0.147
			-0.128	-0.147	-0.128	-0.15
Chi-Square	205.397	200.413	435.144	434.655	434.841	442.478
Sig.	0.257	0.288	0.331	0.35	0.392	0.419
N obs.	204	204	435	435	390	390

Notes: Model: Values are significant at *= $p < 0.1$, **= $p < 0.05$, ***= $p < 0.01$. PROBIT(p) = Intercept +BX. Reported are marginal effects computed at the mean value. (a) Variable omitted; inclusion results in non-convergence for the optimal probit solution but does not significantly affect other coefficients. Variables are in binary format with '1' representing the variable and '0' otherwise, using responses from location, a binary variable for Home or not home is used to measure the impact of respondent working in a relaxed environment in contrast with a work environment. The different occupational levels are also included, where a subgroup of interns and volunteers combined is not included. Other control variables (binary independent variables) such as gender = male, a low income level i.e. those earning below $75,000 per annum and age (those who are less than 45 years) are also included.

Table 3.2. Factors affecting ambiguity attitudes

	Experiment 2						Experiment 3				
	Treatment 1-Darkscreen			Treatment 2-Investment			Treatment 1-Darkscreen			Treatment 2-Investment	
Dependent	AA	AN		AA	AN		AA	AN		AA	AN
Intercept	1.832***	-1.735***		.760*	-1.119**		1.112***	-1.982***		1.152***	-1.781***
	(.455)	(.564)		(.407)	(.478)		(.147)	(.235)		(.148)	(.209)
Treatment	-.459***	.276		-.049	.269		-.328*	.096		-.321*	.796***
	(.165)	(.194)		(.168)	(.194)		(.172)	(.263)		(.174)	(.224)
Home	-.243	-.213		-.083	-.335		-.369**	.490*		-.365*	.483*
	(.227)	(.306)		(.228)	(.317)		(.186)	(.256)		(.187)	(.250)
Treatment × Home	.138	.363		-.133	.755**		.438	-.579		.293	-.488
	(.289)	(.375)		(.288)	(.370)		(.270)	(.399)		(.266)	(.325)
Young	-.183	.693*		.062	.054		-.031	-.537		.024	-.063
	(.324)	(.358)		(.293)	(.329)		(.236)	(.450)		(.221)	(.275)
Sex=M	-.196	-.033		-.228	.074		-.123	.262		-.200	.119
	(.137)	(.168)		(.139)	(.162)		(.133)	(.194)		(.132)	(.159)
STATS_Good	-.100	-.005		.095	.005						
	(.141)	(.170)		(.142)	(.163)						
Student_PG	-.435	.030		-.216	-.094						
	(.530)	(.727)		(.473)	(.645)						
Student_UG	-.621	-.266		.625	-.238						
	(.414)	(.497)		(.540)	(.582)						
Employed	-.640	.425		.280	-.209						
	(.412)	(.524)		(.372)	(.440)						
Self-employed	-.296	-.425		.177	-.849						
	(.464)	(.729)		(.424)	(.620)						
Unemployed	-.317	.246		.202	-.127						
	(.419)	(.549)		(.386)	(.462)						
Income <75K	-.440***	.088		-.259*	-.057		-.307**	.417**		-.331**	.095
	(.138)	(.169)		(.140)	(.164)		(.133)	(.195)		(.133)	(.161)
Pearson goodness-of-fit test											

Chi-Square	426.795	371.655		430.889	435.530		4339.556	412.365		441.219	428.170
Sig.	.322	.933		.372	.327		.403	.755		.395	.570
N obs.	427	427		435	435		440	440		441	441
Notes:											

Notes: Model: Values are significant at *= $p < 0.1$, **= $p < 0.05$, ***= $p < 0.01$. PROBIT(p) = Intercept +BX. Reported are marginal effects computed at the mean value. (a) Variable omitted; inclusion results in non-convergence for the optimal probit solution but does not significantly affect other coefficients. Variables are in binary format with '1' representing the variable and '0' otherwise, using responses from location, a binary variable for Home or not home is used to measure the impact of respondent working in a relaxed environment in contrast with a work environment. The different occupational levels are also included, where a subgroup of interns and volunteers combined is not included. Other control variables (binary independent variables) such as gender = male, a low income level i.e. those earning below $75,000 per annum and age (those who are less than 45 years) are also included.

Table 3.9. Season effects on main variables in each treatment. The table reports differences in variables between experiments 2 (November) and 3 (April), the latter subtracted from the former.

	Control		Treatment1		Treatment2	
	Nov.	Apr.	Nov.	Apr.	Nov.	Apr.
Mood						
Mean mood at start	3.5250	3.5526	3.4876	3.4979	3.5792	3.5094
Nov-Apr	-0.0276		-0.0104		0.0698	
Mean change in mood	0.0417	-0.0580	-0.0647	0.0182	-0.0693	-0.0702
Nov-Apr	0.0996*		-0.0829		0.0009	
% mood up	0.0875	0.1096	0.0796	0.1687	0.1089	0.1774
Nov-Apr	-0.0221		(-0.0891)***		(-0.0685)***	
% mood down	0.0667	0.0526	0.0896	0.0823	0.1238	0.0792
Nov-Apr	0.0141		0.0072		0.0445**	
% mood impact	0.5676	0.6757	0.4706	0.6721	0.4681	0.6912
Nov-Apr	-0.1081		(-0.2015)**		(-0.2231)***	
Cognition						
Time spent	204.27	108	156.78	209.90	165.29	149.51
Nov-Apr	95.79**		-53.13		15.77	
Ambiguity attitudes						
% ambiguity averse	0.7792	0.7793	0.7313	0.6695	0.7178	0.7698
Nov-Apr	-0.0001		0.0618		-0.0520	
% ambiguity neutral	0.0708	0.0811	0.0597	0.1502	0.1832	0.1786
Nov-Apr	-0.0102		(-0.0905)**		0.0046	
Risk attitudes (WTP measure)						
% risk averse	0.7083	0.7719	0.7214	0.8272	0.6485	0.6113
Nov-Apr	(0.0636)**		(-0.1058)***		0.0372	
% risk neutral	0.1542	0.1085	0.1493	0.0673	0.1485	0.1958
Nov – Apr	0.0457*		0.0819**		(-0.0473)*	
Risk attitudes (WTA measures)						
% risk averse	0.6792	0.6886	0.6269	0.7243	0.2970	0.3927
Nov-Apr	-0.0094		(-0.0974)**		(-0.0957)**	
% risk neutral	0.1792	0.1535	0.2289	0.1440	0.2822	0.2874

Nov-Apr	0.0257	0.0848**	-0.0053
N obs.	240	207	201

Values are significant at *= $p < 0.1$, **= $p < 0.05$, ***= $p < 0.01$

Table 3.10: Pooled data of control and treatment groups (Experiment 2 and 3)

	Ambiguityaverse	Riskaverse	RPaverse
Dark-screen	-0.408***	0.0478	0.139
	-0.135	-0.129	-0.139
November	0.201	-0.208	-0.298**
	-0.133	-0.129	-0.139
Young	-0.213*	0.0543	-0.267**
	-0.113	-0.109	-0.115
Male	-0.0599	-0.0222	-0.175
	-0.111	-0.106	-0.113
Work	-0.0253	0.00684	-0.029
	-0.181	-0.176	-0.185
Home	-0.0158	-0.119	0.142
	-0.191	-0.185	-0.197
Low_income	-0.324***	-0.0231	-0.243**
	-0.112	-0.108	-0.115
South	0.154	-0.134	0.0494
	-0.117	-0.11	-0.119
Constant	0.869***	0.558***	0.986***
	-0.242	-0.202	-0.215
Observations	619	619	619
Pearson goodness of fit			
Chi-square	24.19	6.01	20.58
Sig.	0.0021	0.6459	0.0083
Treatment-Investment	-0.127	-0.748***	-0.508***
	-0.137	-0.126	-0.13
November	0.128	0.0786	-0.285*
	-0.159	-0.147	-0.153
Treatment2*Nov	-0.0516	-0.254	0.347*
	-0.191	-0.179	-0.183
Young	0.0083	0.266***	-0.340***
	-0.0978	-0.0915	-0.0929
Male	-0.151	0.107	-0.280***
	-0.0955	-0.0897	-0.0908
Work	-0.212*	-0.0937	0.211*
	-0.125	-0.116	-0.118
Home	-0.414**	-0.202	0.21
	-0.174	-0.164	-0.165
Low_income	-0.259***	0.0519	0.0953

	-0.0976	-0.0919	-0.0939
South	0.0305	-0.054	0.0312
	-0.101	-0.0934	-0.0956
Constant	0.957***	0.261	1.165***
	-0.245	-0.225	-0.237
Observations	860	860	860
Pearson goodness of fit			
Chi-square	19.36	116.26	44.16
Sig.	0.0223	0.0000	0.0000

Table 3.10 represents a pooled probit regression with a dummy variable "dark-screen" for the top table "Treatment-Investment" i.e. investment frame. The table shows what factors explain the ambiguity or risk attitudes within the entire sample, for different sub-samples i.e. those exposed to either treatment screens. RPaverse = risk averse measured using the reservation probability question. Other binary variables included are November, i.e. when the survey was taken, and the south region to control for areas with high sunlight periods. Moreover, the location categories were arranged into three groups, work, home and outdoors, this is because most work and home facilities are indoors, and a control variable "south" is already included to control for sunlight effect. Hence the variables included in binary format with '1' representing the variable and '0' otherwise, are for Home, work, gender = male, a low income level i.e. those earning below $75,000 per annum and age (those who are less than 45 years) are also included. The treatment variables are included respectively, i.e. Dark screen indicates a dark background and lower table shows the Treatment with investment frame. An interactive variable is included i.e. Treatment2*November, to control for effects from low sunlight, as low sunlight does result in more aversion.

Chapter 4 Central bank communication and uncertainty attitudes

4.1 Introduction

Central Bank announcements (whether in quantitative or qualitative formats) do affect the financial market, as shown in numerous studies (e.g. Ricci, 2015, Hanousek et al, 2009, Rosa, 2008; 2011, Rosa and Verga, 2007 etc). For example, a study by Dewachter et al (2014) illustrates how verbal statements and comments on the foreign exchange market influences uncertainty for traders within that market. Furthermore, Demiralp and Jorda (2004) illustrates how announcing changes, enables the Federal Reserve to move the actual funds rate. Bernoth et al, 2004 showed how the use of money market interest rates, could improve the predictability of Central Bank decisions in terms of interest rate. Also, some authors (Poole et al, 2003; Swanson 2006) argue that the Federal Reserve's practice since 1994 of making same-day announcements of monetary policy decisions is a contributing factor to improving predictability and reduction in uncertainty. These reactions to Central Bank announcements are possible given that information from Central Banks in general can represent either signal channels (an indication of future policy directions) (Kaminsky and Lewis, 1996; Kim 2003), a co-ordination channel (Sarno and Taylor , 2001) or just a means to channel common knowledge which can be simultaneously observed and interpreted homogenously by all market participants.

Blinder (1996) suggests that more communication by a Central Bank should enhance the effectiveness of the Central Bank's communication, and its monetary policies. This implies that increased frequency in communication would result in more information, which ought to result in better understanding of the Central Bank's intentions and alignment of people's expectations to its anticipated objectives. However, market participants have not been able to accurately forecast future policy announcements. In particular, Ehrmann and Fratzscher (2003) provide

evidence of market error since 1999 in forecasting with monetary policy decisions, which falls within 0.30% to 0.50% from the actual outcome. This illustrates that market participants do receive communication of Central Bank, but are still unable to accurately align with its objectives. The question then becomes: why is there such a difference in views of the economy and in predictions of monetary policy, despite regular formal communications (announcements) from the Central Bank? A study by Born et al (2011) suggests that not only is the content of an announcement relevant but so is the state of the economy when the announcement is made. This implies that people's perception of information could be affected by the state of the economy they may have a positive or negative perception of the economy irrespective of announcement content. This chapter anticipates that people do not just receive Central Bank communication but do so within an environment, which may not only be a channel of passing information, but might also influence how people perceive this information.

Information from the Central Bank is made available by a reliable channel such as the media (Lamla and Lein, 2011; Lamla and Strum, 2008: Blinder et al, 2004). The media also broadcast discussions of Central Bank announcements and these discussions form economic signals (e.g. informal discussions, speeches) to members of the public about the economy's future. The Federal Reserve makes four main announcements available to the public. The announcements include macro-economic issues like monetary policy, employment issues, and inflation. Of these issues, monetary policy is known to always affect the markets given its relevance. This chapter proposes that a Central Bank announcement could create an environment which facilitates differences in decision, it has an impact on their perception of certainty. This effect is demonstrated on uncertainty attitudes through a direct channel (the announcement) and an indirect channel (other factors, of which this chapter proposes information overload and anxiety from discussions). The researcher proposes that deviations in expectations could be a result of either unclear signals (Cukierman and Meltzer, 1986) from different forms of

communication (verbal speeches, interviews and other forms of information about the Central Bank's activities): or too much information from media broadcast which could increase general agitation amongst people, or broadcasted informal discussions on impacts of policy change on people's welfare.

Typically, people's attitudes to risk and ambiguity are expected to remain constant (Rothschild and Stiglitz, 1971) despite changes to the market or in decisions made by members of the public. This chapter shows that people's attitudes do not remain constant but shift when important policy change occurs. This effect is subject to the level of attention to Central Bank communication via any media channel. Lamla and Lein (2014) suggest that outside an updating period (i.e. a period where people would have heard the news and updated their expectations on the economy) people are not attentive, to the news. Thus, it is possible that after the announcement occurs, people may not receive the news because they are not attentive to it. Carroll (2003) provides evidence to illustrate that consumers update their expectations once a year, while Doepke et al (2008a) shows that people in the Euro area do so once in 18 months because it is costly. Lamla and Lein, (2014) further show, that when there is a cheap reliable source, people can update their expectations more often. Consequently, this chapter shows that when people pay attention to information from the Central Bank, they could update their expectations, and do so using several forms of information. Thus, people could be exposed to precise and imprecise information resulting in different effects on their attitudes. Furthermore, this difference in certainty of information leads to different effects in attitudes across sub-samples.

In order to demonstrate the differences in perceptions of an announcement, which are created from exposure to different levels of certainty within an economic environment on people's judgement, this chapter conducts a field experiment using a survey on US consumers during a change in monetary policy in December 2015. This event provides a good basis for the

study, as Federal Reserve announced a raise in rates which had not occurred in a decade. This raise in rates from 0.25 to 0.50 received a lot of media attention with positive comments; as such this event is selected as an example of a shock to the environment. This surveys are conducted around the event, within two days before and two days after the announcement. This chapter expects that the level of anxiety built will be different before and after announcement the and that this effect will be seen in people's judgement. Hence, where there is higher anxiety it will be reflected in potentially increased caution in people. To test this out, subjects are presented with abstract questions which are unrelated to the announcement and are based on Ellsberg's two box problem (Ellsberg, 1987) sets and willingness to accept risk (Tversky and Kahneman, 1979).

Based on the data, this chapter finds that people are less ambiguity-averse after an announcement across subsamples. More so, results indicate attentive people have a higher ambiguity-averse proportion compared to inattentive subjects, whose ambiguity attitudes are not significantly different across sub-groups. In terms of risk-aversion, attentive subjects require lower risk premium as compared to inattentive subjects who require higher risk premium. This implies that attentive subjects seem less risk-averse after the announcement, while inattentive subjects seem more risk-averse. The difference in ambiguity and risk attitudes reflects the effect of different levels of certainty over the type of information which subjects are exposed to. The adjustment of attitudes after the announcements suggests that subjects do update their expectations. However, people's updates are heterogeneous across attentive and inattentive subjects and further demonstrate the impact of the certainty effect.

4.2 Literature Review

People's judgments can be affected by several factors, ranging from external such as day-light conditions (Kamstra et al. 2003), and games/sport sentiments (Edmans et al, 2007) to internal factors such as mood (De Martino et al, 2006), emotions (Gross and D'Ambrosio, 2004) and uncertainty (Masolo and Minto, 2015). These factors influence judgement based on people's perception and of the economic environment; and how these factors are perceived could be relevant for making financial judgements. For example, decisions about consumption (Ahmed and Cassou, 2016; Fraj and Martinez, 2006); investment, saving (George Katona, 1974; Bernanke 1984; Kimball 1990: Aaberge et al, 2017) and perception of risk are affected by people's perceptions of the economic environment. The economic environment matters for people's perceptions of price changes, economic forecasts and social amplifications of economic forecast, as it informs their expectations of future outcomes of economic issues (Ranyard et al, 2008). Consequently, people are interested in economic issues and such information could be provided by Central Banks within their economy (Hayo, 1999) through the media.

4.2.1 The role of media in central bank communication

The media mainly covers news from Central Banks and makes it available to the public (Berger et al, 2011a; Blinder, 2008 and Bohm et al, 2012). The broadcast of news is typically subject to the favourability of its content as a prerequisite for receiving greater or lesser coverage on such news (Berger et al, 2011b). News intensity is also determined by its content (Lamla and Lein, 2014) i.e. increased frequency of media reports on a Central Bank announcement leads to an increased tendency for consumers to absorb the new information presented. Additionally, the importance of news contents also determines the signals that consumers will infer from the announcements (Bohm et al, 2012), as consistent reporting improves the accuracy of consumers' expectations when they receive more information from the media (Lamla and Lein, 2014).

However, this effect depends on the tone in which the news is presented, such that negatively-toned news reverts the effect of intensified news. Furthermore, Lamla and Lein, (2014) show that the media's perception of news influences the level of coverage it receives. The intensity on reports also improves the public's knowledge of Central Bank information. A study by Lamla and Lein (ibid) shows that intensive news reporting like an increased frequency in media reporting of an Central Bank announcement leads to increased tendency for people to absorb the information presented and improves the accuracy of consumers' inflation expectations as they receive more information via the media.

Berger et al (2011b) suggest that the media assumes a monitoring role by critically evaluating the performance of the Central Bank. Using print media channels, information about Central Bank announcements is made available in view of prior market expectations and the inflation environment. For example, when inflation rates are increasing in the Euro zone, it results in a less favourable discussion in the media on the decisions of the European Central Bank. This shows that when policy results in negative surprises, the tone of the report is generally more negative.

4.2.2 Emotion as an indirect negative affect on economic decisions.

Emotions arguably play a role in decision making either directly or indirectly through their effect on other factors (Bosman and Van, 2002). For example, emotions are relevant in psychological exercises such as attention, learning, and memorising (Izard et al, 1984). Emotions are also relevant for rational decision-making in economic decisions (Frank, 1988) and preferences (Hirshleifer, 1987; Loewenstein, 1996). Therefore, emotions could play a role in uncertainty attitudes as people are not only rational beings but also behavioural. People can display emotional states such as fear, anger, sadness and anxiety, which can affect their preferences. This chapter proposes that people's judgements are sensitive to not just information, but the behaviour (emotions) of others within the economy. Emotional beings tend to

overestimate unexpected outcomes and underestimate events with less likelihood: when this occurs, it could increase the impact of events on individuals' judgements (Wilson and Gilbert, 2003). This exaggeration in reaction could stem from the influence of the media.

Emotions arise when people evaluate an event as relevant or important to one's concerns. When such concerns are subject to a negative interference this could result in negative emotions such as sadness, anger, fear or anxiety, while positive effects could lead to joy, happiness, confidence or relief (Loewenstein, 1996). These types of effects suggest that emotions could have a direct impact on people's concerns or preferences. Emotions also suggest that people could take an action based in response to the supposed stimuli. The action taken would indicate the result of an evaluation of that action's consequences (Frijda, 1986; Lazarus, 1991). This suggests that people's emotions are associated with the actions taken and probably with the intensity of their emotions.

This chapter suggests that anxiety built up from the informal discussions surrounding Central Bank announcement and from information overload after the announcement is made result in an indirect trigger in people and consequently changes to uncertainty attitudes. The negative affect on people's perception of information seems to be prominent for people who are not attentive to Central Bank communication thus resulting in aversive attitudes even when there is information that should suggest otherwise. This chapter finds that the effect is subject to attentive levels, which determines whether people are aware of the announcement being made or not.

4.2.3 Negative effect on economic decisions

Emotions influence the process of decision-making indirectly by changing the perception and evaluation of other costs and benefits (Elster, 1998). Consequently, people are of the notion that emotions play a part in a range of negative economic phenomena, like consumer boycotts, hostile takeovers, failures in merger negotiations, trade or price wars, stock market crashes or tax

fraud. For example, consumers have been seen to react angrily to an increase in prices which was perceived as unfair, resulting in the consumers reducing their buying proportions (Kahneman et al, 1986; Rotemberg, 2002). Thus, the integration of emotion into decision-making can be viewed as a process aimed at adapting their decisions to their environment. This process seems to incorporate the characteristics of the environment, such as a change in price (Rotemberg, 2002), in deciding actions to take. Thus, depending on what people believe and expect from their environment, people's judgments can be influenced by an effect from emotions. Apart from emotions, mood also affects people's decisions. The effect varies with the type of mood. For example, Mittal and Ross (1998) show that for positive effect, participants could regard an ambiguous strategic task as an opportunity and would take lower risks as compared with people in a negative mood. When tasks were given either a positive 'opportunity' frame or a negative 'threat' frame, the effect on risk-taking was stronger for participants who were in a negative mood. However, these effects are by no means universal, as Forgas (1995) suggest that the effect of moods on decision making depends on the information processing mode which a decision maker is in. Thus, this study considers the effect that a negative affect, such as anxiety, could have on information processing of Central Bank communication. An affect may be the frame of information or could come from the environment. In this chapter, it is anticipated that the environment (i.e. the level of anxiety) affects information processing of respondents.

