Ca' Foscari
University
of Venice

Master's Degree Programme

in Economics and Finance
"LM-56 (Scienze
dell'economia)"

Final Thesis

Can Financial Professionals avoid behavioral biases?
A survey experiment.

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Academic Year
2017/2018

Contents:

Introduction:

Everyone in the daily life has to deal with many different tasks and situations. Some of them are easy to manage and others are more difficult to process. At the same time our cognitive system has to process and elaborate thousands of information in response of all those tasks and issues. Establishing the probabilities of uncertain events is a complex and time-consuming operation. Our brain has excogitated an easier and faster way to simplify this data processing phase by using the so called "*heuristics"*. Heuristic << […] rules reduce the complex tasks of assessing probabilities and predict values to simpler judgmental operations>> (Tversky e Kahneman, Judgments under Uncertainty: Heuristics and Biases 1974, 1124-1131).

In particular the *Prospect Theory,* developed by Kahneman and Tversky (Tversky e Kahneman 1979), states that an individual's risk tolerance may change dependently of the random situations that she/he has to face.

These theories have reconsidered the classic decision-making process, and they opened the way to the development of behavioral finance and economics.

In this study, we investigate whether the *Prospect Theory* (PT) and the heuristic rules applies to all the individuals, independently from their age, sex, education, culture and profession, paying particular attention to financial professionals and non-financial professionals.

How was possible that highly qualified professionals all over the financial sector weren't capable to predict rationally worst financial and economic crisis in the last 70 years? How was possible that they became victim of the famous "*animal spirits?".* What we would like to know is if there are particular behavioral and cognitive patterns that allows financial professionals to avoid systematically behavioral biases. As history teaches us, human beings have a short memory and they hardly learn from past errors.

We will analyze and compare two different approaches, the metaphysical, which was the one used by Kahneman and Tversky in their studies, and the motivational, mainly developed and

used by Lopes.

The study is based on data collected by a survey experiment conducted on a sample of professionals, working in the financial sector, and on a sample of non-financial professionals between Ireland, Italy, U.K, Germany and Australia. Professionals and non-professionals will have to answer to the same set of questions that will investigate their capability to avoid biases and will give us an insight of their conscious and unconscious risk tolerance. We think that in a world where the importance of data analytics and Artificial Intelligence is consistently growing, the capability of financial professionals to control their behavioral and unconscious errors will be extremely important, especially in the role of controlling those machines and in the understanding of big data. The first chapter shows the point of view of the *Prospect Theory*, chapter two shows the theoretical basis and hypothesis of the motivational approach, lead by Lopes, in chapter three we discuss our methods, approach and testable predictions, chapter four shows the results of the surveys, in chapter five we analyze and compare the result and chapter six is inclusive of our conclusions and comments of the study. With this study, by putting professionals and non-professionals at the same level, we want to assure that financial professionals have the capabilities to contrast their inner animal spirits and as Kahneman wrote words: << It is wise to take admissions of uncertainty seriously but declarations of high confidence mainly tell you that an individual has constructed a coherent story in his mind, not necessarily that the story is true”>> (D. Kahneman 2011)

Chapter I: The Prospect Theory's Approach

1.1 The Prospect Theory:

The Prospect Theory (PT) has been a cornerstone for the development of behavioral studies applied to the economic theory. As a matter of fact, PT has completely reconsidered the utility theory as a descriptive model of decision making under risk (Tversky e Kahneman, Prospect Theory: An Analysis of Decision under Risk 1979). The "classical" utility function is based on the hypothesis that all individuals will always try to maximize their utility and, in order to do so, they will always use rational criteria to make a choice under uncertainty conditions (U. Rigoni, Teorie normative e descrittive della scelta in condizioni di incertezza 2016).

Developed by Israeli psychologists Daniel Kahneman and Amos Tversky in 1979 and published in *Econometrica* journal, this theory demonstrates the inconsistency of the rational hypothesis on which is based the classical utility theory and in particular it puts the spotlight on irrational choices driven by individuals' behavior.