4.2.4 Feelings as information

General agitation (a negative state of emotion such as anxiety, or sadness) in the environment is a source of information to people (Schwarz and Clore, 1996). Anxiety as a negative emotion could be seen as an anticipatory affective, which results in cognitive and behavioural responses towards a possible threat (Grupe and Nitschke, 2013). In a study by Pham

(1998) and Schwarz (1990), negative emotional states such as sadness and anxiety are said to be of informational value. Similarly, Schwarz and Clore (1983) demonstrate that anxiety and sadness are interpreted as information regarding the choices people would have made. They show that people make judgements and decisions by inspecting their feelings and interpret what these feelings mean for issues under consideration. Furthermore, this chapter infers that anxiety from people could serve as a signal that an environment (economic in nature) is uncertain and uncontrollable (Schwarz and Clore, 1996). As a result, anxiety could steer up people's preferences toward options that would reduce risk and uncertainty. This is further supported by Raghunathan et al, (2006) who suggest that information from feelings provide a nuanced signal. Thus, people within an environment, interpret the general feelings as information which also affects their judgments and beliefs. Consequently, it is no surprise that during an economic change, people's decisions and uncertainty preferences people are influenced by anxiety, which seems to amplify sensitivity to negative emotion (Gu et al, 2017). The effect of anxiety on risk preference demonstrates that people who are anxious may not avoid economic risk, but could avoid the anticipated loss that comes from taking economic risk (Engelmann et al, 2015). This suggests that anxiety could be a factor in the information which influences people's perception of uncertainty as would a negative affect.

4.2.5 Information overload and decisions

Psychological studies have long demonstrated effects of expectations on judgment, whereby the provision of information, either implicitly or explicitly, prior to an experience or decision can exert a substantial influence on the observed behaviour (Sanfey, 2008). The concept of information overload (i.e. receiving too much information) is associated with similar concepts such as cognitive overload (Vollmann, 1991), sensory overload (Lebowski, 1975), communication overload (Meier, 1963), knowledge overload (Hunt and Newman, 1997) and

information fatigue syndrome (Wurman, 2001). Information overload tends to result in dysfunctional consequences (such as stress or anxiety) and a diminished decision quality. For example, it could affect consumers' perception of information and results in reduced value of information from media sources (e.g. social media and other online resources) and lead to the avoidance of news (Lee et al, 2017). This chapter suggests that when people become over-whelmed by information overload, their decision-making and well-being could be affected (Jackson and Farzaneh, 2012). Information overload could also result in stress and fatigue for people who are attentive to it, (Lee et al, 2016). O'Reilly (1980) shows how information overload could result in feelings of stress, anxiety, and low motivation le. This chapter proposes that information overload could result in less information processing in people and affect their attitudes.

Consequently, people's feelings, either as perceived from information provided or from the environment (i.e. the feelings of others), could lead to disruption of information processing. Disruptions could be in the form of discounting information or regarding information perceived as negative, leading to avoidance and loss of information. This could have implications for communication, as every Central Bank expects to align the views of people within the economy with its objectives. Thus, the implications of emotional impediments could result in alternative outcomes from the expectations of members various financial regulators. By demonstrating the impact of uncertainty on people's judgments of ambiguity and risk, this chapter shows the indirect effect of anxiety in the environment on people's perception of uncertainty.

This chapter proposes that as people rely on the media for information (Lamla and Strum, 2008: Blinder et al 2004); media discussions would be a major channel for the public of signals (such as informal discussions, speeches). The media, in covering news from Central Banks, is most likely dependent on favourability of the news content, based on the study by Berger et al (2011b) and Berger (2006). Another study by Bohm et al, (2012) also compliments the findings

in Berger's (2011a) study. Although the study is based on Czech National Bank, the study also observes the favourability and the extent of media coverage. Similarly, the media's perception of news influences the level of coverage it receives. Hence, media intensity in the reporting of news also improves the public's knowledge on Central Bank information. A study by Lamla and Lein (2014) shows that intensive news reporting improves the accuracy of consumers' inflation expectation, as they receive more information via the media: in other words, increased frequency of media reporting on Central Bank announcements leads to an increased tendency for consumers to absorb the new information presented. This could result in information overload: with varied levels of content and intensity, coverage could lead to different levels of economic uncertainty, to which people's preferences are sensitive. Thus, people exposed to different environments will adjust their preferences in line with the level of general agitation within that economic environment.

General agitation (a negative state of emotion such as anxiety or, sadness) in the environment is a source of information to people (Schwarz and Clore, 1996). In studies by Pham (1998) and Schwarz (1990), negative emotional states such as sadness and anxiety are said to be of informational value. Furthermore, Schwarz and Clore (1996), indicate that anxiety could be a signal that the environment is uncertain and uncontrollable. As a result, anxiety could steer up preferences toward options that would reduce risk and uncertainty. This is further supported by Raghunathan et al (2006) and suggests that information from feelings provides a nuanced signal. Thus, people within an environment, interpret general feelings as information which also affects their judgment and beliefs. Furthermore, anxiety (general agitation) is associated with stress and uncertainty.

Based on the data people are less ambiguity averse after the announcement across subsamples. Also, the results indicate that the ambiguity attitudes of informed people are affected by the economic environment, unlike uninformed people, whose ambiguity attitudes are

not significantly different across sub-groups. In terms of risk aversion, the effect of the announcement, is dependent on people's awareness of monetary policy changes, as informed people require lower risk premium as compared to uninformed people who require higher risk premium. This also implies that informed people become less risk-averse after the announcement, while uninformed people are more risk-averse. The difference in ambiguity and risk-attitudes reflects the effect of the environment on people. This effect is reduced with communication from the Central Bank for informed people, but uninformed people are still affected by media pressure and are therefore have increased risk-aversion.

4.2.6 Communication of policy changes to the public

Central Bank communications are typically tools aimed at enlightening the public of its about the organisation's objectives (Blinder et al, 2008). Thus, people can estimate which policies would maximize these objectives. This suggests that regulatory bodies assume that the public understands economic indicators like inflation and interest rates. In a study by Ehrmann and Fratzscher (2007), it is further suggested that members of the public presumably know the dynamics of these indicators, how to employ this information, and its parameters, based on the unobserved objectives and preferences of the Central Bank. However other studies (Carroll, 2003; Blanchflower and Mac Coille, 2009; Easaw et al, 2010) suggest that, this learning process can result in alternative behaviours which deviate from that of the rational expectations, leading to the public revising their estimates of long-run average inflation upward. This change in turn leads to an actual rise in inflation. This suggests that one factor which can influence the learning process of people is the clarity of all forms of regulators' signalling and discussions on economic issues with the public as indicators for policy changes. When the signals used are not consistent, the public suffers from lack of adequate information. This in turn affects people's beliefs, which depend on how much information they have.

Therefore, it is assumed that with information asymmetry people (the public) would be able to predict future policies of regulators and form expectations that align with their objectives. However, when forms of communication provide inconsistent views, people have to make assumptions and this could result in different beliefs for all parties. For example, Vinogradov (2012) further illustrates how unclear bailout policies result in different beliefs for agents (i.e. bankers) and deposits on the liquidation of insolvent banks. The difference in agents' beliefs is a consequence of Central Bank communication, which follows a policy of "constructive ambiguity". Based on this form of communication, it is assumed that the public could estimate the probability of banks being bailed out. This implies that the bailout policy is not known beforehand, arguably on the basis of preventing risk-taking by banks.

This type of communication is similar to Cukierman and Meltzer's model in 1986 which embedded the idea of political ambiguity. Similarly, this type of policy assumes the public can form rational expectations of policy based on past indicators and economic signals. Meanwhile, changes in the macro economy may not be captured by past economic signals or indicators. Given that people have certain constraints over which they have no control over, namely policy changes and income levels, then people might adjust their preferences to meet the conditions around them. When communications are clear and objectives are transparent, people should be able to predict which policy the Central Bank would choose, as it can be argued that various forms of communications and actions creates past signals of Central Bank policies, which members of the public would consider when estimating future Central Bank policy. The only alteration to this process would be a break in signal due to a financial crisis, as past signals would not inform the public about that. Furthermore, a break in signal could come from financial regulators making adjustments in policies to deal with such events. This could be done using clear communications and observable signals. However, where these communications are inefficient and signals are ambiguous to the public, this creates uncertainty. The lack of clear

signals and different views creates “unknown unknowns”: i.e. ambiguity and pessimistic views of the economy, since estimates made by the public would be based on uncertainty, i.e. estimates of the probability of occurrence given a range of possible events, each with its own probability. This sort of uncertainty is presented by Vinogradov (2012) as a special case of ambiguity. Subsequently, the uncertainty results in feelings of general agitation which feeds back to the economic environment. This is channelled via media broadcasts and further discussions by people of uncertainty surrounding potential regulators’ ambiguous policy. Feelings can be a source of information for people in making decisions and influences how people process information (Schwarz, 2011), such that where feelings of agitations are higher, this may reflect in higher pessimistic views of the economy and vice versa.

Adapting this line of reasoning into this chapter, pessimism and optimism are defined by people’s indicated perceptions of interest rates (based on responses to the survey) rather than household choices as suggested in Vinogradov's study. If the choices of people within this chapter – reflected their responses to questions asked about prices in general and interest rates leads to different average expectations and perceptions in the different states of the economic environment for which probabilities of policy changes are different, this would imply that uncertainty within the economic environment results in a change in the average perception of the economy.

4.3 Theoretical framework and design of experiment

People rely on different forms of communications including verbal (Dewachter et al, 2014) and non-verbal communication from Central Bank, to build expectations and inform financial decisions. This reliance on Central Bank communication suggests that it provides information which directly helps to form beliefs about the economy and lead to subsequent decisions. Walstad (1997) and Walstad and Rebeck, (2002) provide evidence to illustrate that economic knowledge has a direct and significant effect on the viewpoints of its nationals regarding several economic issues. Therefore, it can be assumed that people are interested in economic issues, especially issues related to the Central Banks in their economy (Hayo, 1999). Thus, people are expected to pay attention to Central Bank information given their reliance on its communication.

Traditionally, it is assumed that people update their expectations with information, whilst presumably their uncertainty attitudes will remain fixed (LeRoy, 1973: Rabin, 2000; Ross, 1981; Ross, 2004; Rothschild and Stiglitz, 1971). For example, Merzifonluoglu (2015) investigated the sensitivity of procurement strategies to risk attitudes which were presumed constant. Yet, studies (Wijayaratna and Dixit, 2016; Dohmen et al, 2011) show that the context of a decision matters. For example, a study by Moskaliuk et al (2017) on transportation shows that the presence of information in the choice set reduces risk aversion, which causes a reduction in people's valuation of information and reliability. Hence, this chapter expects that, if information can impact people’s perception of risk, then potentially information about the economy on relevant matters may have some effect on risk attitudes.

Based on literature, ambiguity preferences can be affected by the frame of messages. For example, Bier and Connell, (1994) show that people’s preference are ambiguity seeking when probabilities were positively framed and ambiguity-neutral when probabilities are negatively

framed. The timing of information also matters as Liu and Onculer (2017) show that time whether an event is in the future or in the present does affect ambiguity preference. The study shows that the tasks (i.e. choosing or rejecting) people perform moderates their ambiguity preference, it shows that people's attitudes remain constant for low probability events and could change when more people prefer the ambiguous option to risky lottery task (Liu, 2011). This chapter uses risk and ambiguity based tasks as measure of uncertainty to test the impact of uncertainty generated around an announcement, within the economic environment on people's attitudes to uncertainty.

Central Bank announcements are one of the ways in which the public is educated about the economy through the media. Before an announcement is made, the media may broadcast an informal discussion deliberating on the information that might be provided and its potential effects on the economy. The media's perception of news influences the level of coverage it receives. Moreover, the public's knowledge of Central Bank information is improved when there is intense media reporting. A study by Lamla and Lein (2014) suggest, that intensive news reporting (i.e. more frequent media reporting on a Central Bank announcement) leads to an increased tendency for consumer to absorb the information, consequently improving the accuracy of consumer's expectations. This could result in a build-up of anticipation before the event occurs, and could create uncertainty, depending on the content and intensity of the broadcast. Further discussions amongst people within the economy would only help to fuel this outcome. This chapter expects that people's attitudes will be affected not by the outcome of the policy as this announcement was highly anticipated as a positive outcome, but rather by the consequence of this change on people's welfare. The uncertainty created by lack of adequate and clear future projections could impact people's perception and consequently their attitudes towards uncertainty.

4.3.1 How it works

The findings and discussion in a study by Born et al (2011) suggests that the public are not the only concerned with the content of an announcement, but also the state of the environment when the announcement is made. Before an announcement occurs, the media does broadcast informal discussion, and verbal comments made by members of the Board (Federal Reserve). This chapter does not include any empirical measurements of the magnitude of such broadcasts. It anticipates that before an announcement is made, people may be exposed to several forms of information which would include broadcasted informal discussions, comments, the media's interpretation of comments and speculation, as well as personal opinions. It further anticipates that people may also be exposed to the feelings and opinions of others around them, and expects that before the announcement, the level of uncertainty perceived would vary, but this would mostly affect people based on whether they are attentive and what sorts of information they pay attention to.

Broadly speaking, the information to which people may be exposed is grouped into precise (clear information from Central Bank or relevant institutions via various media outlets, and clear projections from economist) or imprecise information such as informal discussion with unclear conclusions, feelings of people “feelings-as-information” in Schwarz and Clore, (1996), and speculations. Attentive people may be more apprehensive when they are exposed to more speculation, rumours, and media publication of informal discussion, as such imprecise information may result in built-up anticipation, rather than a clear positive expectation. This could lead to a psychological impact on people’s perception of the news and consequently affect people’s uncertainty attitudes. Meanwhile, people who are inattentive to media speculations and other associated information should not display agitation towards the announcement, and could be different compared to those who are attentive.

When the announcement occurs, this could increase the amount of information available to respondents, due to increased media broadcasts (Lamla and Lein, 2014). This chapter expects that people who are interested in economic issues, and know of the institution's actions, (Blinder et al, 2008) should not be reflecting signs of uncertainty in their decisions after the announcement. Thus, if attentive people were previously affected by built anticipation, this should be corrected when the announcement occurs. On the other hand, the increased broadcasts imply that attentive subjects are exposed to excessive information, which could result in information overload (Haksever and Fisher, 1996) and thus the strain of filtering information could also result in a negative perception of the information. Meanwhile, those who are inattentive to the media, though exposed to the announcement may not be attentive to it: they may be attentive to other forms of information previously mentioned, such as opinions from further discussions, others' feelings, information overload and the subsequent strain of filtering information. These could cause inattentive people to view the information as negative, or not be affected at all by their environment.

Apart from being rational, people are emotional and subsequently prone to factors which could influence their emotions (Katona, 1994). With further broadcast and increased communication within the economy, this may result in general agitation and worry. Thus, this chapter hypotheses that if there is built anxiety before the announcement it could impact on people's attitudes. The impact seems to affect their perception of the economy and decision process, but when substantial, this would reflect in decisions made. There could be effects on both attentive and inattentive respondents, as both groups may be attentive to built-up anxiety, which may lead to increased caution. Studies have shown that regret, anger and other emotions can become information for people (Loewenstein, 1996) and can influence people's interactions with others (Van Kleef and Gerben, 2009) as well as decisions. For example, anxiety is a signal

for uncertainty. Uncertainty is known to affect people's judgment, leading to more cautious behaviour.

This chapter anticipates that uncertainty would make it harder for people to accurately make relevant adjustments when monetary policy changes in macro-economic fundamentals occur. For example, Masolo and Minto (2015), show the effects of uncertainty surrounding a policy-maker's potential actions on people' decisions to consume or/and save. Thus, if people are expected to maximize utility based on their preference when such as changes to policy or income level constrains occurs, then in the light of uncertainty, such a decision process becomes more complicated for people since the probabilities of the outcomes are not known. This might lead to people overweighting events with less likelihood and underweighting events with high likelihood (Hertwig et al, 2004). Hence, when an economic change occurs, there might be a deviation based on the expectations and the level of economic uncertainty. Thus, people's attitudes towards uncertainty, which are measured in this chapter using risk and ambiguities, might be sensitive to the information and level of economic uncertainty that exist within an environment. The results of this chapter show that people's perception of news is affected by uncertainty.

4.4 Experimental design

Generally, consumer expectations are estimated based on either media expectations or consumer survey. In multiple countries, surveys are the most common means of conducting national measures of the public's inflation expectations (Blanchflower and Coille, 2009; Bryan and Venkatu, 2001; Curtin, 1996; Jonung, 1981; Ranyard, Del Missier, Bonini, Duxbury, and Summers, 2008). The Reuters/University of Michigan Survey of Consumers (henceforth, Michigan Survey) has been measuring inflation expectations of Americans for more than 50 years (Curtin, 1996, 2006). Median responses generally track official estimates of realized inflation, sometimes even outperforming professional forecasters (Ang, Bekaert, and Wei, 2007; Hafer and Hein, 1985; Thomas, 1999). Additionally, studies like Carroll (2003), estimates consumers' expectation on inflation using the media, while Lamla and Lein, (2008) estimates consumers' expectation on interest rates by analysing media reports on inflation in Germany. Moreover, Central Banks such as the European Central Bank and Federal Reserve make use of consumer index surveys to measure the expectations of individuals within their country (Galariotis et al, 2018; Blinder 1999).

This study focuses on the public's stated expectations and perception, which is captured using a survey conducted around a well-anticipated interest rate hike in the United States. To demonstrate the impact of announcements on people's judgement in an economic environment (Schwartz, 2011), this chapter conducts a field experiment using a survey on US participants using a change in monetary policy. The announcement was made on the 16th of December 2015. In order to capture individuals who would be anticipating the news, but may be uncertain about its effects, the study recruited people two days before the official monetary announcement was made and broadcasted. This was done using Survey Monkey, which ensures that a representative group (see descriptive statistics in Table 4.2) is recruited despite of subjects not receiving any monetary remuneration. The media is a cheap and reliable source of information; more

individuals would be updated with relevant information (Lamla and Strum, 2013) or are at least exposed to it. This chapter depends on the assumption that people would rely on media sources, such as online, television and radio, print, as well as friends, family, and colleagues. Hence, by recruiting two days before the announcement, this ensures that this chapter captures people who are exposed to speculation (positive expectations) about future effects even before the announcement, as people are expected to update their information from time to time when it becomes available, and potentially more when there is increased broadcast (Caroll, 2003). For example, Dookpe et al (2008) shows that in the Euro area, people update their expectations from Central Bank communication once in 18 months because it is costly to do so. However, Lamla and Lein, (2014) shows that with intensive news reporting on a Central Bank announcement, there is an increased tendency for consumer to absorb the new information presented in the media. This improves the accuracy of consumer's inflation expectations, as they receive more information from the media. Hence, with cheap and available information, people should update their expectations within two days of the announcement. Alternatively, before the announcement people could be exposed to anxiety built up from informal discussions and anticipations of future effects of the policy change which intensify prior to the announcement. Anxiety could come from uncertainty, developed as a result of inconsistent views of members of the Federal Open Market Committee (FOMC) (Blinder et al, 2007) and from informal discussions broadcast in the media about potential future changes in terms of policy. Hence, this group forms the control for the experiment: a group marked by anticipation, resulting in uncertainty of what this impact could be expectation of future income. This pattern of data collection is a unique feature to this chapter, ensuring that enough people were exposed to the information before and after the announcement.

A second survey with similar questions sets is then conducted within four days of the first recruitment. This ensured that people who have heard the news are captured: however, these are

not the same subjects that were recruited in the first survey as Survey Monkey could not guarantee getting the same subjects. Nonetheless, the groups are similarly representative of the population of the United States and participants with similar characteristics in terms of the proportion of genders, ages, incomes, and locations are targeted. By recruiting within the two days following the announcement, this ensures that the media would have circulated the information, given its importance. As Lamla and Lien (2011) points out, important news gets more media attention, hence this study expects that given the relevance of this announcement, there will be a high level of broadcast of the news. This creates a treatment group of subjects who are most likely exposed to information from the Central Bank via all media sources and non-media resources. This group is marked with more information: a mix of prior speculation, the news, and more deliberation over the impact on the future economy. A key feature for this group is that those who are attentive to the news should have less uncertainty, compared to others who are not attentive to news. This is because those who are consistently attentive to Central Bank communication would have built up a trust and understanding of its activities (Kramer et al, 2008). Compared in this way, for which the difference between sub-groups suggest the effect of difference in uncertainty about impact on future income from information available within the economic environment.

This study conducts two experiments, comprising two samples with different subjects so that average decisions would reflect the impact of the environment in their choices on risk and ambiguity questions. This design has similarities to Bailion et al (2016), in which people were asked to watch a movie (the treatment factor) to measure the casual effects of emotions on ambiguity preference. Some people watched a sad movie and others a happy movie. Afterwards people were given risk-based problem sets and the differences between groups were compared to test for a negative effect on people's decisions. Similarly, the author expects that the judgements of people will be affected by the levels of agitation built up within each economic environment.

Thus, people in both groups should be affected differently and therefore reflect this in their decisions. Using as an example, the December 2015 policy announcement by the Federal Reserve, this chapter shows the impact of different levels of uncertainty generated around an announcement and how it could affect people's judgement their attitudes towards uncertainty. Consequently, the hypothesis is that there is a differences in people's attitudes due to difference in their exposure to information – including imprecise information such as speculations, informal discussions, and people's feelings/perception of rumours and precise information after the announcement – and that this difference will reflect factors of the environment as an information effect in their decisions. It was also hypothesised that this difference in information leads to a difference in the reaction of respondents within the different samples before and after the announcement; based on their attention to either precise or imprecise information. The figure 4.1 below illustrates how speculation could lead to a direct effect on uncertainty decisions before announcement, while after the announcement, information overload or the information (content of the announcement) could lead to a change in uncertainty attitudes.

[Figure 4.1 here]

Table 4.1 here

The hike in interest rates provides a good basis for the study, as Federal Reserve announced an increase in rates which had not occurred in a decade. This rise in rates from 0.25 to 0.50 received a lot of media attention, making this event a good example for this chapter. Questions (see Table 4.1 below) are designed based on Ellsberg's two box problem sets (Ellsberg, 1987), and willingness to accept risk (Tversky and Kahneman, 1979). These are standard tasks for measuring uncertainty attitudes in people. The data is split into two groups, based on the indications of respondents on being informed about the announcement via any means. Respondents were asked to select an option answering the question "…Have you heard any news about the monetary policy of the Federal reserve? What did you hear?" from a drop-

down menu of seven options which demonstrated which information they were attentive to inattentive. This set-up is similar to the questions used by Kramer et al (2008), who asked subjects to indicate whether they were attentive to the European Central Bank's activities. Based on the responses of those who selected the options indicating that they heard something about Federal Reserve increasing rates or something about rates, were labelled as attentive, while those who indicated that they had not heard anything were classified as inattentive. From these responses, people were split into 'attentive' and 'inattentive about announcement'. Most analysis is done on the basis of a split in attentiveness to Central Bank communication. Table 4.1 above shows the questions which respondents are asked in the survey. The survey has four parts, with the first part focusing on perception and expectation questions on interest rates and prices-in-general. Part 2 presents typical lottery-based questions and two Ellsberg box questions, which are unrelated to the news. The study includes these measures to determine the impact of information as communicated prior to and after the announcement on people's judgement. Given that these questions are unrelated to the announcement this would ensure no bias to the choices of respondents and the choices indicated by subjects would reflect the impact on information as perceived either before or after the announcement. Using responses to these questions, the risk and ambiguity attitudes of people are measured before and after the announcement. This chapter tests for difference in attitudes across subsamples which would indicate the effects of agitation provoked by the environment on people due to amplified speculations about policy actions (the change in monetary policy), circulated mostly via the media within the environment. Therefore any effects would show in a difference in the attitudes of people when compared before and after the announcement from the Central Bank for all sub-samples.

From responses to lottery questions, the certainty equivalent (CE) is measured, i.e. the certain amount that makes a subject indifferent between playing the lottery and obtaining this amount for sure, using responses to question 11 above. For the given expected value (EV) of the

lottery, this measure can be transformed into risk premium (RP) by taking the difference between the Expected value and the Certainty equivalent. Then, using these values, people are classified into binary variables representing risk-averse, -neutral and -seeking. People are classified as neutral if the difference between expected value and indicated preferred amount is zero, or seeking if the difference is negative and averse if positive. The risk premium and fractions of risk -averse, risk-neutral and -seeking attitudes, as well as fractions of ambiguity attitudes, are tested using an independent non-parametric test.

$$RP = \text{Expected value (from response)} - CE \text{ (from question)}. \quad (4.1)$$

To measure ambiguity attitudes responses to questions 12 and 13 (in Table 4.2 below) are used to categorise respondents as ambiguity-neutral if they choose A in question 12 and B in question 13 or vice versa. The questions are identical to questions used in Chapter 3, where subjects are ambiguity-averse if they choose a ball to win a price (using a drop-down option) from either of two boxes marked A (50/50 probability) or B (unknown probability). A selection of B in both questions would indicate ambiguity-seeking, and if they choose A in both questions this would indicate ambiguity-averse. A change between boxes, either A first and B second or the reverse, would indicate ambiguity-neutrality. These results are then converted to binary variables and used to test the difference between both samples, before and after for significant difference in attitudes given that the announcement occurred. This test of ambiguity attitudes is used, for example, in Eichberger et al (2015), and Butler et al (2014). Other tests of ambiguity aversion exist (e.g Halevy, 2007; Dimmock et al, 2016) but these are lengthier and therefore less suitable for short online surveys. Furthermore, the data set is split into two groups based on the indications of respondents and whether they were attentive to the announcement via any means. From these responses, people are split into ‘attentive’ and ‘inattentive’ and these classifications are used for most analysis. Table 4.1 above shows the questions which respondents are asked in

the survey. This chapter tests for difference in attitudes across sub-samples which would indicate the effects of Central Bank information on people.

Table 4.2 here

Table 4.2 above shows the distribution of the two groups, both of which are fairly similar across all variables. Although participants are different, Survey Monkey tried to ensure that the distribution of both groups are matched. Nonetheless, this study used a chi-square distribution test to analyse differences between samples and most groups are non-significantly different except for a subcategory of age, 45 – 54, which was significantly different by p-value < 0.05. However, overall the age group is not significantly different. Hence, we control for this variable to further analyse using binary variables that represent this group.

4.4.1 Binary Variables

To indicate the factors which could affect the risk and ambiguity aversion of people within this chapter, probit models (see equation 2 below: where ambiguity and risk aversion binary variables are dependent variables) are applied to analyse such effects. Dummy variables included in the model are used to control for most factors, where '1' indicates the presence of a variable. These control variables include age. The binary variable 'young' takes '1' for subjects who are 44 years and below, or '0' otherwise (controlling for this group helps to see if the difference in age 45-54 matters), Gender (Females) is included in line with Dimmock et al 2013, who shows females as less risk averse in comparison to males.

$$\text{PROBIT}(p) = \text{Intercept} + \beta X \qquad (4.2)$$

There are also dummies for media channels (TV or radio, online, paper), as Blinder and Krueger (2004) identifies television and newspapers as the two most important sources of economic information. This is derived from question 15, where respondents indicate the sources on which they rely. A binary variable is generated every source where '1' indicates the presence of a source and '0' for other sources. Participants are asked to indicate only three sources at

most. Hence, this study acknowledges that there are overlaps of sources: however, the purpose of using binary variables is to test whether that channel of information matters, and in what way it impacts people's attitudes if it does. This chapter does not measure how much the news was broadcast, nor its coverage, but simply assumes that with such high relevance of the content of the announcement, there should be high media broadcast and high anticipation from respondents. Rather, it assesses the sources which people indicate as their sources of economic information and identifies how these sources can impact decisions or attitudes towards risk and ambiguity. Other control variables include 'income level' a binary variable with '1' for subjects who earn <$75,000 per annum, and '0' otherwise, as well as the literacy level of participants. Dimmock et al (2013) show that the financial literacy of households is an explanatory factor for ambiguity aversion, so there is a need to control for this. This study uses responses to the literacy question (question 15 in Table 4.1) to categorize respondents' levels of literacy. Subjects are asked four questions and, using the proportion of correct answers, are grouped into five categories as shown in Table 4.2, with 2.87% and 3.7% of participants getting no correct answer before and after the announcement. This indicates that a good proportion of subjects have a fair understanding of economic matters and how they could affect them.

4.4.2 Financial literacy

Given the difference in the distribution above (Table 5.2), this chapter controls for literacy, as economic knowledge could also affect the perception of economic information. Using a dummy variable, which assigns '1' to indicate participants with high literacy and '0' otherwise, this chapter controls for the impact of knowledge in reaction to Central Bank announcement. Responses to literacy questions (see question 10 in Table 5.2) provide us with a measure of the proportion of individuals who are financially literate, of which at least half of our population demonstrated high economic literacy and only about 10% had very low literacy on financial issues.

According to Anders et al (2017), financial literacy is positively correlated with a number of important household financial behaviours. These include retirement planning and precautionary savings (Hastings et al, 2013) and household financial security (Lusardi et al, 2011). This chapter expects that such a correlation could exist in this data too, which is why it is controlled for. To test the financial literacy of respondents, they were asked four questions (see table 3.1 above) similar to standard financial literacy test, such as the "Big 3" financial literacy questionnaire pioneered by Lusardi and Mitchell (2009; 2011) and the U.S. National Financial Capability Study (NFCS). Furthermore, Hastings et al (2013) and Anders et al (2017) links the score of these questions to different financial behaviours and finds that more financially literate people are more likely to save, plan for retirement, pick up credit information, and have better-diversified portfolios. Thus, controlling for literacy will allow for a clear test of the impact of future income uncertainty as a consequence of the different levels of uncertainty people are exposed and attentive to.

4.4.3 Expectations and perceptions

An individual's perceptions of price changes, economic forecasts and social amplifications of forecast informs their expectations of future levels of economic factors such as inflation (Ranyard et al, 2008). This occurs due to people's assumption that the past trends of prices, for example, can continue. Thus, it is no surprise that an individual's expectations could influence their attitude and behaviour towards economic issues as well as their financial choices. Jonung (1981) in his study uses data from a survey to estimate consumers' perceptions and expectations of inflation rates. These question types ensure that individuals think about more general 'things around them'. Within this chapter, the researcher is interested in how people perceive their economy ('things around them'), rather than their perception of the general inflation rate. The idea is to prime respondents to think about how they spend their money in terms of prices of items in the shop etc., thus this chapter adapts these question types (See Table

4.1 above questions 1-8) as a measure of people's expectations and perception of prices and the things they spend their money on.

Furthermore, to measure future expectations, respondents are asked a similar question but with a change in context to the future year, referring to "prices in general during the next 12 months". This also helps people to think about prices in relation to different household expenditures. An alternative question could be to ask for the "prices you pay" as this would further prompt people to think of things such as housing, food and clothing. As the focus of this chapter is assessing people's consumption, the measure of prices in general as applied in this chapter should suffice. In addition to questions on prices in general, respondents are asked about their perceptions and expectations of interest rates, which in measured using car loan rates in relation to the news (see question 1 and 3, Table 4.1). These questions assumes that from the announcement about changes to monetary policy, respondents are able to interpret the information and update their expectations based on their attention to media broadcast (Lamla and Lein, 2008) and this update would reflect in their stated estimates.

4.4.4 Measuring uncertainty attitudes

Using the measures of uncertainty attitudes with Ellsberg type questions and a lottery based question in the previous chapter. This study further examines how attitudes may explain consumers' marginal allocations to expenditures. These questions are unrelated to "prices in general" and the announcement, but are used to analyse people's attitudes towards risk and ambiguity. Using the response to the two Ellsberg box questions, people are grouped into 'ambiguity-averse' if they choose the 50/50 options for both questions; 'ambiguity-neutral' if they switch between options, either unknown option then 50/50 or vice versa, and 'ambiguity-seeking' if they opt for the unknown option in both questions.

Risk attitudes are measured using the response to the lottery-based question. By taking the different between the expected value of the lottery $50,000, and the certainty equivalent (CE)

indicated by respondents in answers to question 11, the risk premium is calculated. These values are further analysed to generate a risk-averse dummy variable, indicating '1' if the risk premium is positive, and zero otherwise i.e. risk-neutral or risk-seeking. Similar dummy variables are generate for 'risk-seeking' indicating '1' for risk premium less than '0' otherwise, and for 'risk-neutral', risk premium equals to zero. An alternative measure of uncertainty would have been a question asking about uncertainty on inflation. More so, this chapter relies on these measures of uncertainty attitudes to provide an exclusive and rigid measure of uncertainty attitudes, which focuses on the effect on judgements rather than on the effect of inflation uncertainty. To further ensure robustness, certain factors are controlled for such as income levels, age and gender, which are all indicated in the study using dummy variables, such as 'young' (i.e. those aged 45 years and below), female, and high income levels (those earning, above $75,000 per annum).

4.4.5 Media sources

The media plays a relevant role in providing information to the public. Lamla and Strum (2013) also identifies the media as a cheap and reliable source of communicating information to the public from the Central Bank, while Lamla and Lein (2014) suggest that the media is relevant to people in forming expectations about economic issues such as inflation. Hence, the media is relevant for the expectation formation process, because most people obtain their information from news reports. Blinder and Krueger (2004), show that consumers obtain their economic information largely from TV and newspapers. Furthermore, Hayo et al (2008) identify newswire reports or written reports as the main ways in which the Central Bank communicates to the public. These go to support the opinion by Van Raaij (1989) that economic news affects people's formations and expectations of causal attributions through the way it provides information. Hence, this chapter acknowledges that the media is relevant for creating the environment which impacts people's consumption-savings motivation. This chapter further suggests that future research should aim to test for the effect of these sources, as well as other forms of information

in the study. The media channels covered in this chapter includes online, television and radio, word of mouth or hearing from colleagues, friends and family members and print. These different sources could have various levels of impact on people's attitudes towards consumption-savings.

4.5 Results

The Mann-Whitney test is used to compare the average risk premium between both groups for differences between mean risk-premium, as shown overall by the results in Table 4.3a. There is a significant difference between the average risk premiums of both groups. The results suggest that the announcement creates different environments where the uncertainty level about future economic outcomes differs, thus resulting in different impacts on people's judgement. This impact is reflected in risk attitudes from people's judgements and attitudes to uncertainty. People who are attentive to an announcement and know its contents react differently to people who indicate that they were inattentive to the announcement: people who are attentive are less agitated by the environment. This suggests that people who have a higher knowledge of Central Bank activities were less vulnerable to pressures within the environment (Erhmann and Fratzscher, 2011). The result shows that the environment does matter for decisions and shows the impact on uncertainty attitudes.

Ho: the average risk premium for subjects before and after announcement are equal

H_1: the average risk premium for subjects before and after announcement are not equal

Ho: the average risk premium for attentive subjects before and after announcement are equal

H_1: the average risk premium for attentive subjects before and after announcement are not equal

Ho: the average risk premium for non-attentive subjects before and after announcement are equal

H_1: the average risk premium for non-attentive subjects before and after announcement are not equal.

[Figure 4.2a]

[Figure 4.2b]

From Figures 4.2 a and 4.2 b above, which show the distributions of risk premium across samples for before and after the announcement, the cumulative distribution (Figure 4.2a) does not suggest that there are any variations in the samples. Figure 4.2b, however, does suggest that there may be differences in the sample (see a hump on the scale between $15,000 to $40,000) and that the sample is not normally distributed. This suggests the use of non-parametric method in identifying difference: consequently, the Mann-Whitney U test which is a non-parametric test for distributions with non-normality, is used to test for difference in means. The difference in sample distribution (Table 4.2b: graphical illustration) hints that the announcements could help to create environments with different certainty levels which impact people's risk premiums. We anticipate that before the announcement, attentive subjects are exposed to more anticipations and uncertainty, and could therefore show more aversion, than their inattentive counterparts.

To investigate this effect and view this difference in reaction, the groups are compared using a difference in means test (Mann Whitney U test in equation 3 below) and presented in Table 4.4 and 4.5 below. The data set is mostly split into treatment groups, before and after the announcement. Using a further natural sub-division of data based on attention to Central Bank information, the data set is further split into smaller groups. Looking at the fractions of risk attitudes below in Table 4.3, it affirms that people' risk attitudes are sensitive to the environment.

$$U = mn + \frac{m(m+1)}{2} - T \qquad (4.3)$$

Table 4.3 shows that the mean risk premium is higher ($22,723 > $18,695) for attentive subjects before the announcement than after. This is followed up with a higher proportion of risk-averse subjects (0.68 compared to 0.588 after the announcement). For those who are inattentive to the news, the average risk premium ($17,057) is lower before than after ($23,619). Higher risk premium suggests that people want more compensation for risk before the announcement, when there is high anticipation about the announcement and its effects. After the announcement, there is less risk-aversion but more risk-neutrality (0.204 before < 0.29 after). The rise in neutrality suggests that precise news makes people who update their preferences indifferent to risky prospects. The contrasting difference for inattentive subjects, where there is a higher proportion 0.078 (significant at p-value < 0.05) of risk-seeking subjects after the announcement, suggest that those who were not paying attention to precise news are potentially still risk-seeking. The results suggest that attentive and inattentive people react in different ways to the announcement. Although alternative factors that could drive this reaction are not tested for, a good hypothesis would be that people may well react to strain or stress, either from speculation about future impact on the economic before the announcement or from information overload after the announcement. In Table 4.3 below, a lower proportion of risk aversion after announcement seems to imply that the announcement dampens the uncertainty in the environment. However, the presence of information overload could cause people to avoid or undervalue the information available, thus leading to increased aversion after the announcement for inattentive respondents. The inattention could be a consequence of the strain of filtering excessive information, namely noise and news. Hence, the effect on risk attitude seems to be a function of stress or anxiety as a consequence of information made available from various media sources, through from which the Central Bank and other institutions communicate to their

nationals. Although communication ought to help resolve some of the uncertainty surrounding this change, the channel of communication may affect this process.

Table 4.3 here

Table 4.4 here

4.5.1 Ambiguity attitudes

A similar pattern of results compared to the risk averse fractions above, is found in the ambiguity attitudes of subjects. Specifically, the proportion of ambiguity-averse people is high in Table 4.4 above, where ambiguity-averse has a proportion of subjects before the announcement of 0.863 compared to after the announcement with 0.793. This is the case across all sub-samples and reduces significantly, (with a positive difference between the column under Announcement labelled (1) and (2) showing a difference of 0.07 significant at p-value < 0.01) for people who are attentive to the announcement.

Furthermore, the high proportion of ambiguity-averse attitudes reflects pessimism surrounding the change in monetary policy rather than optimism. In Table 4.4, the proportion of ambiguity-averse attitudes in all groups before the announcement ranges between approximately 87% to 85% . This percentage is higher than in a previous study by Dimmock et al (2016), where the proportion of ambiguity averse people is 52%. Dimmock et al (ibid) studied the relationship between ambiguity attitude and stock market participation. The study showed that there was increased uncertainty when a proportion of investments in the stock market reduced within portfolios of US households. Another previous study by Vinogradov et al (2016) shows ambiguity averse attitude at 70% to 75% maximum, when using the same measure of ambiguity aversion as was used in these surveys. Yet these ambiguity aversion proportions are lower compared to the proportion in this chapter, which starts at 86% and reduces to 78%. The main difference between this chapter and other studies mentioned is the context.

This chapter measures ambiguity aversion during a change in monetary policy, and the high proportion might be explained by a psychological impact which has influenced the perception of uncertainty. In addition, Dimmock et al, (2016) suggest that events which are moderate and of high-likelihood result in a 50% proportion of ambiguity aversion. Thus, if monetary changes were expected, then ambiguity aversion should not be as high, because high ambiguity implies a negative perception of information. Hence, the increase in ambiguity aversion is not just because of monetary change, but the sentiments regarding the changes as well. This reaction in ambiguity shows that people may feel overwhelmed by uncertainty and information: thus they feel more confident in some assessment of known probability but more uncomfortable about decisions in which the probability is unknown (Ghosh and Ray, 1997). For example, people might avoid betting when they lack the information that other players may have, and would confidently bet where they feel they have the same information as other players (Frisch and Baron, 1988). The result shows that people have different attitudes between the occurrences of announcements, suggesting that difference in uncertainty reflects in their ambiguity attitudes.

As the result in Table 4.5 above shows, attentive people have a higher aversion before compared to inattentive people after. This shows the effect of precise information in the environment on people's attitudes towards aversion. More puzzling is the consistently high levels of aversion for inattentive people. This suggests that although people are not attentive to precise information from the media, they could be attentive to other forms of information (imprecise information and possibly information overload) which could result in aversion. Knowledge of Central Bank activities could help reduce this effect as Walstad (1997) and; Walstad and Rebeck (2002) highlighted that the knowledge of economic issues does significantly affect people's perception of them. Thus, more prior knowledge could mean less sensitivity to speculation. This observation of inattentive subjects provides some evidence to reinforce the prior hypothesis,

which explains the impact of information overload as a potential source, causing people to perceive information as negative.

4.5.2 Media pressure as a channel for anxiety in the environment

As earlier stated, communication from Central Bank is carried out using various media mechanisms, which could affect the effectiveness of communicated information. These channels of communication seem to matter for people's uncertainty attitudes (Dimmock et al, 2011). Using a probit model we show which media sources can explain the proportion of ambiguity averse subjects within the entire sample.

$$\text{PROBIT } (p^*) = \text{Intercept} + \beta X \qquad (4.4)$$

The probit model is used in this study, as it takes dependent variables that are binary (i.e. either '1' or '0'), given that the ambiguity-averse variable is a binary variable, such that when p* is greater than zero, the subject is ambiguity-averse . The probability that p* =1 is given by equation 2, where β is the vector of coefficients to be estimated. Positive coefficients mean that the probability Φ ($X'_1 \beta$) of a subject being averse with that variable, where Φ is cumulative distribution. Similarly, a negative coefficient shows the probability of a subject being less averse.

Using 'ambiguity-averse' as a dependent variable, the model includes binary variables for age (young i.e. <45 years), gender (female), low income (< $75,000 per annum), and binary variables representing three main sources of information, television and radio, newspapers, and online sources. Informal discussions amongst family members and colleagues – hence 'word of mouth' – is not included as a source variable. Table 4.6a below illustrates that media channels do matter for subjects who are ambiguity-averse, but not those who are risk-averse. The television/radio channels seems to support an increase in ambiguity aversion before announcement, while the internet/online channel reduces it after announcement. This indicates that channels intensify the potential perception of information for people and that these channels can amplify effects within the environment. In order to test for the impact of media channels and

other forms of information such as word of mouth, television/radio, online, are included in a probit (equation 4.4 above) is used to test for the effects of media channels on uncertainty attitudes with risk averse (RA) and ambiguity aversion (AA) as binary dependent variables (see formulas for models below). Binary variables represent the announcement occurring, gender (female), age ('young' referring to subjects who are below 45 years), low income denoting subjects who earn above $75,000 per annum) high literacy, (those who scored 3 and above on the literacy test) and different media outlets. Each channel was tested individually (columns 2 to 5 on Table 4.7a) using binary variables to indicate the presence of one media and the absence of others isolating the effects on each media sources on all ambiguity-averse individuals within the entire sample.

Table 4.5 here

Table 4.6a here

Table 4.6b here

Looking at Tables 4.6a and 4.6b above, the results demonstrate that ambiguity aversion is negatively associated with Central Bank communication, as more communication implies less aversion. Yet for risk-averse attitudes, there are neither effects of the announcement nor its channels. This implies that the effects are mainly for ambiguity problems, affecting more complex situations than risky situations. The variation in effects shows that people perceive risk and ambiguity differently when there is uncertainty surrounding news. This supports findings by Blinder et al, (2008) who states that increased communication should lead to better accuracy, as this leads to more certainty. Table 4.5 also supports the findings above as it demonstrates that TV media (0.240 significant at p-value< 0.05) seems to drive the impact of the environment on people' sensitivity to uncertainty. This is seen in Table 4.6a above, as before the announcement the media (television and radio) leads to increased ambiguity aversion. After the announcement,

the media (internet) also leads to reduced ambiguity aversion. The interaction of media on ambiguity aversion suggests that the presentation of information by media outlets help procure and reduce the impacts of economic changes on people.

4.6 Discussion

Swanson (2006) argues that the Federal Reserve's practice of making same-day announcements of monetary policy decisions since 1994 was an important contributing factor in improving predictability and reduction of uncertainty. The results of this study agree with this, as attentive subjects show less ambiguity (0.793 in Table 4.4) after the announcement. Additionally, a study by Selma Demiralp and Oscar Jorda (2002:2004) illustrates that announcing changes of Central Bank federal funds rates imminently enables the Federal Reserve to move the actual funds rate. Thus, it is no surprise that subjects who are attentive when macroeconomic forecasts are communicated and who were provided with information that serves as indicators about future interest rates, which is expected to help members of the public, predict future Central Bank actions better; especially when this information is made available to public, through various means such as the media.