The approach used by Kahneman and Tversky in order to formulate and develop the PT is based on their findings in the psychological field, especially the study published in 1974 on heuristics, effects and behavioral biases (Tversky e Kahneman 1974). Heuristics condition the data processing phase of a situation or an output and, in our situation, a prospect or a game. At the same time also cognitive effects create a distortion in this phase and influence the choice of the game. A key role is played by the *framing effect*: from the rational point of view, an individual should always be able to consider as equal two prospects, formulated in different ways, but with the same output. In a famous experiment (Tversky e Kahneman 1981), Kahneman and Tversky have demonstrated that this doesn't happen and they have also find out that preferences between two equal games vary dependently on the frame of the game. The participants were told that U.S is preparing for an unusual Asian disease, which is expected to kill 600 people. They asked to select one out two alternative programs to combat the disease. The consequences of the programs were the following:

- If program A is adopted, 200 people will be saved.
- If program B is adopted, there is 1/3 probability that 600 people will be saved, and 2/3 that no one will be saved.

In this scenario, the majority of participants prefer the first option. This is due to the fact that a chance to save certainly 200 people is more attractive than a prospectus with an equal expected value of 1/3 chance to save 600 people (E (U) A= 1*600=600; E (U) B $= \frac{1}{3} * 600 =$ 200). A different group of participants were told to select one the following programs with the following consequences:

- If program C is adopted, 400 people will die;
- If program D is adopted, there's 1/3 probability that nobody will die, 2/3 that 600 will die.

Here the expected utility of the games is 400. In this case the second option has been the preferred one, due to the fact that the certain death of 400 individuals is less acceptable than a chance of 2/3 that 600 will die.

From this example, we can understand how the willingness to take risks changes between a loss scenario and a gain scenario: in a loss scenario, individuals are more risk seeker and in a gain scenario, individuals are more risk averse.

This is an extremely important result, because it clearly rejects the classical expected utility's point of view among risk attitudes: instead of having individuals with only a risk seeker or neutral or a risk averse nature, Kahneman and Tversky suggest that everyone could be potentially the three things together, it depends only by the scenario of the prospect.

The authors have divided the prospect's judgment process in two main phases, both divided in sub-phases:

- Phase one: *editing phase;*
- Phase two: *prospect valuation,* where we have the utility function and the weighting function;

In phase one the individual edits the prospect, manages and simplify the data set in order to process it easier and faster. It is in this phase when heuristics are applied and so it's in this phase when our cognitive bias start to influence our choices. Since it is in this phase when individuals

reformulate their data, also the value function and the weight given to each prospect depend from it. What is very important to keep in mind is that this process in sub-optimal by definition. By managing the data set, we unconsciously exit from the optimal field of evaluation and enter into a sub optimal one. Since this happens at the very beginning of a prospect valuation or a game, we can easily understand the importance of our cognitive system, which has well defined biological limits (U. Rigoni, Teorie normative e descrittive della scelta in condizioni di incertezza 2016). The phase is composed by six different processes:

I. *Coding:* as we said before, our risk appetite changes weather we are in the dominion of losses rather than in the dominion of gains. The coding phase is where we determine the reference point for our valuations. This point usually represents our current assets position (Tversky e Kahneman 1979). Another interesting point is to understand which are the dependencies behind the selection of the reference point. Kahneman and Tversky (*ibidem)* suggest that two dependencies could be the way the offered prospects are formulated, so weather there's a *framing effect,* and by the expectations of the decision maker. Rigoni (*ibidem)* suggests also that the reference point could depend by the individual's experience, culture and education. This is the first step for the personalization of the decision maker's utility function. Maybe we can share the same reference point, but we will have a specific point for each of us.