The media could influence this process of managing expectations through intensive coverage and the tone of the content (Lamla and Lein, 2014: Carol, 2005). Table 4.5 shows a lesser proportion of ambiguity-averse subjects after the announcement based on media sources used by subjects. Consequently, this may also imply that whilst the media provides precise information that could reduce uncertainty, it also provides imprecise information, which could explain the higher proportion of ambiguity-averse subjects prior to the announcement. This indicates that the media could serve as a catalyst which fuels speculations and could bombard

people with excessive information which may be perceived negatively. Furthermore, the strain from built uncertainty prior to an announcement and information overload also gives out signals of uncertainty, which hypothetically could influence the public to view the information as a negative or undermine its content. However, this effect is only likely for individuals who were not attentive to precise information after the announcement, but were attentive to imprecise information before the announcement. This is because, prior to the announcement, we hypothesise that the media could help foster uncertainty, which could come from inconsistent signals and informal discussion about different opinions. Members of a monetary policy committee could disclose these either intentionally (e.g by conducting a debate in public) or unintentionally (e.g via uncoordinated communication). Thus where it seems that Central Bank provides unclear or ambiguous communication, this may affect the views of future announcement, (Blinder, 2007).

In conclusion, this study has shown that people are affected by their environment via exposure to certainty or uncertainty from precision and/or imprecision of information. The study has shown that people are sensitive to various forms of communications in the environment due to deliberations about the impact of economic change on the future economy, which is exemplified using a monetary policy announcement. Ambiguity attitudes have been shown to have a positive relationship with uncertainty. This is similar to findings by Gu et al (2017), who show that anxiety has a positive relationship with risk avoidance: when uncertainty about an event increases, so does ambiguity associated with that event.

Furthermore, the study hypothesis that a possible explanation for a high proportion of ambiguity-averse with inattentive subjects could be their interpretations of other people's sentiments about the economy. When negative perceptions are expressed and shared as information; those who do not have information from the Central Bank could interpret the news as negative, and would be averse in their attitudes. A study by Harms and Kretschmann (2009)

suggests that feelings can be incorporated into decision in several forms. In this chapter, the feelings of anxiety is hypothesised as a potential factor which leads to increased caution, especially when dealing with ambiguous problems sets. Furthermore, this effect is prominent amongst people who are attentive to Central Bank communication as compared with those who are inattentive. This, indicates that the content of the announcement does affect people, but there are other factors which people are sensitive to and which also plays a role in impacting people psychologically, in turn affects their perception of the content.

4.6.1 Key implications

It is assumed that Central Bank communication affects financial markets via changes in macroeconomic factors that underlie financial decisions, while attitudes are assumed constant. This chapter shows that the latter is not the case, as informal discussions in the media add to general agitation, which leads to people perceiving the economic environment as pessimistic with reference to the economic policy announcement. People's ambiguity attitudes reflect the level of economic uncertainty perceived as a response to economic policy announcement. Therefore, the impact of informal discussions on attitudes needs to be considered by politicians and regulators, as decisions are also shaped by attitudes, not just by communicated fundamentals. As Kossowska et al (2015) show, when people are concerned about uncertainty, their level of stress is associated with their utilitarian decisions those which regard their welfare.

As expected, information from the Central Bank announcement should dampen general agitation for attentive people updating their information via the media. Nonetheless, other forms of information (imprecise information) could lead to information overload through exposure to noise and news. This is even the case for attentive people, as general agitation could still result in a similar effect for both groups. Too much information causes strain, leading to reduced value of the information or total avoidance. This strain could indirectly lead people to view the information as negative or uncertain, thus resulting in cautious behaviours. Thus, when the level

of anxiety comes either from speculation prior to the announcement or from information overload, then people both attentive and in-attentive may follow the general opinion of others in the economy, as opposed to their own knowledge. This could lead to different levels of economic uncertainty, to which people's preferences are sensitive. Thus, people exposed to different environments will adjust their preferences in line with the level of general agitation within that economic environment.

Figure 4.1: Theoretical Framework

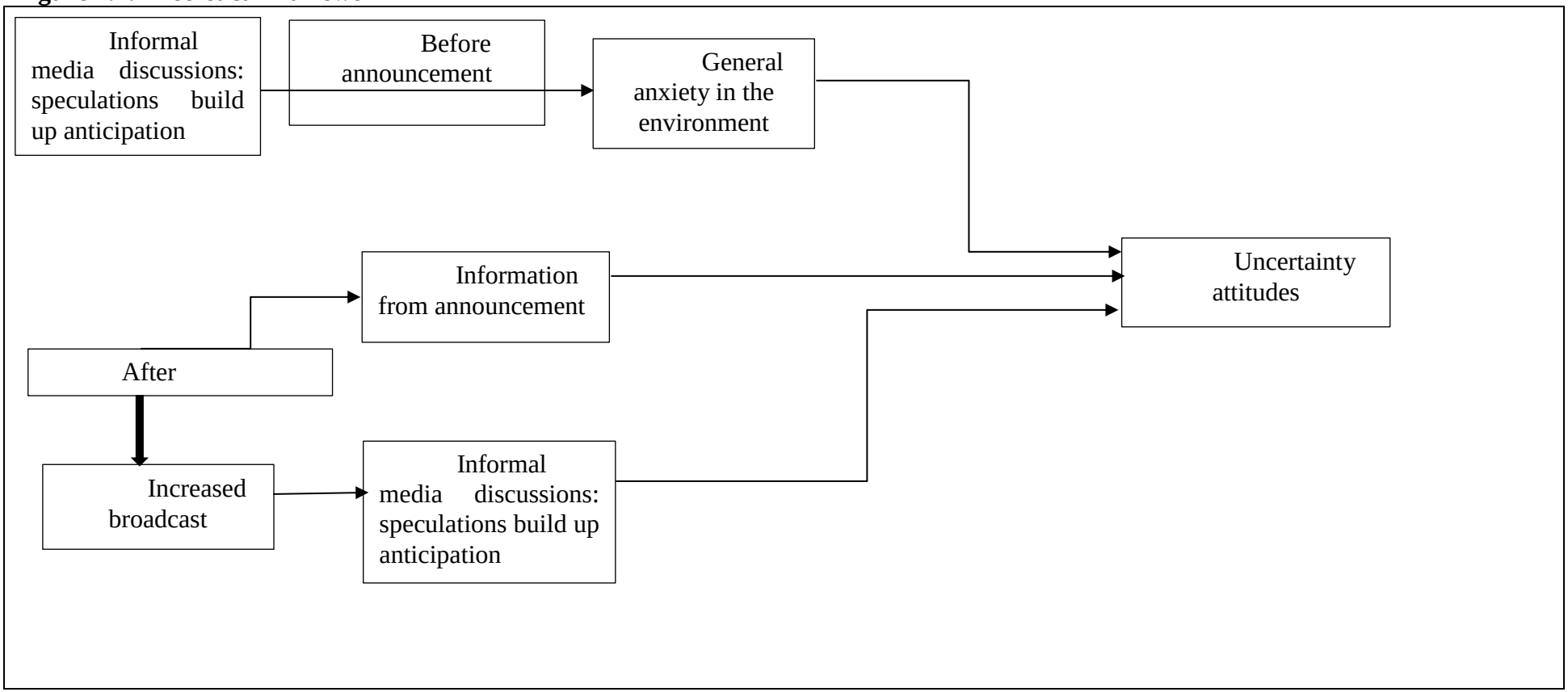
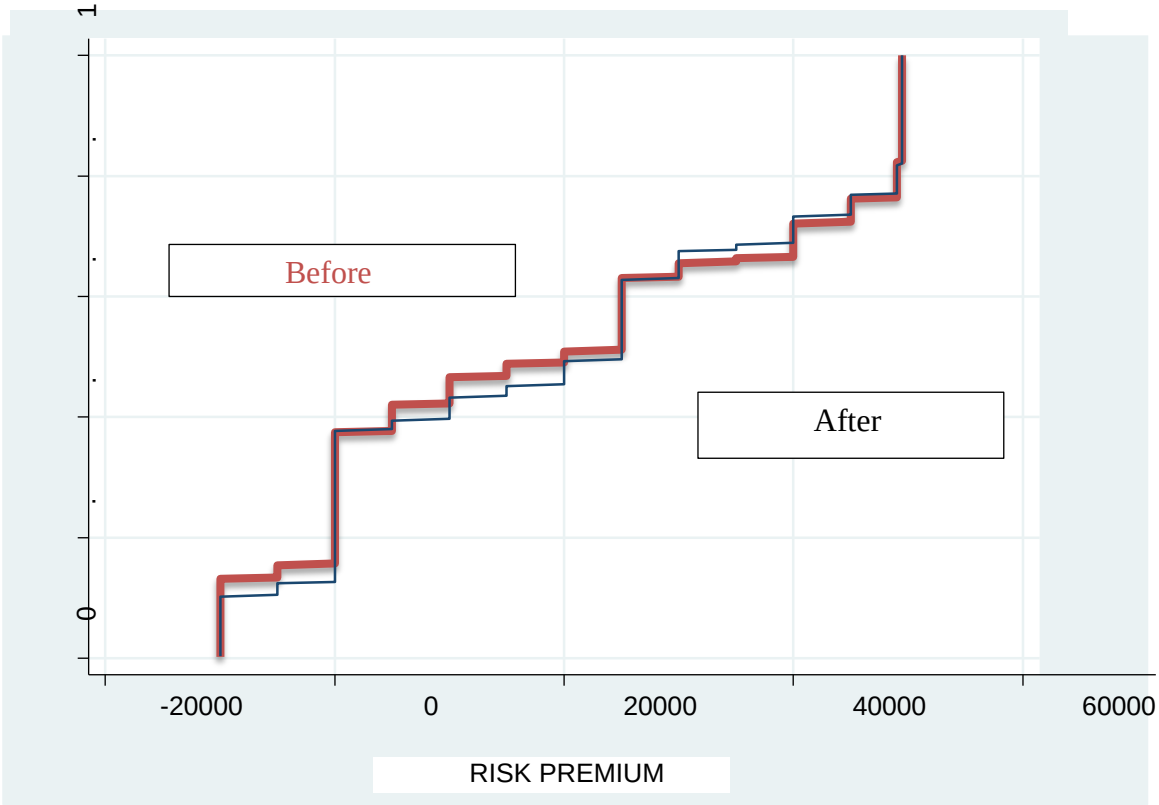
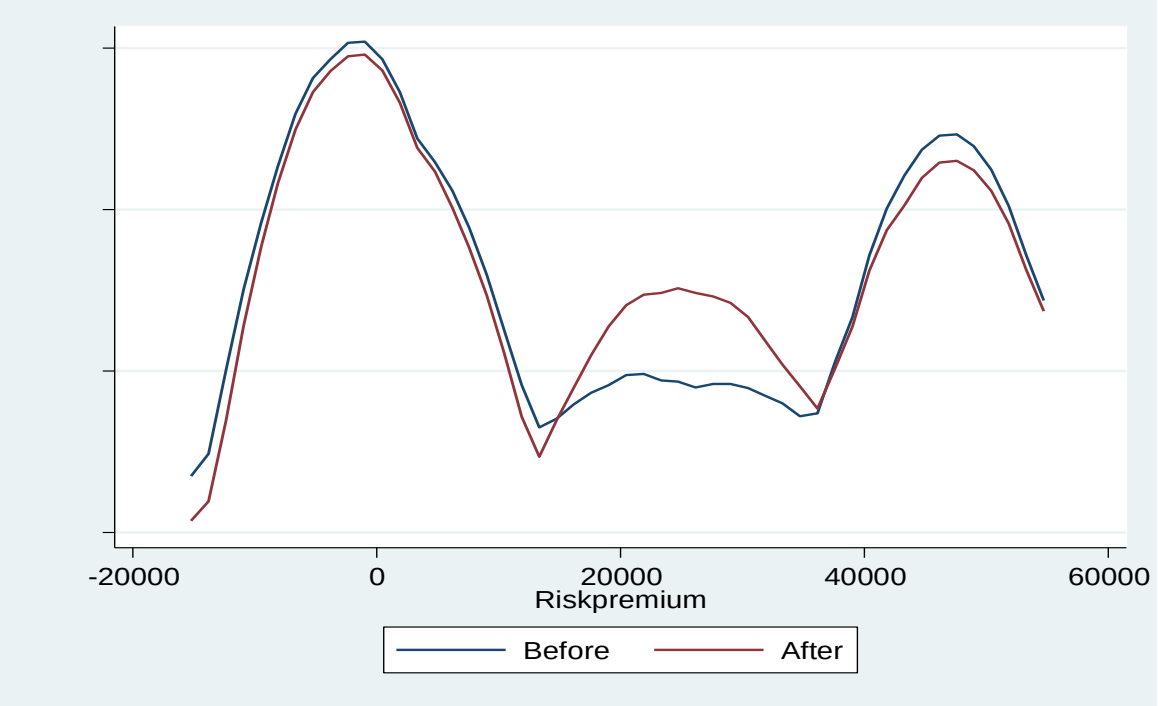


Figure 4.2a: Cumulative sample distribution of risk premium for sub-groups before and after announcement



Notes: Figure 4.2a shows the cumulative distribution for risk premium. It shows two sample distributions where the red line indicates the cumulative distribution of all subjects before the announcement, while the blue line indicates the cumulative distribution of all subjects after the announcement. A cumulative distribution function above shows the probability for the risk $f(x) = P(X \leq x)$ where *x* is the risk premium within each group, i.e. before or after announcement.

Figure 4.2b: Sample distribution (Risk premium before and after announcement)



Notes: Figure 4.2b shows the distribution for risk premium. It shows two sample distributions where the red line indicates the non-normal distribution of all subjects before the announcement, while the blue line indicates the non-normal distribution of all subjects after the announcement.

Table 4.1: Questions asked using the survey

Questions 1 to 9 Perception of interest rates and prices in general	
Perception of interest rate	What annual interest rate do you think an average US citizen would be charged, if they take a car loan of $10,000 this week? Please use the drop-down menu below.
Perception of "Prices in general"	From your perspective, by how much did prices in general change during the past 12 months? Please use the drop-down menu below. For example, if you think prices on average have decreased by about 5%, choose "down by 5%"; if you think they have risen by 5%, choose "up by 5%".
Expectation of interest rate	What annual interest rate do you think an average US citizen will be charged, if they take a car loan of $10,000 in a year from now? Please use the drop-down menu below.
Expectation of "Prices in general"	By how much do you think prices in general will change during the next 12 months? Please use the drop-down menu below. For example, if you think prices on average will decrease by about 5%, choose "down by 5%"; if you think they will rise by 5%, choose "up by 5%".
Financial Decision	If you had an extra $1,000 now, how much of this amount in dollars you would spend in the current situation on the following (you can also allocate the whole amount to just one option): Stocks (mutual funds); Safe assets (401k, pension funds, treasury bills) Term deposit for 3 months or more Mortgage contribution (raise mortgage deposit or make an extra payment) Buy a car, holiday trip, jewellery or durable goods like a fridge/freezer Other household expenses
Confidence level	How confident are you in this answer?

Question 10 (Literacy)	
	In your opinion, how many of the following four statements are true? a) An investment with a high return is likely to be high risk. b) High inflation means that the cost of living is increasing rapidly. c) It is usually possible to reduce the risk of investing in the stock market by buying a wide range of stocks and shares. d) If you put $100 into a no fee savings account with a guaranteed interest rate of 2% per year, at the end of five years there will be over $110.
Risk and Ambiguity (Questions 11 – 13)	
Risk	Consider a lottery ticket with a 50% chance of winning $100,000 and 50% chance of getting nothing. What is the LOWEST AMOUNT of money you would accept in exchange for this lottery ticket? We assume that you would also be happy to swap the lottery ticket for any amount higher than the one you indicate.
Ambiguity	Consider two urns, each containing 100 balls coloured either red or blue. Urn A contains red and blue balls in an unknown proportion. Urn B contains 50 red balls and 50 blue balls. You will get a prize if you draw a ball
Awareness and Channel of information (Question 14 and 15)	
Awareness (attention of monetary changes)	During the last week, have you heard any news about the monetary policy of the Federal Reserve (Fed)? What did you hear?
Sources of economic information	During the last week, what were your main sources of information on economic and business conditions? Please choose up to three options.

Table 4.2: Descriptive statistics of variables		
	Before	After
N responses	495	468
Completed	406	391
Female %	54.19	53.2
Age %		
18 – 29	15.27	17.9
30 – 44	30.3	27.88
45 – 59	33.74	24.81
60 and above	20.69	29.41
Heard %	52.45	61.46
Income %		
Very high income	9.63	4.35
High income	8.15	8.69
Moderate income	32.35	23.79
Low income	36.79	38.11
Very low income	11.11	13.3
Sources of Information %		
News papers	3.1	5.38
Online	17.08	14.91
Television and radio	40.13	46.94
Word of mouth	39.69	34.96
Financial literacy %		
Very high literacy	54.07	48.4
High literacy	24.64	28.4
Moderate literacy	13.4	12.59
Low literacy	5.02	6.91
Very low literacy	2.87	3.7

Table 4.3: Average risk premium and fraction of responses with different risk attitudes

	Announcement		Attentive		In-attentive		Paired Groups		
	-1	-2	-3	-4	-5	-6	(1) -(2)	(3) - (4)	(5) - (6)
	Before	After	Before	After	Before	After	*Difference between groups*		
Observation	395	363	206	221	185	139			
Risk-premium	19965	20534	22723	18695	17057	23619	-570	4028.73**	(-6561.95)***
Risk-averse	0.625	0.623	0.684	0.588	0.557	0.683	0.003	0.0962**	(-0.127)**
Risk-neutral	0.22	0.253	0.204	0.29	0.243	0.194	-0.033	(-0.086)**	0.049
Risk-seeking	0.154	0.124	0.112	0.122	0.2	0.122	0.03	0.117	0.078**

Notes: groups compared as "before" against "after", results on the last row indicates the significant level of t-test. *** Significance at 0.01, ** significance at 0.05 and * significance at 0.10. Difference calculated for respective sub-samples in columns

Table 4.4: Average fraction of respondents with different ambiguity attitudes

	Events		Attentive		In-attentive		Paired Groups		
	(1)	(2)	(3)	(4)	(5)	(6)	(1)-(2)	(3)-(4)	(5)-(6)
	Before	After	Before	After	Before	After	Difference between groups		
Ambiguity-averse	0.863	0.793	0.874	0.783	0.854	0.82	0.070***	0.091***	0.034
Ambiguity-neutral	0.043	0.063	0.044	0.068	0.038	0.05	-0.02	-0.024	-0.013
Ambiguity-seeking	0.094	0.143	0.083	0.149	0.108	0.129	(-0.050)***	(-0.067)**	-0.021

Notes: groups compared as "before" against "after", results on the last row indicates the significant level of t-test. *** Significance at 0.01, ** significance at 0.05 and * significance at 0.10. Difference is calculated for respective sub-samples in column

Table 4.5 Fraction of Ambiguity attitudes for different Sub-sample based on media sources

	Internet		News_Tvradio		Word_of_Mouth	
	Before	After	Before	After	Before	After
	(1)	(2)	(1)	(2)	(1)	(2)
No of observation	249	211	233	230	97	69
Ambiguity-averse	0.8474	0.7156	0.8841	0.7870	0.8144	0.7536
(1) - (2)	0.1317***		0.0972***		0.0608	
Ambiguity-neutral	0.0562	0.1090	0.0258	0.0739	0.0722	0.0870
(1) – (2)	(-0.0528)***		(-0.0482)***		-0.0148	
Ambiguity-seeking	0.0964	0.1754	0.0901	0.1391	0.1134	0.1594
(1) –(2)	(-0.0789)***		(-0.049)**		-0.0460	

Notes: groups compared as "before" against "after", results on the last row indicates the significant level of t-test. *** Significance at 0.01, ** significance at 0.05 and * significance at 0.10. Difference is calculated for respective sub-samples in rows label Before less after , i.e. (1) - (2)

Table 4.6a Ambiguity aversion of respondents in both samples, to reflect what media channels affect attitudes.

VARIABLES	(1) Ambiguityaverse	(2) AmbiguityAverse	(3) AmbiguityAverse	(4) AmbiguityAverse	(5) AmbiguityAverse
Announcement	-0.282**	-0.274**	-0.274**	-0.269**	-0.271**
	(0.114)	(0.113)	(0.113)	(0.113)	(0.113)
Young	-0.107	-0.108	-0.170	-0.190	-0.174
	(0.144)	(0.142)	(0.138)	(0.139)	(0.138)
Female	-0.280**	-0.292**	-0.290**	-0.300***	-0.305***
	(0.115)	(0.115)	(0.115)	(0.114)	(0.114)
Low income	-0.141	-0.139	-0.145	-0.148	-0.143
	(0.130)	(0.130)	(0.129)	(0.129)	(0.129)
TV	0.240**	0.247**			
	(0.116)	(0.116)			
Online	-0.114		-0.133		
	(0.126)		(0.125)		
Newspapers	-0.0320			-0.0465	
	(0.115)			(0.114)	
Word of Mouth					-0.0690
					(0.141)
Constant	1.583***	1.546***	1.773***	1.776***	1.763***
	(0.286)	(0.277)	(0.260)	(0.268)	(0.261)
Observations	701	701	701	701	701

Note: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. The result shows a probit model indicating coefficient of attentive respondent's ambiguity averse attitudes as it interacts with different media sources while controlling for other factors.

Table 4.6b: Risk aversion of respondents in both samples, to reflect what media channels affect attitudes.

VARIABLES	Risk-averse	Risk-averse	Risk-averse	Risk-averse	Risk averse
	(1)	(2)	(3)	(4)	(5)
Announcement	-0.0526	-0.0417	-0.0442	-0.0510	-0.0387
	(0.0977)	(0.0971)	(0.0974)	(0.0974)	(0.0972)
Young	-0.0991	-0.0731	-0.0849	-0.116	-0.0932
	(0.123)	(0.120)	(0.117)	(0.119)	(0.117)
Gender	0.0860	0.0744	0.0764	0.0823	0.0749
	(0.0990)	(0.0982)	(0.0987)	(0.0984)	(0.0982)
Low income	0.0190	0.0282	0.0261	0.0156	0.0241
	(0.109)	(0.108)	(0.108)	(0.109)	(0.108)
TV	0.0541	0.0582			
	(0.0996)	(0.0993)			
Online	-0.0214		-0.0409		
	(0.111)		(0.110)		
Newspapers	-0.119			-0.122	
	(0.100)			(0.0997)	
Word of Mouth					0.0561
					(0.123)
Constant	0.284	0.207	0.259	0.330	0.245
	(0.236)	(0.228)	(0.212)	(0.220)	(0.213)
Observations	701	701	701	701	701

Note: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. The result shows a probit model indicating coefficient of attentive respondent's ambiguity averse attitudes as it interacts with different media sources while controlling for other factors.

Chapter 5 Impact of Central Bank on precautionary motives

5.1 Introduction

Decisions regarding consumption and savings are well investigated under renowned theories. For example income, consumption and savings have been investigated using the life cycle/permanent income hypotheses (Wang, 1995; Caballero, 1990; Mishra et al, 2012; Mauro, 1995: Ghosh and Ostry, 1995; Guvenen 2004) and precautionary savings hypotheses within the context of future income uncertainty (Skinner, 1988; Guiso et al, 1992; Lursadi, 1997; 1998), to address the relation between people's preferences to save or consume, and their level of wealth. In particular, Ricardo (1990) suggests that increased income uncertainty can explain reduced consumption and increased savings. This demonstrated in a study by Guvenen (2004), who used the life-cycle model to investigate how the consumption-saving decisions of individuals on labour information can be altered. The study suggests that incomplete information about expected income growth or labour income risk could lead to increased incentive for precautionary saving due to associated increase in uncertainty, and less consumers learning of (i.e. able to know and project) of their income growth rate. This finding implies that incomplete information about income growth affects people's allocation of income to consumption and savings. However, these studies do not consider Central Bank announcements nor monetary policy changes and how these kinds of economic information could affect people’s consumption attitudes, if at all. Therefore, this chapter seeks to fill this gap.

The preceding chapter shows that people are affected by information, namely the precision or imprecision of news from the media about a Central Bank policy announcement. Similarly, news in the form of comments or verbal statements affects the foreign exchange (Dewachter et al, 2014) and actual funds rate (Demiralp and Jorda, 2004) and improves the

predictability of interest rate (Bernoth et al, 2004). Hence, this chapter expects that news from the Central Bank about the forecast for the economy's future outlook would be of interest to individuals and could potentially influence their stated preferences to save and/or consume. As Van Raaij (1989) shows, economic news affects people's formations and expectations of causal attributions through the way it provides information. This influence on people's choices to consume or save is expected to be a by-product of the impact of such news on uncertainty attitudes as demonstrated in the previous chapter. Furthermore, Thomas and Sam (2004) demonstrate that people rate the speed of news and its anticipated impact on other people (market participants) as more important than its accuracy.

Consequently, the researcher anticipates not only that information from the Central Bank creates an environment which affects attitudes, but that changes in attitudes could elicit changes in people's consumption-saving judgments. Typically, people's perception of the economic environment is a relevant factor in for making financial judgements. For example, decisions about consumption (Ahmed and Cassou, 2016; Fraj and Martinez, 2006); investment and saving (Knut et al, 2017; Aaberge et al, 2017) are affected by what people perceive about their economic environment. Also, knowledge of macroeconomic fundamentals tends to impact the processing of information, perception of information and attitude towards economic issues (Hayat and Farvaque, 2011). Ranyard et al (2008) states that, the economic environment also matters for people's perception of price changes, economic forecasts and social amplifications of economic forecast, which inform their expectations of future levels of economic issues. It has been argued that individuals are interested in economic issues and related information about the economy which is generally provided by Central Banks (Hayo, 1999). There is therefore a need to understand how people's perception of a Central Bank announcement could affect consumption and saving preferences. Assuming that people's uncertainty attitudes are affected as well, such an impact

on their uncertainty attitude would reflect in their stated allocations of marginal income. Consequently, this chapter proposes that the motivation for precautionary savings of people in this chapter should be mechanised via people's uncertainty attitudes. In other words, if there is an effect on people's uncertainty attitudes it would be reflected in their allocation of marginal income. It is important to note that this chapter does not claim that the announcement itself causes a direct impact on people's attitudes, but that it creates an environment which elicits a psychological impact on people, which would reflect in their choices. The mechanism behind this psychological impact, hails from the precision and certainty surrounding economic issues communicated by the Central Bank, and its potential impact on people's future income, whereby imprecise information marked with uncertainty would result in pervasive attitudes.

People's attitudes are usually affected by their sensory attributes i.e. how they feel, and their expectations from an action, for example a choice or decision (Holbrook and Hirschman, 1982; Millar and Tesser, 1986; Triandis, 1979). It is argued that, people's attitudes towards consumption or savings suggest how an individual may respond to an object when it recieves either favourable or unfavourable evaluation (Kolter 2000 as cited by Tsang et al, 2004). Previous studies have tried to measure consumer attitudes as a way of predicting behaviour towards spending (Batra and Ahtola, 1991; Poterba, 1988) and saving or investing (Constantinos et al 2015). For example, in a study by Watson (2003), people who are highly materialistic are more likely to view themselves as spenders and have favourable attitudes toward borrowing. Contrarily, Trandis (1979) argues that people's behaviour may not be a function of a one-dimensional attitude, but of their expectations of the result from actions, and how they feel (such as happy or anxious) about such outcomes. However, this chapter focuses on uncertainty attitudes (risk and ambiguity), which are mostly assumed to be constant (risk attitudes studied by LeRoy 1973: Rabin 2000; Ross 1981; 2004), with a few

exceptions. For example, Merzifonluoglu (2015), in his study investigated the sensitivity of procurement strategies to risk attitudes and shows that these attitudes change based on the perception of information. This suggests that people's attitudes may change in response to information which may affect their preference for risk.

In order to demonstrate that a change in ambiguity and risk attitudes affects stated consumption choices, this chapter conducts survey experiments in 2015, when the change in policy announcement was announced. These surveys were conducted two days prior to and two days after the monetary policy announcement. Respondents were asked to allocate an extra earning of $1,000 based on any information surrounding the Central Bank monetary policy announcement. Using other standardised questions measured for variables such as prices in general, perceived interest rate, expectations of future prices, and interest rate; and uncertainty was measured using lottery-type questions and Ellsberg questions respectively.

The results shows that the type of information to which people are exposed and/or attentive matters for their stated allocation. Specifically, it shows that the precision and clarity of information in an economic environment influences people's marginal propensity to consume, depending on whether they pay attention to such information. The results indicate that those who are attentive to news allocate more money to consumption before the announcement while inattentive people reduced their allocation to discretionary consumption and increased household consumption. This allocation indicates no precautionary savings motive for attentive respondents and a slight motive for inattentive respondents. However, the results from the previous chapter shows that ambiguity aversion was higher before the announcement suggesting a negative perception of news which ought to result in precautionary motives for both attentive and inattentive respondents.

The result supports findings by Kimball (1990) which shows that income risk could increase marginal propensity to consumers within the permanent income hypotheses context.

The current study extends the literature by showing that within a difference in certainty of information, potential uncertainty towards future income leads to increased consumption rather than less. The result shows ambiguity aversion as an explanatory variable for consumption allocation, which results in increased allocation rather than reduced allocation as proposed by the precautionary savings hypotheses. The result further shows that people's marginal allocations align with their individual characteristics, such as their risk attitudes and income level. For example, low-income earners substitute household expenditure to increase discretionary expenses. This preference is similar to highly risk-averse individuals as well. Thus, the effect from quality of information is also subject to the characteristics of individuals.

5.2 Consumer expenditures and relevant factors

According to Danziger (2004) people's preference to spend is governed by their needs and force of habit. For example, household expenses, loan repayments, rent etc. would occur based on need. Other expenses, could be classified as discretionary expenditure – consumer spending on things that they want to buy rather than what they need (Danziger, 2004, as cited by Sarial-Abi et al, 2016) . This class of expenditure may require more active decision-making by people. Such expenses would be subject to the time of the purchase governed by business cycles and economic conditions, as they are an important indicator of economic wellbeing (Sarial-Abi et al 2016). However, Katona, (1974) also points out that during periods of price increase, people feel the need to save more. In addition, the author notes that in periods of economic decline, borrowing and spending reduces, while in periods of economic recovery this would increase (Katona, 1989: Poterba, 1988).

Furthermore, in years of economic recovery purchases of durable goods and instalment buying tend to increase, resulting in a decline in net saving. Also, people frequently use their savings accounts as the transitory source of financing unusual expenditures, even though they do not save with this purpose in mind and plan to replace the money withdrawn (Mueller and Lean, 1967). Danziger (2004) indicates that discretionary expenses could include large durables, buying a house, car, luxury, jewellery etc: these are not purchases for immediate consumption only, but could be more for future consumption. The nature of these types of expenses, i.e. household necessities and discretionary expenses may have different implications for decisions and preferences. Nonetheless, both expenses typically depend on income, price, interest rate, and expectations. For example, Caroll et al (1994) have shown that people's spending can be explained using consumer sentiment and uncertainty.

5.2.1 Economic uncertainty and consumption behaviour

Economic uncertainty could have consequences for people's economic preferences and consumption preference (Leland 1976: Carroll 2001). For example, literature suggests, that changes from macro-economic changes do affect the economy (Bonciani and Van Roye, 2015), especially changes associated with high uncertainty (Leland, 1968; Hartman, 1976; Bernanke, 1983; Abel, 1983; Kimball, 1990). Consequently, people would typically decide on what to consume or save based on their rational preference to maximize their self-interest to the best of their capability within certain constraints (Nofsinger, 2011). Yet when there is uncertainty this may be difficult and result in alternative outcomes. The effects from uncertainty on the economy can reflect in economic activities such as investments, convex marginal revenues and precautionary savings (Kimball, 1990). Furthermore, Carroll and Kimball (2006) show that individuals may save more (i.e. precautionary savings) when they become aware of the future being uncertain, as a measure of caution. The effect of uncertainty on people's attitudes could also be national, as Arunima (2016) shows that when there is increase in interest rate uncertainty, this has a recessionary impact on the economy.

The effect of uncertainty on people seems to be a consequence of economic shocks. For example, Caroll (2009) shows that when shocks in the economy affect income, either transitorily or permanently, these shocks result in a less marginal propensity to consume for most consumers, but more motivation to consume for impatient consumers. This is because shocks to an economy are accompanied by some level of uncertainty. Bonciani and Van Roye (2015) show how shocks from macro-economic uncertainty affect the economy. Furthermore, Carroll and Kimball (1996) also suggest that economic uncertainty leads to an increase in marginal propensity to consume at a given level of wealth for people with lower level of wealth. This shows that uncertainty as related to income could affect the marginal propensity at a given level of wealth or income.

Furthermore, Carroll and Kimball (2006) also suggest that individuals save more, i.e. precautionary savings when knowledge of the future income is uncertain. As shocks to future income could induce precautionary savings, however, this effect is highly dependent on how people's perceive of the variance in expected income (Feigenbaum, 2008). According to findings from Wang (2004) when people have incomplete information about their earnings, this lack of information could incentivise them to increase savings due to an increase in perceived risk. Wang (2009) also suggests that people would aim to optimize their consumption-saving and investment options due to uncertainty regarding income growth. The author suggests that information about income growth affects people's allocation to consumption, saving and investment. Thus, this chapter proposes that Central Bank information matters for consumption, saving and portfolio allocations, but that the effect could vary based on people's income levels. This chapter anticipates that although there are no direct impacts on people's preferences and current income, the uncertainty about the future, still psychologically affects people's judgements through the environment.

5.2.2 Perception and economic preferences

Consumers' expectations could be seen as the desires or wants of consumers, i.e what a person feels, or what an administration/organisation propose to do, rather than what they do (Parasuraman et al, 1988). Alternatively, people's expectations may be viewed as beliefs about something which could occur in the future (Hoorens, 2017). Expectations may be based on personal experience, information transmitted by others, cognitive construction or heuristic thinking. Consequently, people's expectations are constantly changing in response to information task and service (Khan et al, 2002), conventional and unconventional monetary policy (Galariotis, 2018), and consumer learning (Huang and Liu, 2017). Even where economic preferences are similar to those made in the past, there is no guarantee that consumers will respond in the same way (Katona, 1974).

This explains why when people make judgements; they are not often inclined to view things in absolute terms, but in relation to certain standards, expectations or benchmarks (Tversky, 1985). This tendency has been well-studied by several researchers such as Kahneman and Miller (1986), Sanbonmatsu, et al (1991) and Tversky, 1977. Thus, the attitude, values and perception of the public is a crucial source of information to an economist as well as to policy-makers within the Central Bank (Hayat and Farvaque, 2011) and therefore relevant to this chapter especially, when people's perceptions of price changes, economic forecasts and social amplifications inform their expectations for future levels of economic factors such as inflation (Ranyard et al, 2008). For example, Moon et al (2017) show that consumers' perception of utilitarian and hedonic attributes has a significant and positive predictive power of cognitive and affective attitudes. This suggests that there is a link between decision processing and people's attitudes. Yet, this does not provide an answer as to whether people's change in attitudes is reflected in their choices, as a result of their expectations of the economy. However, there is evidence to suggest that people's perception of risk is positively correlated with their risky behaviour (Rundmo, 1996).

Hence, this chapter anticipates that people's decision processes, are influenced by factors and characters within their immediate environment based on how they perceive it. In a work environment, where individuals are bombarded by environmental factors that impact their senses (sight, smell, touch and taste), individuals determine which stimuli to focus on (Leventhal and Scherer, 1987) to help make decisions. This ability to focus attention, allows each person to respond differently and make different choices in relation to what they choose to concentrate on. This further ensures that individuals perceive the stimuli that satisfy their internal needs, attitudes, feelings and motivations, and thereafter make decisions in response to such stimuli (Likert, 1967).

Therefore, one could assume that people interpret their perception within the context and in relation to similar events or past occurrences. For example, previous studies (McLian, 1995; Rundmo, 1996; Rundmo and Hale, 2003) illustrate how risk perception and behaviours of individuals in a working environment affect their decisions. These studies show that people responded to risk based on how they perceived information about hazardous work conditions. In another study, Moskaliuk et al, (2016) shows how information affects people's attitudes towards risk. However, there are some exceptional situations where a person's knowledge about risk does not lead to being risk-averse but may lead to risk-taking, thus having an inverse effect on their risk attitudes. These variations can be as a result of either overconfidence (you know less than you think you do), under-confidence (you know more than you think you do) or calibrated knowledge (you know what you think you know) (Karen,1991). Thus, the effect on an individual's expectations will not always be the same for every context, and this could vary with information on economic issues.

5.2.3 Central Bank communication and people's perception of information

As discussed in Chapter 4, Central Bank communication addresses various economic issues, including macroeconomic statistics, on exchange rates, statements on inflation rates and objectives, interest rates and economic outlook, amongst others (Dominguez, 2003; Glick and Leduc, 2012). Based on studies by Walstad (1997) and; Walstad and Rebeck (2002), economic knowledge or information directly impacts the opinions of people within an economy. This helps to ensure that institutions like the Central Bank could improve economic alignment and, consequently, economic performance by providing information about its long-term inflation objectives (Bernanke, 2006). Thus the attitude, values and perception of the public could be a crucial source of information to economists and policy makers within the Central Bank (Hayat and Farvaque , 2011), to check how well people's expectations are in

cogruent with Bank's long term objectives. However, even when information is communicated by financial institutions such as the Central Bank on economic changes, people may react differently due to their perception of the announcement or the impact from other factors. For example, Przybyszewski and Tyszka, (2007) show how emotional attachment to currency affects people's opinions of prices. The study shows that when people perceive the Euro currency as high, this results in an increase in the prices of this currency compared to others.

Furthermore, the study also shows that the positive effect attached to a currency results in a perception of prices in this currency being higher than prices expressed in a currency which is not emotionally laden. This suggests that there is an emotional effect of perception which affects the way individuals view information. Therefore, people's perception of consumption could be affected by their perception of other economic factors. For example, Dziuda, and Mastrobuoni, (2009) show that when the European Central Bank makes announcement on changes to the Euro, this had an effect on people's perception of prices of goods that were frequently purchased. Moreover, Burgoyne et al (1999) illustrates the effect of similar currency biases in perceived inflation by individuals in the United Kingdom in 1970 after decimalisation.

Information also affects people's perceptions negatively. As Badarinza and Buchmann (2009) demonstrates, consumers' inflation perceptions and expectations could be driven by the flow of information regarding current and future price developments within countries in the Euro Area. The study analyses the impact of information flow on an aggregate level for the Euro area as well as for a set of countries, using panel techniques. Their findings suggest that degree to which consumers' expectations are conflicting is negatively related to news intensity. Moreover, the results suggest that the absolute bias in expectations decreases as news become more intense and this effect has become more

pronounced since the introduction of the common currency. This implies that with increased news, i.e. after the announcement, people's opinions should be less discordant and the aggregate expectation should be unanimous.

Hence, it is no surprise that Central Bank uses communication as a tool to prepare financial markets for its upcoming actions (Ehrman and Fratzscher, 2007). As such there is a need to study the public's response to Central Bank communication (Blinder et al, 2008). Cukierman (2008) argues that the general public will rationally choose to be inattentive to short-term changes in economic issues, such as inflation rates and unemployment, due to the cost of searching for new information and processing it. However, in another study, the public seems interested in more economic news as the media now makes this readily available and affordable (Blinder et al, 2008). Furthermore, people's interest in economic news is influenced by their individual characteristics, such as gender (Fischer, 1986), income (Bates and Gabor, 1986), inflation and economic expectations, and level of education (Hainmveller and Hiscox, 2006). These factors further affect people's knowledge of economic issues and how they perceive these issues, by impacting information processing, sentiments towards the information received or attitude towards economic issues (Hayat and Farvaque, 2011). Thus, with more attention to information from the Central Bank, this could mean a higher level of attention to economic issues which would reflect in people's perception of such news and their financial decisions.

5.2.4 Precautionary motives and uncertainty attitudes

According to Skinner (1988), it can be argued that precautionary savings may be viewed as a selfish hedge against future income uncertainty. This could arise when individuals supposedly save more and consume less in order to guard against future income downturns in the economy. This instigates the idea that when people perceive and forecast a threat to future income, they would hedge such outcomes by saving more in the present.

Studies (Hakansson, 1971; Sandmo, 1971; He et al, 2015; Leland, 1978; Miller 1977; Carlin et al, 2014; and Sibley, 1975) have shown that uncertainty affects interest rates, portfolio choices and earnings. Yet there is not enough evidence on the effects of uncertainty associated with monetary policy and how this affects consumption, nor how this can be explained using evidence of precautionary savings. Precautionary savings are viewed as a response to risk associated with a convex marginal utility function savings accumulated as a precautionary measure (Leland, 1968; Sandmo, 1970). Hence, this chapter proposes that with increased uncertainty, people are more cautions and therefore would reduce their marginal utility to consume. Thus, the main condition under which precautionary savings would occur is uncertainty, whereby different levels of uncertainty towards income, earnings and labour seem to result in precautionary savings.

This chapter expects that people's perception of uncertainty about their future income, may lead to a cautious attitude towards consumption. Hall and Mishkin (1982) empirically show that when testing the permanent income hypothesis, people's level of consumption is highly sensitive to their income. Thus, where income uncertainty results in an increase in marginal propensity to consume out of current income, such outcomes contradicts the permanent income hypotheses (Kimball, 1990a). This chapter aims to show how changes in uncertainty attitudes, increases or reduces the risk and ambiguity aversion which are unrelated to the direct income of consumers, could affect their marginal propensity to consume. What will be interesting is whether people increase marginal consumption and contradict the permanent income hypotheses or reduce consumption thereby supporting the precautionary savings theory.

5.2.5 The role of feelings in decisions-making

Apart from the direct effect of information, feelings might play a role in decision making and perception of information (Cao and Wei, 2005). Decisions are influenced by situational and environmental factors (Watson, 2000). According to studies by Loewenstien et al, (2001) and Drevets and Raichle (1998), feelings do play a much more significant role in risk judgement and decision-making due to brain activities, which are accompanied by intense emotional states, and which may impact the quality of decisions. For example, in the study by Moreno et al (2002), it was found that managers' affective reactions influence their risk–taking tendencies in capital budgeting decisions and that positive or negative affect changes the commonly found behaviour of people towards risk. Feelings play a key role in mediating decisions especially in framing effects on choices (De Martino et al 2006).They may also influence the context of risky decision choices (Druckman and McDermott, 2008) and result in alterative outcomes. In other words, the decision arrived at by an individual is a consequence of reactions to stimuli which that individual had encountered.

Emotions enable an individual to focus on the critical aspects of a decision so that decision-makers do not get caught up in all the details. Bechara et al (2000) provides remarkable evidence that emotions play a huge role in decision-making, because it helps to improve the process. Hence, despite emotions notably resulting in poor decision-making, lack of it, can also result in poor decisions being made. For example, positive moods have the likelihood to facilitate creativity (Isen et al, 1987; Davis et al, 2017), problem-solving and efficient thought patterns (Isen and Means, 1983; Fredrickson 2001), negotiation and information processing (Isen and Daubman, 1984; Fredrickson and Branigan, 2005) in people, which can lead to a better decision-making process. Invariably, when an individual is faced with a lot of options, his/her emotions can promote the verdict for the best path to be selected.

5.3 Theoretical framework

In order to show that change in ambiguity and risk attitudes affects consumption choices, this chapter investigates a widely anticipated announcement on the change in interest (0% – 0.25%). Given that this change is not substantial, it is anticipated that the announcement should not have any effect on people's consumption attitudes. Thus, by applying the precautionary savings hypotheses, this chapter investigates the motive of consumers when a change in macroeconomic policy occurs, conditioned on the impact of such announcement on people's attitudes towards uncertainty. Kimball (1990a) states that precautionary savings are analogous to risk aversion, as both variables are affected by uncertainty and are sensitive to the optimal choice of a decision variable.

Typically, if information matters for motivation, then when there is uncertainty, this should prompt the motivation to save out of caution. Kimball (1990a) showed that risks can affect consumption when marginal utility is affected at a certain level of consumption. This is because negative marginal utility results in increased motive for precautionary savings. Hence, this chapter hypothesises that people's preferences to save and consume should reflect their attitudes towards uncertainty, as people's attitudes towards consumption or savings reflect a favourable or unfavourable evaluation of an option (Watson, 2003). This chapter anticipates that people try to update their expectations of the economy using available information. However, predicting the outcomes of policy may not be accurate, possibly due to incomplete information and the time of receiving information. Consequently, people's interpretation and expectations of the policy change should differ based on attention to information from the media, i.e. precise (less uncertainty and favourable) and/or imprecise information (more uncertainty and less favourable), about Central Bank actions.

It should be noted that, although there are no direct changes to people's income, people may react to the news because of the potential effects that it could have on income in

future. In particular, consumers' inability to either perfectly predict how they may be affected by the news, or directly link it to their income, could result in cautious attitudes. This impact on their attitude, though, would reflect psychologically in their judgments particularly their allocation of marginal income. Hence, , based on the precautionary savings hypotheses where future income is uncertain, less consumption is expected prior to the announcement, along with increased saving. For respondents who are attentive before the announcement, this chapter proposes that they are exposed to imprecise information and may have a higher incentive to reduce consumption. While after the announcement people are exposed to precise and imprecise information, they would be able to update their perception with precise information and have less uncertainty with higher consumption. Equally, if they pay attention to imprecise information or are strained by excessive information, this may negate the information and result in respondents remaining aversive.

Furthermore, this chapter anticipates that the effect of future uncertainty is dependent on people's attention to Central Bank communication via various media sources, as the media is a reliable and cheap source of information for the public. Consequently, those who are not attentive to information via the media, could be exposed to imprecise information from other sources. Therefore imprecise information would have little or no effect on them before the announcement, nor would they update their information using precise information after the announcement. Yet they are exposed to other forms of information: for example, feelings from others about the future, speculation, which will result in information-overload, and increased strain on people within such an environment. This could also result in motivation to save, rather than consume, due to cautious attitudes. This further proposes that changes in consumption behaviour should align with changes with uncertainty attitudes in the previous chapter. The use of *inter alia* risk (Tversky and Kahneman, 1981) and ambiguity tasks (Ellsberg two box type-questions) as measures for uncertainty, which are unrelated to the

news would give a fair representation of the corresponding psychological impact in responses across different groups. This chapter expects that changes to attitudes due to different types of information should have similar effect on changes to consumption, as attitudes are a measure of uncertainty which could affect consumption. Although the consumer attitudes index and consumer sentiment has been suggested as a proxy for uncertainty by the work of others, including Mishkin (1978), Acemoglu and Scott (1994), and Belessiotis (1996), these measures are not exclusively independent of the event. This chapter expects that this measure could reduce any bias in measuring uncertainty as the questions are unrelated to the announcement.

5.3.1 Use of surveys to measure expectations – An overview

Surveys are used by researchers such as Bates and Gabor (1986) to assess the UK's consumer knowledge of prices and price changes of specific products, on a board range of groceries. Their findings indicate that consumers over estimate price changes as compared with the official rate. Additionally, Jonung (1981) produced a similar finding in his study, using surveys to estimate consumers perceptions and expectations of inflation rates. In Jonung's study, consumers were asked to indicate the percentage for changes of prices in general based on the previous years' prices as an indication of their perception of price changes. The findings from both studies were close to that of national estimates.

Consequently, this chapter uses responses to expectation and perception questions in the survey experiment of Chapter 4 above to measure consumer choices given that an announcement occurred within the United States. Using responses to these questions, variables such as the expectations of prices in general, interest rate (based on car loans), and perception of prices in general and interest rate were measured. An alternative would have been to use the media estimates of expectations, as in studies like Lamla and Lein, (2008) and Berger et al (2011b), whereby the media's presentation of expectations forms the basis of consumer's expectation. Prices in general is used, rather than inflation rates as this ensures the investigation of the effect on people's judgement of their everyday consumptions, such as on durable goods and in discretionary expenses.

5.3.2 Experimental design

This study uses data from the set previously collected in Chapter 4 but focuses on different questions and consequently other measures related to this chapter. This chapter uses responses to Part 1 and Parts 3 and 4 of experiments conducted using the same surveys as in Chapter 4, of subjects who reside in the United States who were randomly selected to ensure that the samples were as representative of the population as possible in terms of age and

gender distribution. Survey Monkey, which was used to do this, aims to ensure that the sample is representative of the population in this case the United States. However, it could not ensure that the same subjects would participate in the study before and after the announcement. Nonetheless, Survey Monkey does try to ensure that the subjects recruited are similar in terms of sample distribution and representative across groups.

Respondents are given identical questions to answer in all surveys which comprises of three main sections; control questions (covering financial literacy, income, age and gender), Perception and expectations sections with questions measuring the expectations and perceptions of prices-in-general as well as interest rates, and questions on measures of uncertainty allocation of marginal income and risk and ambiguity style questions. Respondents within this chapter are exposed to different economic environments based on the information available and also on their attention to news. Thus, this chapter anticipates that there will be different reactions due to exposure to different precisions of information and differing attention to news. It is also expected that these factors will reflect in people's judgements on allocation of marginal income to consumption as well as other options. This design is similar to a study by Chang, (2007) where participants in an experiment are exposed to different emotions from positive (happy) to negative (sad) and asked to conduct identical tasks before the samples are compared for any differences. The table below provides details of the questions asked of participants.

Table 5.1 here

This chapter uses ‘prices-in-general’ to measure perception and expectation of household expenses. This was to ensure that respondents think about the prices of things in general, such as the prices of gasoline, fuel oil, and visible things close by. The study aims to capture the psychological impact on their choices, by focusing respondents on everyday

consumption choices, rather than the concept of inflation. This is further supported with the measure of uncertainty attitudes used in the previous chapter, which applies the use of simple lottery based question type and the two balls Ellsberg question to ensure that there is no bias and no pressure on respondents to provide accurate answers. Furthermore, getting respondents to think about things around them, ensures that their marginal allocation of $1,000 would be based on this thought pattern.

5.4 Data analysis

To analyse data, samples are further split using respondents' indications of whether they pay attention to the news through answers to the question "Have you heard of the announcement either directly or via any other source of business and economy related sources?". Using these responses, individuals are grouped into attentive (heard the announcement) or not attentive (unaware of it). This measure is similar to a study by Blinder et al (2008), where participants indicated if they were attentive to Central Bank announcement. The study was focused on individual's interest in economic issues and their belief in Central Bank activities, as Blinder et al (2008) indicates that being attentive to Central Bank communication helps people to build trust in their Central Bank institutions. Table 5.2 below shows the distribution of respondents split between before and after the Central Bank announcement.

Table 5.2 here

Table 5.2 is a Mann-Whitney (Wilkocon ranksum) test reflecting a fair distribution of individuals' allocation of marginal income, to spending, saving or investment choices. It also shows that there is a significant difference in the proportion of marginal income allocated to spending for household and discretionary expenses, between the control and treatment groups. As anticipated, increased media broadcast leads to increased attention, as there is an increase in attention to news of approximately 9% after the announcement. This could suggest that due to the importance of the announcement, it generated a good level of media coverage and broadcast, and led to intense media coverage, explaining why there is increase in attention after the announcement (Blinder et al, 2008). This, implies that when an announcement is made, individuals who are attentive update their expectations in line with the announcement. If the news is perceived as threatening to future income, this may motivate subjects to be precautious in their current spending. Precautionary saving is viewed

as a response to risk associated with a convex marginal utility function savings accumulated as a precautionary measure (Leland, 1968; Sandmo, 1970). The main condition for this is uncertainty, whereby different levels of uncertainty towards income, earnings and labour seem to result in precautionary savings. On the other hand, if there is a reaction from individuals who are inattentive to Central Bank communication, this chapter proposes that such a reaction would be a consequence of other kinds of information in the environment such as the general anxiety or stress level regarding a change in the economy. Therefore, further analysis is conducted to investigate whether this difference in allocation of marginal income is a result of attention to the announcement or of other factors. This is done using simple linear regression: see equation (5.1) below. The next section reviews the main variables analysed in this chapter and how they are measured.

$$m = \propto + \beta x_1 + \beta x_2 \ldots\ldots + \epsilon \qquad (5.1)$$

Where m is the dependent variable i.e. marginal allocation to household expenses or discretionary expenses, and $X_1, X2\ldots..$ are independent variables such as gender (female) , age (young) which takes '1' for subjects who are 44 years and below or '0' otherwise, low income earners indicated using a binary variable with '1' as earnings <$75,000 per annum and '0' otherwise; and the literacy level of participants, using high literacy for subjects who score above 3 on the literacy questions. Other variables include ambiguity aversion, perception of interest rates, expectations of interest rate and of prices in general.

5.4.1 Marginal propensity to save or consume

In order to test for the impact of certainty (or uncertainty) about announcement on people's judgements, regarding their marginal allocation of income, this chapter analyses responses to a number of questions. Of these responses, question 14 is used as a measure of marginal propensity to save or consume. Question 14 states " If you had an extra $1000, given what you heard how would you distribute it on either or all of the following?:

Household expenses, car/jewellery/holiday, pay off some mortgage, save in term deposit, invest in stocks, or invest in safe assets like treasury bills" This helps to identify people's allocation of extra income, having been primed by either precise or imprecise information about change in monetary policy. If people are uncertain they ought to be cautious in spending: however, Kimball (1990) seems to suggest that where uncertainty is a factor, an extra dollar would loosen a person's budget and make them feel less prudent in his or her allocation of resources, thus encouraging extra consumption.

Question 14 demonstrates how people would spend their extra income in choosing between options such as saving, investing, and spending. Thus, using the responses to either or all of these allocations, one can measure people's marginal propensity to consume, save or invest in response to the change in monetary policy. Other studies measure marginal propensity to consume from the level of wealth when there is less substantial income shocks, (Mario, 2004) or permanent income shocks (Caroll, 2009). In this chapter, these marginal income allocations occur with the assumption that there are no further changes to income during the period of this experiment: respondents were asked to disclose their income brackets and this was used to as a control measure in this analysis. Hence, by comparing the allocation of $1,000 before and after the announcement, a change in consumption which suggests precautionary actions would support previous findings in Chapter 4.

H_0: Marginal allocation of income to household and discretionary expenses of respondents is equal in sample before and after

H_1: Marginal allocation of income to household and discretionary expenses of respondents is not equal in sample before and after

H_0: Uncertainty attitudes of respondents affect the marginal allocation of income to expenses

H_1: Uncertainty attitudes of respondents affect the marginal allocation of income to expenses

5.5 Results

Typically, precise information (from the Central Bank) should affect only those who are attentive (Carroll, 2009), as those who are inattentive should remain the same in their stated consumption choices. Where there is an effect for both samples this would suggest that there are alternative factors affecting the behaviour of consumers. Moreover, it is expected that changes in marginal allocation should be in line with changes to uncertainty attitudes. For example, high uncertainty would imply an increase in aversion and potentially reduced spending and/or increased saving. To test for a difference in stated marginal income allocation given that there is a difference in uncertainty attitudes, the Mann-Whitney U test (equation 5.2) is used, to show difference in means between the samples, whereby the difference in marginal consumption allocation would suggest the impact of the announcement on people.

$$U = mn + \frac{m(m+1)}{2} - T \qquad (5.2)$$

5.5.1 Differences in marginal income allocation

The researcher expects that, if people's uncertainty attitudes are affected by the difference in certainty regarding the impact of the announcement on future income, then this should have an impact on people's expectations about the future economy which should be reflected in people's incentive for precautionary savings. This implies that people's marginal allocation choices would reflect the effect of uncertainty attitudes due to how precise or imprecise the information (informal discussion and people's worry or biased opinions) surrounding the Central Bank announcement is on their future income. The effect is channelled via an impact from uncertainty on people's judgment and processing of information, thereby resulting in different allocations of marginal income to consumption and savings. This chapter further hypothesises that the shift in uncertainty attitudes should correspond with people's consumption choices. Firstly, the result shows that people's marginal allocations choices are different with respect to when the information from the Central Bank announcement was broadcast, and this impact is not only from information but is associated with the change in attitudes.

[Figure 5.1 here][8]

Table 5.3 here

The figure above shows that there could be a difference in the sample distribution for marginal income allocation of household and discretionary expenses. From the figure above, it can be argued that people are more likely to spend on more discretionary expenses after the announcement than before, and less likely to spend on household expenses before the announcement than after. According to Katona (1980), when people perceive the economy as

[8] A K-S test was used to compare the distributions functions of household expenses and discretionary expenses across of samples collected before and after the announcement for equality in distribution, as inequality could suggest an impact of the announcement may exist within allocation of marginal income. The result indicated that sample distribution were not different.

moving from optimistic to pessimistic, this shift in perception could lead to postponing discretionary expenditure[9]. However, the figure above only suggests that the announcement plays a role in resulting differences of stated marginal allocations between expenses, which results in differences in the likelihood to spend before and after the announcement for household and discretionary expenses. This difference is further supported by the findings in Chapter 4 (see Table 5.5) that there is a significant difference in uncertainty attitudes before and after the announcement.

From the allocation of extra income ($1,000) in Table 5.3, it seems that on average, most people across each sub-group would allocate their marginal income more to household expenses, on discretionary expenditure, invest in safe assets, pay off mortgage, invest in risky assets and term deposit. The result suggests that, when comparing groups before and after the announcement, there is a significant difference for average consumption allocations (with less allocation of $48.90 for discretionary expenses and $66.30, in household expenses after the announcement), which supports the results in the figure above. The result shows that people on average allocate more marginal income to household expenses and less to discretionary expenses before the announcement compared with after the announcement. The result also suggests that attentive individuals update their information from the Central Bank and consequently have no significant difference in consumption on average. This shows that attentive individuals as anticipate perfectly internalise the expected changes. Table 5.4 displays results when the data is filtered to account for only household and discretionary choices (i.e. all responses with no allocation to expenditure is dropped). Here, with the filtered data, i.e. the results from Table 5.4, it can be argued that when there is uncertainty of future income, this may lead to significantly more allocation to household and discretionary expenses for attentive and inattentive individuals.

[9] This chapter does not investigate pessimism; however, the author argues that pessimism is associated with aversion, and suggests that where the announcement perceived as negative, it would result in more cautious attitudes. Thus, the study argues that that perception of information plays a role and could trigger a change in attitude. It should be noted that this chapter does not suggest that the news was viewed as pessimistic but acknowledges that the perception is subjective to individuals.

It shows that inattentive respondents allocate more marginal income to household expenses and less discretionary expenses before the announcement than after. Attentive respondents allocate more marginal income to household and discretionary expenses before the announcement, than after the announcement. Hence, it can be argued that attention to a Central Bank announcement does not suggest zero attention to economic information; rather this implies that other forms of information affect the marginal allocation of inattentive respondents. Consequently, it can be inferred that there are other factors driving the change in consumption which could potentially be explained by the change in uncertainty attitudes.

5.5.1.1 How it works: Possible explanations

From the results above, it can be argued that prior to the announcement, people were exposed to speculations about the positively-anticipated news, and comments/statements in discussions characterised with uncertainty about the potential impact of the news on future income. Consequently, due to uncertainty from caused by the announcement on future income, this led to a psychological impact that affected the way people allocated their marginal income. Hence, a possible explanation for the allocation is that uncertainty leads to an increase in marginal consumption as suggested by Kimball (1990), yet this effect does not apply to all types of expenses. Kimball (ibid) suggests that the extra dollar leads people to become loose in their budgets thereby increasing consumption rather than reducing it. However, with lower marginal allocations to discretionary expenses, the author suggests that as a result of the higher thought process required in making decisions to incur discretionary expenses, would have reduced the effect from marginal income.

Furthermore, the effect of uncertainty on marginal allocation varies with exposure and attention to information. For example, respondents who were exposed to speculations and uncertainty allocated more marginal income to consumption, while those where exposed to the news and were attentive to it, allocated less marginal income to consumption. Hence, it can be

argued that people who are attentive to Central Bank communication were less uncertain about their future income, because they knew the activities of the Central Bank and understand its implications. Alternatively, people who were inattentive and who were exposed to the announcement, as well as other forms of information such as, prior speculation, informal discussions and other news, are consequently more likely to be uncertain about the impact of the change in policy on their future income. Furthermore, the strain from information overload after the announcement could result in higher information filtration for inattentive people after the news, leading to total disregard for the information or to a negative perception of the information and its consequent undervaluation (Lee et al, 2016; 2017).

Additionally, the feelings of people could be a form of information. General agitation could lead to a preference for low-risk reward options (Raghunathan and Pham, 1999). Hence, even though the news was positive, several negative factors could cause uncertainty and impact people's judgement, resulting in increased consumption. People could respond to general feelings in their environment, which could result in a negative affect on individuals from the environment and lead to an alternative outcome. For example, in the study by Alevy et al (2007), it was observed that individuals choose to give up their private information and make decisions based on what current public information or signals suggest. Another study by Viscusi et al (2011) also supports this by illustrating how group dynamics can influence the behaviour of individuals within that group. Thus, people might be influenced by other factors in their environment such as the feelings of others.

Table 5.4 here

Table 5.5 here

From Table 5.5 above, it can be inferred that a change in uncertainty attitudes is associated with the change in marginal allocation, since people indicate higher aversion before

the announcement than after. Consequently, they also indicate more consumption before the announcement than after. This result goes against the precautionary motive hypothesis and the permanent income hypothesis, as the results show more allocation to consumption rather than less as the hypothesis suggest. According to Campbell (1986) the permanent income hypotheses suggests that when there is uncertainty, people will consume less and save more. Nonetheless, the study findings are supported by findings in Ahmend and Cassou (2016) which demonstrates that consumers increase when they have increased consumption confidence in a good economic condition, but reduce it when they receive negative news. With positively anticipated news, despite the surrounding uncertainty, it is likely that people were swayed by the content of the news and therefore increased consumption in line with positive information. However, there is no evidence in the result to strongly support this.

5.5.1.2 What about income level?

To further investigate the relevance of the hypothesised effect from uncertainty on people's stated choices, this chapter analyses the marginal allocation of respondents to test for a difference with respect to level of income. To demonstrate this difference, respondents are split into two groups high income (those who earn above $75,000 per annum) and 'low income' earner (those who earn $75,000 and below per annum). A Mann-Whitney U test is used to test for the difference in mean across various sub-samples (before compared to after). The results suggest that high-income earners allocate their marginal income differently by apportioning more to savings, while low-income consumers allocate more to consumption than high-income consumers. This result is similar to findings by Lusardi (1992) and Souleles (1999) that marginal propensity to consume is higher for low-income consumers than for high-income consumers in terms of nondurable goods. This chapter's result shows that low-income earners increase discretionary spending and reduce household expenses, while high-income earners seems to have increased stated household expenses. This difference in stated allocations aligns with findings by

Kimball (1990a;1990b) which suggest that uncertainty increases marginal propensity to consume at a given level of consumption but not for all levels of wealth or income.

The precautionary saving model suggests that where uncertainty is high individuals will save more. However, the results indicate that increased savings after the announcment occur where uncertainty is lower. Caroll (2000) suggests that the desire to accumulate wealth could explain why rich people have higher savings. Luo et al (2009) also supports this finding and adds that the desire to increase wealth reduces the need to save out of precaution in people. Thus, the minor marginal increase to consumption and savings in attentive high income earners could be explained by the desire to accumulate wealth – the 'spirit of capitalism'. Furthermore, Wang (2016) shows that while the spirit of capitalism could reduce precautionary savings, regime shifts could increase precautionary savings. It seems that the different effects are due to the different income levels, such that precautionary savings may be reduced for high-income earners due to the desire to increase wealth, but the change in monetary policy from the announcement could lead to increase consumption for low-income earners.

On the other hand, low-income earners seem to increase discretionary spending and reduce household spending in response to the announcement. Based on the precautionary saving model (Ricardo 1990), in high uncertainty people would save more and consume less. However, prior to the announcement, where this chapter anticipates higher uncertainty for people due to speculation, low-income earners have a higher expenditure on household as compared with high-income earners. These allocations seem to imply that people either do not perceive the information as highly uncertain or are reacting differently to the model. The marginal differentiation hypothesis suggests that people incur more debt in form of instalments and increase borrowing in order to enjoy consumption.

Table 5.6a here

Table 5.6b here

It further suggests that due to economic agitation or self-indulgence, people would consume more when there is uncertainty, rather than save (Reisman et al, 1953). Thus, just as the life cycle model suggests that individuals could increase their consumption in advance by making use of credit (Modigliani 1966;1986 as cited in Kamlietner and Kirchler, 2007), as the use of credit could be appealing to people (Katona, 1975) based on their personal attributes such as attitudes towards credit use, habits (Jeffrey Fuhrer, 2000) and wealth levels since low- income earners use credit to meet their needs (Kamleitner, and Kirchler 2007; Morgan and Christen, 2003). Subsequently, low-income earners may have chosen to increase their stated preferred marginal consumptions if they already use credit as an income substitute for consumption, and this attitude is only fuelled by the announcement. It suggests that low-income earners may be incurring more debt in form of discretionary goods, for example, instalments on cars, jewellery etc.

Therefore, if inattentive consumers are exposed to imprecise information surrounding the impact of Central Bank actions, this should result in perceived uncertainty and reduced consumption when attention is paid to such information, compared with those who are exposed and attentive to precise information. However, the results suggest increased consumption, in line with Kimball (1990), who shows that uncertainty the risk of changes to future income increases marginal utility to consume and results in increased marginal consumption, rather than less. To verify that the increase in consumption is a consequence of caution, the allocations are analysed using control variables to investigate if the attitudes (high ambiguity aversion from Chapter 4) can explain the increase in consumption.

5.5.2 Change in uncertainty attitudes matters for marginal allocation to consumption

The difference across sub-samples is suspected to be associated with the difference in uncertainty attitudes. The tables below provide evidence after having controlled for key variables

such as financial literacy, different age groups, gender, ambiguity aversion, attention to news and other control variables. This chapter controls for ambiguity aversion as a dummy for cautious attitudes in respondents, as this chapter indicates that effects from this variable could explain the marginal allocation of respondents. To further alleviate the influence of income on consumption, as this chapter expects that low income earners are more likely to spend more on household consumption than discretionary, a low-income dummy variable is included to control for this effect. A dummy variable for financial knowledge is included to control for understanding of economic issues and its implications. High knowledge should indicate that subjects understand how this could impact their income in the future, if at all. The results in Table 5.7 indicate that ambiguity attitudes, particularly, ambiguity aversion, can explain the increase in consumption for inattentive participants.

Table 5.7 here

In Tables 5.7 and 5.8, the results further illustrate that marginal allocation to expenses can be explained by uncertainty attitudes. The result shows that ambiguity aversion explains the increases of marginal allocation to household and discretionary expenses for inattentive respondents. The results support previous results above, and explain why inattentive respondents could allocate more marginal income to consumption after announcement for discretionary expenses. However, they do not explain why there is a reduced marginal allocation for household expenses. This difference in allocations is unprecedented for inattentive respondents, as they should have no reaction to precise news. Table 5.7 shows that the lower marginal allocation to household expenses for people who are inattentive to the announcement can be explained significantly by the announcement dummy variable. However, the same variable (announcement dummy) significantly explains an increase in marginal allocation to discretionary expenses. Thus, the results suggest that individuals are informed by other factors which can either result in cautious attitudes or even make them less frugal in their allocations to expenses.

This difference in reaction between attentive and inattentive respondents may be a factor of how information is perceived.

This is clarified by the results in table 5.8 below, where the result shows a pooled data for all respondents before and after the announcement. An interactive dummy variable (Attention * news) is included to control for the effects-specific content, i.e. attention to specific news, whilst controlling for other variables. Furthermore, an interactive dummy variable (News*ambiguity-aversion) is included to control for the effects of the news on ambiguity aversion, thereby controlling for a cautious attitudes in participants due to the news. The results indicate that cautious attitude due to the news results in significantly less marginal allocation to household expenses, but they do not explain reduced allocation to discretionary expenses. It seems that the announcement occurring and associated positive anticipation, could have led to an increase in marginal allocation to discretionary expenses. In addition, subjects within the age of 45 – 59 also indicate more marginal allocation to discretionary expenses. This implies that, these respondents, if attentive, presumably interpret the news as positive either before-hand or afterwards, and would rather allocate their extra income on either expenses that have long-term benefits, such as car, or on a holiday. Furthermore, ambiguity aversion also explains the increase in marginal allocation to both types of expenses, which either suggests that the news was positive to all participants, or in line with Kimball (1990), that uncertainty leads to increased consumption.

Table 5.8 here

Van der Cruijsen et al (2010) shows that the public has a limited knowledge about the European Central Bank which is probably as a result of the quality of communication, and that this affects their trust in the Central Bank Erhman et al, (2012) illustrates that respondents with higher knowledge are 30% more likely to adjust their beliefs based on the communication from the Central Bank than those who have no knowledge of the Central Bank. This is a result from having knowledge of Central Bank activities: being attentive is important for effective

communication and credible policy actions to achieve their objectives. Higher attention to Central Bank activities may result from increased communication and transparency from the Central Bank to its nationals. Also, individuals who have less knowledge will most likely have less interest in future communications, resulting in less credibility for such a Central Bank. Hence, individuals might not take into consideration information from the Central Bank or may rely on other sources of opinions about its intentions. Kimball (1990a) showed the relationship between risk aversion and precautionary savings motives, by stating the similarities between both variables, and showing that negative marginal utility played similar roles for precautionary savings, as utility did for risk aversion. This chapter adds to this finding and shows that ambiguity aversion which is a measure of uncertainty may also have an analogous relationship with precautionary savings motives. The result above shows that consumption savings choices are sensitive to people's psychological perception of information from the Central Bank and its potential impact on their future income.

5.6 Discussion

It was hypothesised that when members of the board, for example the Federal Reserve of the United States express independent and individual perspectives in speeches and other public forums, this provides the attentive members of the public with useful information about the diversity of views and the balance of opinion on the Committee (Bernanke, 2004). However, where these views fail to enlighten the public they could also lead to strain in processing the information. For this chapter, the news was anticipated as positive, hence there is reason to believe that this could be a contributing factor to building uncertainty. Our result shows that the information from the Central Bank does seem to explain the stated choices of attentive people, and that when individuals are attentive they can internalise their expectations and this will reflect in their spending attitudes. The results further suggest that inattentive subjects may be affected by uncertainty, and this reflects in their consumption behaviour as well.

Caroll (2003) proposed that only a fraction of people update their expectation and those who are inattentive stick to their previous views. This chapter shows that people update their opinion subject to the certainty associated with the information to which they are exposed and attentive. This suggests that different groups are exposed to different information i.e. imprecise and precise information, and react to what they are exposed to; although several factors affect consumption preferences, most of which are linked to the uncertainty surrounding future disposable income. Of these factors that have been demonstrated to affect consumption choices, the direct effect of information within the context of monetary policy as it affects uncertainty attitudes and consumption preferences has not been illustrated. This chapter shows that when individuals are sensitive to the environment and adjust their attitudes towards risk this change is also reflected in their stated consumption behaviour. Despite of being a toolkit for managing expectations, Central Bank announcements can result in grievous consequences if not well managed.

For this reason, some Central Banks, for example, the European Central Bank, the bank of England and the Federal Reserve of the United States communicate with members of their economy to manage these reactions. Dewachter et al (2014) illustrate how verbal statements and comments on the foreign exchange market influence uncertainty for traders within that market. In their study, verbal comments can be a source of uncertainty, in which case they would result in short-term reactions and shocks in exchange rates. Also, in moments of severe uncertainty within the markets and economy, the Central Bank authorities communicate more than would have been expected in hope of alleviating uncertainty levels amongst traders. For example the Eurozone increased in volatility due to comments from the chairman of the board in the US Federal Reserve (Dewachter et al, 2014). Thus, there is a need to analyse the systematic approach applied by Central Banks in communicating with the public so that it is able to manage the expectations of its recipients.

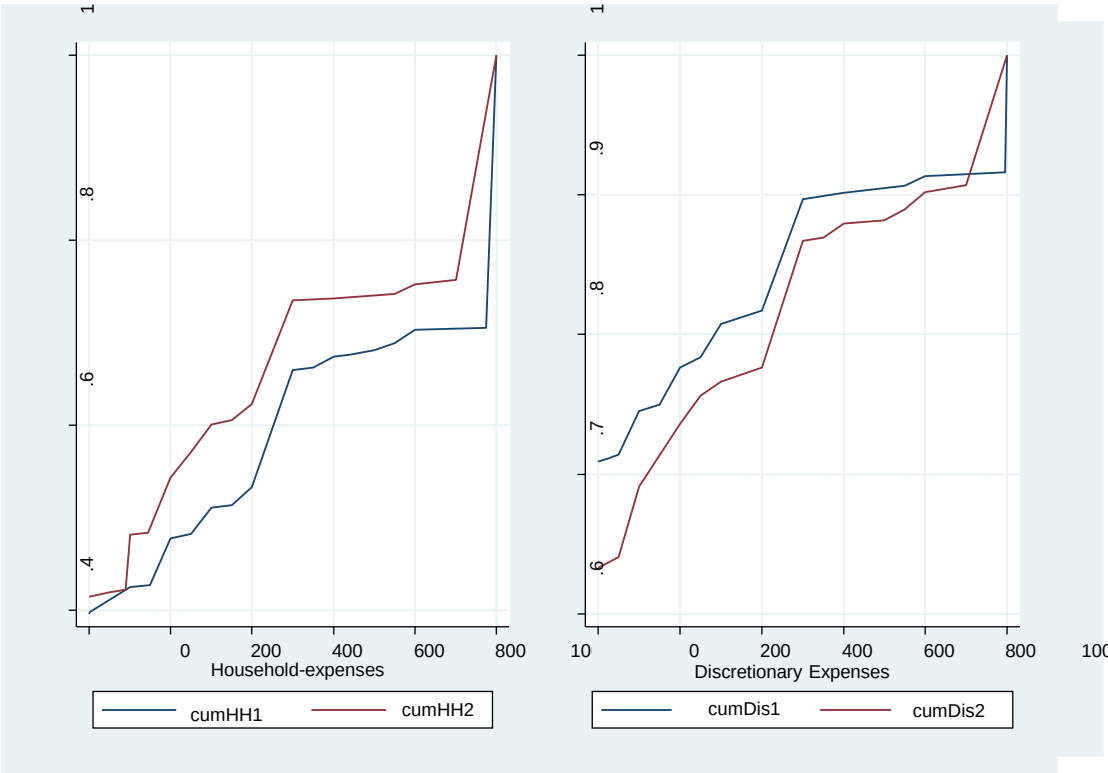
This chapter focused on how communication from the Central Bank creates regimes marked with different levels of uncertainty. Uncertainty may have been caused by inconsistent verbal statements and, informal discussions on announcement marked with speculations, as well as by uncertainty on the impact of the policy change on future income. Therefore, an optimal communication strategy is needed to enable individuals to act within the expectations of the central banks and seemingly result in the needed impact of central bank announcements. For example, Blinder (2000) notes that in October 2000, the ECB's President at the time Wim Duisenberg hinted to an interviewer that the central bank will cease its intervention in supporting the Euro. This information led to an immediate depreciation of the Euro and a heavy criticism of Mr Duisenberg. Similarly, in April 2006, an off-record comment made by Ben Bernanke, the federal reserve chairman, also led to strong market reactions as his statement at a congressional testimony was misinterpreted Investors thought that Bernanke was contradicting himself by saying that interest rates could easily go up. Subsequently, such events only reiterate the need for

an optimal way of communicating to ensure that people understand signals and that the Central Bank can meet their aims of managing expectations.

5.6.1 Conclusion

From all indications, being attentive is relevant for people's judgement and this could be affected by changes in attitudes. Even more, this change is subject not only to strategy and information, but potentially also to how the information is perceived by consumers. In effect, a study by Blinder (1996) suggests that raising the frequency of communications by Central Bank should enhance its effectiveness in communicating its monetary policies. This implies that increased frequency in communication would result in more information and potentially a better understanding of Central Bank's intentions as well as its objectives. However, this chapter shows that information alone, may not be sufficient in aligning people's expectations, and that institutions may need to consider the state of the nation, and the certainty surrounding information being communicated. This could then ensure that a Central Bank is able to manage expectations and is sensitive to the uncertainty surrounding its communications, such that information with higher uncertainty is strategically communicated and managed. The findings indicate that, it may be relevant for policy makers to focus not just on communicating information, but on how that information is perceived, irrespective of its content being negative or positive. The study further hypothesis that information overload could be an underlying factor which drives the people's perception of Central Bank communication within their economy. Thus, policy-makers need to consider the role of the media in influencing the perception of communications to ensure that they can adequately manage the expectations of the public.

Figure 5.1: Cumulative Sample distribution function of household and discretionary expenses before and after the announcement



Notes: cumHH1 is the sample distribution of household expenses before the announcement and cumHH2 is the sample distribution of household expenses after the announcement, cumDis1 is the sample distribution of discretionary expenses before the announcement and cumDis2 is discretionary expenses after the announcement

TABLE 5.1 Survey questions for experiment

Questions 1 to 9 Perception of interest rates and prices in general	
Perception of interest rate	What annual interest rate do you think an average US citizen would be charged, if they take a car loan of $10,000 this week? Please use the drop-down menu below.
Perception of "Prices in general"	From your perspective, by how much did prices in general change during the past 12 months? Please use the drop-down menu below. For example, if you think prices on average have decreased by about 5%, choose "down by 5%"; if you think they have risen by 5%, choose "up by 5%".
Expectation of interest rate	What annual interest rate do you think an average US citizen will be charged, if they take a car loan of $10,000 in a year from now? Please use the drop-down menu below.
Expectation of "Prices in general"	By how much do you think prices in general will change during the next 12 months? Please use the drop-down menu below. For example, if you think prices on average will decrease by about 5%, choose "down by 5%"; if you think they will rise by 5%, choose "up by 5%".
Financial Decision	If you had an extra $1,000 now, how much of this amount in dollars you would spend in the current situation on the following (you can also allocate the whole amount to just one option): Stocks (mutual funds); Safe assets (401k, pension funds, treasury bills) Term deposit for 3 months or more Mortgage contribution (raise mortgage deposit or make an extra payment) Buy a car, holiday trip, jewellery or durable goods like a fridge/freezer Other household expenses
Confidence level	How confident are you in this answer?

Question 10 (Literacy)	
	In your opinion, how many of the following four statements are true? a) An investment with a high return is likely to be high risk. b) High inflation means that the cost of living is increasing rapidly. c) It is usually possible to reduce the risk of investing in the stock market by buying a wide range of stocks and shares. d) If you put $100 into a no fee savings account with a guaranteed interest rate of 2% per year, at the end of five years there will be over $110.
Risk and Ambiguity (Questions 11 – 13)	
Risk	Consider a lottery ticket with a 50% chance of winning $100,000 and 50% chance of getting nothing. What is the LOWEST AMOUNT of money you would accept in exchange for this lottery ticket? We assume that you would also be happy to swap the lottery ticket for any amount higher than the one you indicate.
Ambiguity	Consider two urns, each containing 100 balls coloured either red or blue. Urn A contains red and blue balls in an unknown proportion. Urn B contains 50 red balls and 50 blue balls. You will get a prize if you draw a :
Awareness and Channel of information (Question 14 and 15)	
Awareness (attention of monetary changes)	During the last week, have you heard any news about the monetary policy of the Federal Reserve (Fed)? What did you hear?
Sources of economic information	During the last week, what were your main sources of information on economic and business conditions? Please choose up to three options.

Table 5.2 Descriptive statistics for survey before and after announcement

	Before	After
Number of responses	495	468
Completed	406	391
Female %	54.19	53.2
Age %		
18 – 29	15.27	17.9
30 – 44	30.3	27.88
45 – 59	33.74	24.81
60 and above	20.69	29.41
Heard %	52.45	61.46
Income %		
Very high income	9.63	4.35
High income	8.15	8.69
Moderate income	32.35	23.79
Low income	36.79	38.11
Very low income	11.11	13.3
Sources of information %		
News-Papers	3.1	5.38
Online	17.08	14.91
Television/radio	40.13	46.94
Word of Mouth	39.69	34.96
Financial literacy %		
Very high literacy	54.07	48.4
High literacy	24.64	28.4
Moderate literacy	13.4	12.59
Low literacy	5.02	6.91
Very low literacy	2.87	3.7
Average proportion of marginal income allocated %		
Investments-stocks	10.1	9.77
Safe assets	14.09	13.65
Term-deposit (savings)	6.24	7.88
Mortgage	12.4	13.38
Discretionary expenses (Car jewellery and holiday)	15.9	20.25
House hold expenses	42.7	36.25

Table 5.3: Average stated marginal allocation to choices in different sub-samples before and after announcement

	Announcement		Attentive		Inattentive		Difference between averages before and after announcement		
	Before (1)	After (2)	Before (3)	After (4)	Before (5)	After (6)	(1) - (2)	(3) - (4)	(5) -(6)
Invest-stock	100.3	97.5	128.6	121.8	68.6	58.3	2.7	6.2	10.4
Invest-Safe Assets	138.3	131.4	154.8	125.6	119.5	140.7	6.8	29.1	-21.2
Term deposit	62.4	77.5	60.8	71.6	64.6	86.7	-15.1	-11.4	-22.1
Mortgage	120.6	132.5	111.4	139.3	131.1	121.6	-11.9	-27.8	9.5
Discretionary	154.5	203.3	151.9	167.8	157.4	260.4	(-48.9)**	-15.9	(-103)***
Household	424.0	357.7	393.3	373.4	458.8	332.3	66.3**	19.8	126.5***
N observations	395	363	210	224	185	139			

Note: all values are in dollars as portions of $1,000 allocated to different options *** indicates that P-value < 0.01, ** indicates p-value<0.05, and * indicates p-value<0.10

Table 5.4: Average allocation to spending on discretionary and household expenditure for allocations to spending only

	Announcement		Inattentive		Attentive		*Difference between group before and after*		
	Before (1)	After (2)	Before (3)	After (4)	Before (5)	After (6)	(1) -(2)	(3) -(4)	(5) -(6)
Discretionary spending	552.23	529.11	482.20	582.09	606.02	507.43	23.12	(-99.89)**	98.59**
N observations	121	146	66	67	49	74			
Household Spending	699.27	614.34	663.93	567.44	737.53	651.09	84.93***	96.48**	86.44**
N observations	252	236	131	88	117	137			

Note: all values are in dollars as portions of $1,000 allocated to different options. *** indicates that P-value < 0.01, ** indicates p-value<0.05, and * indicates p-value<0.10

Table 5.5: Average risk-premium and fraction of respondents with different risk and ambiguity attitudes

	Events		Attentive		Inattentive		Paired Groups		
	(1)	(2)	(3)	(4)	(5)	(6)	(1) - (2)	(3) - (4)	(5) - (6)
	Before	After	Before	After	Before	After	*Difference*		
Risk-premium	19965	20534	22723	18695	17057	23619	-570	4028.73**	(-6561.95)***
Risk-averse	0.625	0.623	0.684	0.588	0.557	0.683	0.003	0.0962**	(-0.127)**
Risk-neutral	0.22	0.253	0.204	0.29	0.243	0.194	-0.033	(-0.086)**	0.049
Risk-seeking	0.154	0.124	0.112	0.122	0.2	0.122	0.03	0.117	0.078**
Ambiguity-averse	0.863	0.793	0.874	0.783	0.854	0.82	0.070***	0.091***	0.034
Ambiguity-neutral	0.043	0.063	0.044	0.068	0.038	0.05	-0.02	-0.024	-0.013
Ambiguity-seeking	0.094	0.143	0.083	0.149	0.108	0.129	(-0.050)***	(-0.067)**	-0.021

Note: *** indicates that P-value < 0.01, ** indicates p-value<0.05, and * indicates p-value<0.10.
This is a merged table generated by combining Table 4.4 and Table 4.5 from chapter 4.

Table 5.6a: Average stated marginal allocation on various options (saving, investing, and expenses) in different sub-samples income

	Low-income	Low-income	High-Income	High-Income	*Diff between before and after*	
	Before (1)	After (2)	Before (3)	After (4)	(1) - (2)	(3) - (4)
Invest-stock	68.18	73.94	189.22	174.40	-5.76	14.81
Invest-Safe Assets	113.43	131.17	197.65	133.33	-17.74	64.31*
Term deposit	72.11	65.04	40.20	108.93	7.07	(-68.74)**
Mortgage	$131.41	141.53	142.16	93.45	-10.12	48.70
Discretionary Expenses	126.96	226.48	175.49	142.86	(-99.52)***	32.63
Household Expenses	487.91	361.84	255.29	347.02	126.07***	(-91.73)*
N observations	242	236	102	84		

Note: *** p-value<0.01, **p-value<0.05, and * p-value<0.10. Values are in dollars ($)

Table 5.6b: Average allocations of marginal income allocation on expenditures

	Before-Announcement		After - Announcement	
	High-income	Low-income	High-income	Low-income
	(1)	(2)	(1)	(2)
# of observation	106	250	87	258
Household expenses	255.0943	482.3	352.2989	358.7016
Difference in means (1 - 2)	(-227.2057)***		-6.4027	
Discretionary expenses	179.2453	129.7	137.931	217.0543
Difference in means (1 - 2)	49.5453*		(-79.1232)**	
	High-income earners		Low-income earners	
	Before	After	Before	After
	(a)	(b)	(a)	(b)
# of observation	106	87	250	258
Household expenses	255.0943	352.2989	482.3	358.7016
Difference in means (1 - 2)	(-97.2045)**		123.5984***	
Discretionary expenses	179.2453	137.931	129.7	217.0543
Difference in means (1 – 2)	41.3142		(-87.3542)***	

Notes: the table above shows the difference in means for each sub-sample for high income earners less low income earners. Where * would indicate p-value < 0.10, **p-value<0.05, and *** p-value < 0.01 as indicators of the level of significance of difference between the means of each sub-sample.

Table 5.7: Factors influencing the allocation of marginal income to household and discretionary expense (data split based on attention to announcement).

	Inattentive		*Attentive*	
VARIABLES	*Household*	*Discretionary*	*Household*	*Discretionary*
Announcement	-95.16*	117.5*	-64.73	-41.88
	(50.91)	(60.17)	(43.91)	(73.09)
age1	131.0**	105.7	194.0**	-47.49
	(62.34)	(69.57)	(80.68)	(99.98)
age2	253.0***	179.4*	178.0**	-19.68
	(68.46)	(94.61)	(79.45)	(95.37)
age3	353.7***	64.68	245.4***	165.9*
	(124.3)	(144.0)	(80.13)	(94.31)
Female	43.63	-9.493	6.622	-48.94
	(51.37)	(65.67)	(45.23)	(64.74)
Low-income	-84.54	-67.09	49.58	-79.42
	(68.86)	(80.09)	(50.29)	(78.83)
High-literacy	-87.95*	-15.22	48.96	11.89
	(49.49)	(63.78)	(44.48)	(67.92)
Ambiguity-averse	104.8*	125.2*	81.08	87.45
	(62.31)	(74.57)	(55.74)	(85.33)
Constant	486.2***	348.4**	395.6***	600.5***
	(126.8)	(152.6)	(125.0)	(159.6)
Observations	198	121	215	104
R-squared	0.133	0.100	0.080	0.109

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1, age1 is a dummy indicating respondents between 18 – 29, age2 are between 30 – 44 and age3 are subjects between 45 - 59

Table 5.8: Factors influencing the allocation of marginal income to household and discretionary expense (pooled data).

	Pooled data before and after	
VARIABLES	Household	Discretionary
Announcement	101.4	214.6**
	(81.45)	(103.3)
Attention	5.447	65.34
	(47.93)	(73.08)
Attention*news	22.00	-148.4
	(65.91)	(91.23)
News*ambiguity_a	-230.3***	-138.7
	(82.09)	(109.4)
Age1	144.0***	63.09
	(48.80)	(56.86)
Age2	209.0***	101.9
	(50.83)	(66.76)
Age3	268.3***	195.3***
	(59.13)	(73.34)
Female	34.09	-17.10
	(33.93)	(45.89)
Low-income	6.446	-66.49
	(40.74)	(55.42)
High-literacy	-15.55	-7.552
	(32.87)	(45.96)
Ambiguity-averse	204.0***	194.3**
	(59.95)	(86.37)
Risk-averse	-8.016	66.50
	(33.55)	(45.18)
Constant	316.8***	291.2**
	(99.00)	(131.5)
Observations	413	225
R-squared	0.108	0.101

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1, this table above controls for interactive variables such as News*Ambiguity averse dummy, interaction dummy (Announcement*Attention to news); and age variables including age1 is a dummy indicating respondents between 18 – 29, age2 are between 30 – 44 and age3 are subjects between 45 – 59. Showing results for pooled data before and after for marginal allocations to either household or luxury expenses.

Chapter 6 Conclusion

This thesis has shown how the environment plays a pivotal role in the decision-making process, which suggests that attitudes towards uncertainty may be subject to the context (i.e. the level of uncertainty surrounding information and difference in screen format). This thesis uses three essays to show the impact of the environment on uncertainty attitudes measured using ambiguity and risk. It showed in the third chapter that a simulated environment does influence the decision-making process, but does so by interacting with a number of other factors which affects individuals when they make decisions. It demonstrated this by presenting different groups of individuals with identical problems in different working environments: in this case, a neutral and a simulation of the traditional trading environment. The study can conclude that the difference in behaviour is a result of the framing effects of the features in a working environment. This chapter focuses on illumination from screens because people who work with such screens, have the option of deciding which screen format to work with and could choose format which either increase or reduce illumination. Consequently, knowing whether these screen formats contribute to the decision making process could help to enhance performance in the work-place. This chapter also contributes to the literature on information processing and shows that the presentation of information matters. These findings do not provide evidence to claim that there is a causal effect from work screens on people's attitudes, but it demonstrates that there is a difference in attitudes between subjects exposed to different colour schemes.

Chapters 4 and 5 show that not only do people's uncertainty attitudes respond to external stimulus, but the effect on uncertainty attitudes can translate into people's stated choices. The second essay shows people's attitudes are sensitive to information in their economic environment; the certainty of information affects their uncertainty attitudes when there is a change in macro-economic policy. By investigating the sensitivity of people's uncertainty attitudes to their economic environment; this chapter demonstrates how informal media

discussions prior to and after a monetary policy announcement affect people's ambiguity aversion and risk aversion. The effect of media discussion is subject to individuals' attention and exposure to either precise or imprecise information surrounding the change in monetary policy announcement and its potential impact on people's welfare in the future. These effects on individuals' attitudes seem to be directly affected by the information and hypothetically also by general anxiety (worriedness) triggered by the communications from regulators. In this chapter, I hypothesise that information could also have an impact on individuals when in excess, which could create a negative affect and increase associated anxiety, which could be perceived as increased uncertainty. The media plays the role of a catalyst by fuelling speculations on economic issues and monetary policies. Increasing broadcast results in an excess of available information for attentive individuals and causes more anxiety.

This chapter is further extended in the third essay, to measure the impact of change in uncertainty attitudes to consumption by focusing on the allocation of marginal income to expenses (i.e. household and discretionary expenses). This essay showed that people allocation of marginal income can be affected when there is a corresponding effect on their uncertainty attitudes. People's perception of information is not only dependent on the content itself, but also on the environment where the information is communicated. It shows this by demonstrating that when people are exposed to different certainty of information prior to and after an announcement, this affects people's uncertainty attitudes, which in turn explains people's increased consumption. As results show ambiguity aversion explains the increased marginal allocation to household and discretionary expenses. Both chapters demonstrate this effect using a Central Bank announcement in December 2015 to nationals of the United States. The announcement included a change in policy (a hike of interest rates) which had been anticipated. Although, the news was positive, factors within the environment resulted in different reactions to the news, including the negative perception of positive information.

6.1 Limitations and areas for further research

The main limitation in this thesis comes from its methodology which, while convenient has some drawbacks. The use of surveys limit the control of the environment as compared to a laboratory, which makes it difficult to isolate the effect of the screens only. Consequently the interactions cannot be fully accounted for as there could be other factors at play. Although, this chapter tries to control for some of these effects, there are no absolute guarantee that this was achieved. Furthermore, in recruiting participants for this chapter, the launching of the surveys was within the jurisdiction of the survey platforms and participants took the surveys when they wanted. In the future, to control for factors such as sunlight effect and cortisol levels, it may be best to recruit participants, randomly but within different times such as morning and evening. By randomly allocating participants to different times of the day, this could allow the author to control for other variables such as greater or lesser cortisol levels, sunlight exposure and so forth. Furthermore, the use of survey platforms in recruiting participants for online surveys resulted in limited question sets. Subsequently, some questions were dropped for example, question on productivity was dropped to make room for cognitive questions in the third experiments. This meant that productivity could not be controlled for across all data sets.

Consequently, by building on the findings from Chapter 3, an area for further exploration would involve investigating information processing across different work settings, such as working from home, shared spaces, and meeting rooms, and the role of this (if any) in making judgements in uncertainty. This builds on findings by Moskaliuk et al (2017), who showed that people's attention and concentration are higher in an office environment than in other environments and focuses, on these factors in terms of making ambiguous and risky decisions within these environments rather than just focusing on performance. Further research can be conducted using the United Kingdom as a focus, since there has been a recent discussion of increasing interest rates (lending rates to commercial bank) from 0.5% to 0.75% base rate. It will

be interesting to observe the effect of this policy change announcement on people's income but in particular, observing different types of individuals, from austere to non-austere and the subsequent effects on marginal income.

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Appendix

A.1. Survey questions on risk and ambiguity.

Instructions:

In addition, the treatment group is subject to a mild time pressure stimulus in the following form: “The experiment should not take more than 5 minutes of your time with the average full completion time of 2 minutes and 43 seconds. We will record the time you spend to answer the questionnaire from the moment you click the "Next question" button below.” This stimulus is implicit as we do not *require* subjects to compete with others, yet they may be intrinsically motivated to do so. Extra pressure is created by making the initial experiment description lengthier for the treatment group.

A.2. Recruitment, randomization and incentives

Principles to ensure validity of data obtained through online experiments are discussed, for example, in Horton et al. (2011) and Vinogradov and Shadrina (2013), and are adopted in this chapter.

In Experiment 1, participants are recruited via Facebook using snowball sampling. In order to maximize the effect of intrinsic incentivization, a personal plea and invitation to friends and friends of friends (and so on) were posted on Facebook. Although we effectively work with a convenience sample, an effort was made to ensure diversity of responses by emailing and inviting various cohorts of potential respondents. Subjects were advised that the survey would take less than five minutes and consists of 15 questions that have no right or wrong answers (Crawford et al 2001, find that more participants are likely to take part in a survey if they know it is rather short), which helped us recruit participants and encourage forwarding the invitation to further participants.

In Experiment 1, the invitation post (or email) contained a web-link to the survey on Qualtrics. This basic "survey" consisted of one screen with a brief description of the experiment, identical for all participants, and a request to confirm their willingness to participate by clicking the "Continue" button. This button was associated with a randomization script that further redirected subjects to one of the two differently styled surveys, as described for the control and the treatment groups above. Participants were explicitly told there would be no remuneration. Their main incentive to participate was based on the friendly relationship with the person who sent them the invitation, and an interest in the survey. Participants could opt out of the survey at any point in time, and were not forced to answer questions, thus there were no incentives to misreport their actual decisions and beliefs.

In Experiments 2 and 3, participants were recruited by Surveymonkey from a database of subjects who gave an earlier consent to take part in surveys. Subjects were allocated to groups by randomizing the links to one of the three surveys in the invitations by Surveymonkey, controlling for similarity between the resulting subsamples in terms of their demographic composition. Surveymonkey incentivizes subjects to participate by promising to donate to a charity of their choice. In a special control question, subjects confirmed that they took part in the survey mainly because they wanted to donate to the charity, wished to help researchers collect necessary data and were curious to see what sort of questions they would be asked.

Although different incentives may, in general, lead to different reported and actual choices, our design is based on randomly assigning subjects to control and treatment groups, across which incentives are identical. Conclusions are based on the differences between these groups, thus eliminating the incentives factor. In addition, we follow Vinogradov and Shadrina (2013) in controlling for non-monetary intrinsic motivation of subjects. For this purpose, the total number of questions in all experiments is kept above 12, which ensures subjects have to exercise some effort to complete the questionnaire, and face a trade-off between completing the survey and switching to other activities. Incomplete responses are subsequently disregarded, which leaves us with observations with high intrinsic motivation, where subjects are less likely to provide random and or inconsistent answers. We also discard responses that took over 15 minutes to complete, as our purpose is to ensure subjects were exposed to the computer interface we have designed for them, the effect of which would be less pronounced if subjects are distracted by other tasks.

Survey Control Group

Start of Block: Control group working environment

Q1 By scrolling the bar either up or down, please describe your mood

1 (1)

2 (2)

3 (3)

4 (4)

5 (5)

Q2 Where are you taking this survey from?

- Home (1)
- Office space (2)
- Public space (coffee shop, restaurant) (3)
- Library (4)
- other (5)

Q3 How productive are you in this environment?

- ○ Very Productive (1)
- ○ Productive (but i will prefer to work elsewhere) (2)
- ○ Uncertain (3)
- ○ Unproductive (4)
- ○ Very Unproductive (i try to avoid working from here when possible) (5)

End of Block: Control group working environment

Start of Block: Control Group decision-making questions

Q4 **Consider a lottery ticket with a 50% chance of winning $100,000 and 50% chance of getting nothing. What is the LOWEST amount of money you would prefer to this lottery ticket? We assume that you would also be happy to swap the lottery ticket against any amount higher than the one you indicate.**

- ○ $60,000 (1)
- ○ $50,000 (2)
- ○ $40,000 (3)
- ○ $30,000 (4)
- ○ $20,000 (5)

Q5 **Consider a lottery ticket with a 50% chance of winning $100,000 and 50% chance of getting nothing. What is the LOWEST amount of money you would prefer to this lottery ticket? We assume that you would also be happy to swap the lottery ticket against any amount higher than the one you indicate.**

- ○ $60,000 (1)
- ○ $55,000 (2)
- ○ $50,000 (3)
- ○ $45,000 (4)
- ○ $40,000 (5)

Q6 **Consider a lottery ticket with a 50% chance of winning $100,000 and 50% chance of getting nothing. What is the LOWEST amount of money you would prefer to this lottery ticket? We assume that you would also be happy to swap the lottery ticket against any amount higher than the one you indicate.**

- ○ $40,000 (1)
- ○ $35,000 (2)
- ○ $30,000 (3)
- ○ $25,000 (4)
- ○ $20,000 (5)

Q7 **Assume, you have $1,000. What is the LOWEST CHANCE of winning $10,000 that you would prefer to this sure payment of $1,000? We assume that you would also prefer a lottery ticket with a higher chance of winning this amount than the one you indicate.**

- ○ 5% chance of winning $10,000 (1)
- ○ 10% chance of winning $10,000 (2)
- ○ 20% chance of winning $10,000 (3)
- ○ 30% chance of winning $10,000 (4)
- ○ 40% chance of winning $10,000 (5)
- ○ 50% chance of winning $10,000 (7)
- ○ I will prefer to keep my $1,000 safe (6)

Q8 **You can get a lottery ticket free of charge. Which one of the following lottery tickets would you choose?**

- ○ A lottery ticket with a 1% chance of winning $100,000 (1)
- ○ A lottery ticket with a 10% chance of winning $10,000 (2)
- ○ A lottery ticket with a 25% chance of winning $4,000 (3)
- ○ A lottery ticket with a 50% chance of winning $2,000 (4)

○ I am indifferent between these lotteries (5)

End of Block: Control Group decision-making questions

Start of Block: Control group demographics

Q9 Consider two urns with 100 balls in each. Urn A contains red and blue balls in an unknown proportion. Urn B contains 50 red balls and 50 blue balls. You would get a prize if you draw a RED ball. Which urn would you draw from, urn A or B?

○ Urn A (unknown proportion) (1)

○ Urn B (50/50) (2)

Q10 Consider the same two urns with 100 balls in each. Urn A contains red and blue balls in an unknown proportion. Urn B contains 50 red balls and 50 blue balls. Now you would get a prize if you draw a BLUE ball. Which urn would you draw from, urn A or B?

○ Urn A (unknown proportion) (1)

○ Urn B (50/50) (2)

Q11 How old are you?

- 24 and below (1)
- 25-34 (2)
- 35-44 (3)
- 45-54 (4)
- 55 and above (5)

Q12 What is your gender?

- ○ Male (1)
- ○ Female (2)

Q13

What is your employment status?

- ☐ Employed (1)
- ☐ Unemployed (2)
- ☐ Self-employed (3)
- ☐ Undergraduate student (4)
- ☐ Postgraduate student (5)
- ☐ Intern (6)
- ☐ Volunteer (7)

Q14 How much knowledge of statistics do you have?

- ○ Never heard of it (1)
- ○ Heard of it but never used it (2)
- ○ Heard of it and have applied it a little (3)
- ○ Had a course in it (4)
- ○ Had a course in it and applied it (5)
- ○ I have a professional knowledge of it (6)
- ○ Use it professionally and as an expert (7)

Q15 Please describe your mood now

1 (1)

2 (2)

3 (3)

4 (4)

5 (5)

Q16 Please tell us what you think about the survey?

_____

_____

_____

_____

_____

End of Block: Control group demographics

Survey Treatment group 2

Start of Block: Treatment group working environment

Intro This screen explains your task in this experiment.

The experiment should not take more than 5 minutes of your time, with the average full completion time of 2 minutes and 43 seconds. We will record the time you spend to answer the questionnaire from the moment you click the "Next question" button below.

All questions are about hypothesized investment decisions. The graphics are for illustration purpose only, all necessary information is provided in the text of the question.

The first three questions will ask you about your willingness to swap a risky investment project against a certain amount of money for sure. On the scale given please choose the answer that is the closest to your true choice.

Further two questions will ask you about your investment choices among several risky projects.

Final two questions will ask about your choices between projects about which you have different degrees of awareness.

In the beginning and in the end there will be three to five more questions about you. All data remains anonymous and there is no way to identify your personality from the data that we

collect.

You answers will significantly help us understand how people make decisions under uncertainty. We therefore expect that your answers truly reflect the choices you would make when facing these situations in the real life.

We thank you in advance for your help.

Q1 By scrolling the bar either up or down, please describe your mood

1 (1)

2 (2)

3 (3)

4 (4)

5 (5)

Q2 Where are you taking this survey from?

- ○ Home (1)
- ○ Office space (2)
- ○ Public space (coffee shop, restaurant) (3)
- ○ Library (4)
- ○ other (5)

Q3 How productive are you in this environment?

- ○ Very Productive (1)
- ○ Productive (but i will prefer to work elsewhere) (2)
- ○ Uncertain (3)
- ○ Unproductive (4)
- ○ Very Unproductive (i try to avoid working from here when possible) (5)

End of Block: Treatment group working environment

Start of Block: Treatment group decision-making

Q4

A portfolio manager or security trader would usually work with a computer interface resembling this screen including the colour scheme and graphics.

Figures on the right show bits of information similar to those typically present on a portfolio

manager's or security trader's monitor.

In making your decision you only need the details presented in the question below. You will have an opportunity to share your thoughts about the interface at the end of the study in the feedback section.

Consider the following lottery ticket with a 50% chance of winning $100,000 and a 50% chance of getting nothing. What is the **LOWEST** amount of money you would prefer to this lottery ticket? We assume that you would also be happy to sway your lottery ticket against any amount higher than the one you indicate.

- ○ $60,000 (6)
- ○ $55,000 (9)
- ○ $50,000 (10)
- ○ $45,000 (11)
- ○ $40,000 (12)
- ○ $35,000 (13)
- ○ $30,000 (14)
- ○ $25,000 (15)
- ○ $20,000 (16)

Q5 Consider two urns with 100 balls in each.

Urn A contains red and blue balls in an unknown proportion.

Urn B contains 50 red balls and 50 blue balls.

You would get a prize if you draw a **BLUE** ball. Which urn would you draw from, urn A or B?

- ○ Urn A (unknown proportion) (6)
- ○ Urn B (50/50) (13)

Q6 Consider two urns with 100 balls in each.

Urn A contains red and blue balls in an unknown proportion.

Urn B contains 50 red balls and 50 blue balls.

You would get a prize if you draw a **RED** ball. Which urn would you draw from, urn A or B?

- ○ Urn A (unknown proportion) (6)
- ○ Urn B (50/50) (13)

Q7 A portfolio manager or security trader would usually work with a computer interface resembling this screen including the colour scheme and graphics.

Figures on the right show bits of information similar to those typically present on a portfolio manager's or security trader's monitor.

In making your decision you only need the details presented in the question below. You will have an opportunity to share your thoughts about the interface at the end of the study in the feedback section.

Assume, you have $1,000. What is the LOWEST chance of winning $10,000 that you would also prefer a lottery ticket with a higher chance of winning this amount than the one you indicate.

- ○ 5% probability of success (6)
- ○ 10% probability of success (13)
- ○ 20% probability of success (14)
- ○ 30% probability of success (15)
- ○ 40% probability of success (17)
- ○ 50% probability of success (18)
- ○ I will keep my money safe (16)

Q8 A portfolio managers or security trader would usually work with a computer interface resembling this screen including the colour scheme and graphics. Figures on the right show bits of information similar to those typically present on a portfolio manager's or security trader's monitor. In making your decision you only need the information below. You will have the opportunity to share your thoughts about the interface at the end of the study in the feedback section.

You can get a lottery ticket free of charge. Which one of the following lottery tickets would you choose?

- ○ A project with a 1% probability of success yielding $100,000 if successful and nothing if not (6)
- ○ A project with a 10% probability of success yielding $10,000 if successful and nothing if not (13)
- ○ A project with a 25% probability of success yielding $4,000 if successful and nothing if not (14)
- ○ A project with a 50% probability of success yielding $2,000 if successful and nothing if not (15)
- ○ I would randomly choose one of the above projects as they look equally attractive to me (16)

End of Block: Treatment group decision-making

Start of Block: Treatment group demographics

Q11 How old are you?

- ○ 24 and below (1)
- ○ 25-34 (2)
- ○ 35-44 (3)
- ○ 45-54 (4)
- ○ 55 and above (5)

Q12 What is your gender?

- ○ Male (1)
- ○ Female (2)

Q13

What is your employment status?

- [ ] Employed (1)
- [ ] Unemployed (2)
- [ ] Self-employed (3)
- [ ] Undergraduate student (4)
- [ ] Postgraduate student (5)
- [ ] Intern (6)
- [ ] Volunteer (7)

Q14 How much knowledge of statistics do you have?

- ○ Never heard of it (1)
- ○ Heard of it but never used it (2)
- ○ Heard of it and have applied it a little (3)
- ○ Had a course in it (4)
- ○ Had a course in it and applied it (5)
- ○ I have a professional knowledge of it (6)
- ○ Use it professionally and as an expert (7)

Q15 Please describe your mood now

1 (1)

2 (2)

3 (3)

4 (4)

5 (5)

Q16 Please tell us what you think about the survey?

_____

_____

_____

_____

_____

Consumer expectations and perception

Welcome to our Survey

In this survey we will ask you 7 questions about your perception and expectations on economic issues relating to the United States of America as presented in newspapers, TV and other media sources. Additionally, we will also request that you indicate your choices between safe, risky and uncertain alternatives. This survey comprises of 14 questions in total and will take about 5 minutes of your time to complete. You can leave the survey at any time by closing your browser's window. Please click the next button below if you wish to continue and take part in this study, or close the browser if you do not want to take part in it

Q1 Based on what you may have read or heard about interest rate policy, at what annual rate do you think an average US citizen would be charged, if they take a car loan of USD10,000 . Please provide your answers using the slider below. For example 5 percent would be 5 on the slider.

_____ Current Annual rate

Q2 Based on what you may have read or heard about interest rate policy assume you needed to decide on how to use $1,000 extra earnings. In the current situation, how much of this amount you would spend on the following (you can also allocate the whole amount to just one option)

_____ Invest money in stocks(mutual funds) for 3 months

_____ Invest in safe assets (401k, pension funds, treasury bill) for 3 months

_____ Save in term deposits for 3 months

_____ Pay as deposit for or a repayment towards your mortgage

_____ Spend on buying a car, holiday trip or jewelry

_____ Other household expenses

Q3 During the LAST 12 months do you think prices in general have gone up or down or stayed where they are now? Please use the slider below to indicate by what percentage you expect prices in general to change. For example if you expect prices to go down indicate by selecting -5 on the slider. And if prices in general has stayed the same just indicate 0(zero) on the slider. Or, if prices in general have gone up indicate 5 for 5%.

_____ Prices in general

Q4 How confident are you about your previous answer? Please indicate by adjusting the slider below, where 1 would indicate "not confident or not sure" and 5 indicates "absolutely sure" of your answer.

- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5

Q5 Please describe your expectations about possible price changes for the NEXT 12 months, by what percentage do you expect prices in general to change for the Next 12 months? if you expect NO Changes please indicate 0 (zero). However if you expect prices to go up by 10% indicate 10 on the slider. Or, if you expect prices to go down by 10% please indicate -10 on the slider below.

_____ Prices in general

Q6 How confident are you about your previous answer? Please indicate by adjusting the slider below, where 1 would indicate "not confident or not sure " and 5 indicates "absolutely sure" of your answer.

- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5

Q7 Based on what you have heard on interest rate policy at what annual rate do you anticipate that an average US citizen would be charged on average in a year from now, if they took a car loan of USD10,000 ?" Please provide your answers using the slider below. For example 5 percent would be 5 on the slider.

_____ Annual rates in a year from now

Q8 Given the recent happenings, suppose you are given a lottery ticket with a 50% chance of winning $100,000 and 50% chance of getting nothing. What is the LOWEST amount of money you would prefer to this lottery ticket? We assume that you would also be happy to swap the lottery ticket against any amount higher than the one you indicate

- ○ $20,000
- ○ $25,000
- ○ $30,000
- ○ $35,000
- ○ $40,000
- ○ $45,000
- ○ $50,000
- ○ $55,000
- ○ $60,000

Q9 Consider two urns with 100 balls in each Urn A contains red and blue balls in an unknown proportion, Urn B contains 50 red balls and 50 blue balls. You would get a prize if you draw a RED ball. Which urn would you draw from, urn A or B?

- ○ Urn A (Unknown proportion)
- ○ Urn B(50/50)

Q10 Furthermore, what if you are presented with the same two urns with 100 balls in each. Urn A contains red and blue balls in an unknown proportion. Urn B contains 50 red balls and 50 blue balls. Now you would get a prize if you draw a BLUE ball. Which urn would you draw from, urn A or B?

- ○ Urn A (Unknown proportion)
- ○ Urn B (50/50)

Q11 Please tell us a little bit about yourself

- ○ Male, 24 years old and below
- ○ Male, 25-34 years old
- ○ Male, 35-44 years old
- ○ Male, 45-54 years old
- ○ Male, 55 years and above
- ○ Female, 24 years old and below
- ○ Female, 25-34 years old
- ○ Female, 35-44 years old
- ○ Female, 45-54 years old
- ○ Female, 55 years and above

Q12 Please indicate how often you read newspapers either on-line or in hard copy, for economic related issues (e.g. unemployment rate, interest rate, GDP growth etc.) Never

- ○ Less than Once a Month
- ○ Once a Month
- ○ 2-3 Times a Month
- ○ Once a Week
- ○ 2-3 Times a Week
- ○ Daily

Q13Please indicate how well you understood the survey. Where "1" would indicate that the survey was "not easy to understand and highly difficulty". While, "5" would indicate that the survey was "easy and well understood".

- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5

Q14 Please tell us what you feel about the survey