II. *Combination:* when it's possible, individuals simplify prospects by combining the probabilities associated with identical outcomes. For example, if we have two prospects with a potential gain of 10 and the associated probabilities of 0.1 and 0.4, the prospect will be evaluated as a potential gain of 10 with an associated probability of 0.5.

III. *Segregation:* when a prospect has a component without risk, that component is segregated from the risky one. See the example below:

Prospect A		*Prospect A (segregated)*	
Probability	*Output*	*Probability*	*Output*
0,2 0,8	+200 +300	*Sure gain* *0,2* *0,8*	+200 0 +100

Table 1.

The prospect is divided in a sure gain of +200, which is the riskless component, and in a risky prospect (+100; 0, 8), where 100 is given from 300-200.

IV. *Cancellation*: it consists in discarding shared or common components of prospects, modifying arbitrarily the structure of the given data set of the prospect.

V. *Simplification:* subjects round probabilities and outcomes. A prospect with an outcome of 201 and a probability of 0,29 will be consider as a prospect with an outcome of 200 and a probability of 0,30. A consequence of this rounding process is considering uncommon events as impossible ones and very common events as certain. For example, an event with a probability of 0,001 will be considered as impossible and an event with a probability of 0,99 as certain. This thing has strong implications, especially in the insurance field. In order to build a well-diversified portfolio, insurance companies apply the principals of the law of big numbers, creating portfolio with policies on catastrophic or very uncommon events. This mean that on one hand they deliberately assume risk, because the payment they may have to do in case the underlying events occurs is very big, and on the other and they use this extreme probability to diversify their portfolio and reduce the risk at a portfolio level. The simplification will eliminate these extreme events and will also reduce the beta of the portfolio. Another interesting consideration could be that simplification could lead to an excess of overconfidence in decision making: if an event with a realization probability of 0,99 is consider as certain, the willingness to assume risk could rise when there's still a 0,01 non-realization probability.

VI. *Detection of dominance:* it is the operation of scanning of the offered prospects to

detect dominated alternatives and reject them without further evaluation.

The second phase is the evaluation of prospects, where the individual chose the prospect with the highest value or expected value (Tversky and Kahneman 1979). The value of a prospect is give from two functions: the first one is used to assign a value to the game and the second one to weight up the probabilities associated to the games. So, the value function of a game will be:

$V(Prospect) = \sum_{i=1}^{N} \pi \ \ (Pi)\ v\ (x_i)$, where:

- p_i is the probability associated with the i-th output
- x_i is the i-th output
- π is the weighting function
- v is the value function

It's important to keep in mind that all the components are the result of the previous phase *(s. supra, par 1.1)*, so this means that the results of a prospect are evaluated as differences from a reference point, which it depends on many aspects such as culture, profession, etc.., and the amount of probabilities and the associated results are filtered throw the process of editing. For example, we could find a probability of 0.10 instead of 0.8 and a result of 100 instead of 99. Furthermore, the weighting function doesn't weight the probabilities linearly. This means that the sum of the weights could be more or less than one, as the probability assessment indicates. The decision weight will be, in the major of the cases, smaller than the associated probability. The weight given to a probability of 0.40 is likely to be smaller than 0.40 (Tversky and Kahneman 1979). In other words, the actual weight of a 50% chance to win 1000 or nothing, depending on coin throws, is less than 50%. As Kahneman and Tversky suggest, *<<the two scales coincide (i.e., $\pi(p) = p$) if the expectations principle holds, but not otherwise.>> (ibidem).*

So we can say that when: $\pi\ (p) = 0$, and $\pi\ (1) = 1$ and because of this, the function is growing and extreme events such as impossible ones are ignored. So on, when the probability is small there's an over weighting of the probabilities, so $\pi(p)>p$; this is an extremely important point, because it explains why people buys insurance policies for very unusual events, such as catastrophes, fire etc.. We basically give them more importance rather than what they should

actually get. On the other hand, when the probability is very high, we can see an under weighting of it and $\pi(p)<p$. We basically give less importance to very common events. Last feature happens when we have $0<p<1$. In this situation we observe the so called (*ibidem) subcertainty* and $\pi(p) + \pi(p+1) <1$: this is why the weighting function is not linear. In this situation, when we move from an uncertain option to a certain one, we change the way we value the probability: moving from an uncertain prospect to a certain one, make us give more weight to the certain result than what it should normally have been given. That's why we will have this kind of function:

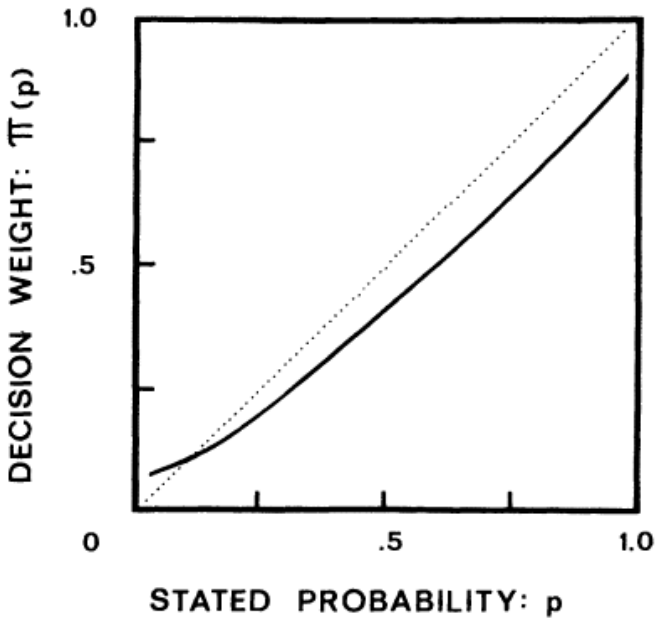

Figure 1 – Weighting Function of Probabilities, (Tversky and Kahneman 1979).

The *value function* is based on the variation from a reference point. Kahneman and Tversky have suggested the following formula (Tversky and Kahneman 1992):

$$V(x) = \begin{cases} x^{0,88} & if\ x \geq 0 \\ -2,25(-x)^{0,88} & if\ x \leq 0 \end{cases}$$

As a result, the function is convex in the loss dominion and concave in the gain dominion, as we can see below:

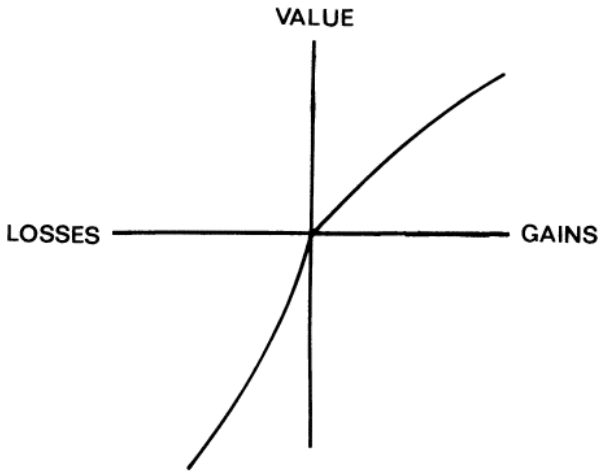

Figure 2 – Value Function, (Tversky and Kahneman 1992)

The most interesting areas of this function are its extremities. Dependently from the reference point, in presence of potential high losses individuals start to be risk averse and risk seeker for high gains, which is something different from what is normally expected from the utility function in PT. Another point is the importance of the reference point and since it is based on qualitative factors rather than quantitative ones (*ibidem)*, our study will investigate this point in order to observe whether the dependencies of professional status and financial knowledge could play a role in this extremely important point.

1.2 The Cumulative Prospect Theory:

Because of this particular behave of the function at its extremities, Kahneman and Tversky have developed an "upgraded" PT, which is called *Cumulative Prospect Theory* (Tversky and Kahneman 1992). Instead of basing their utility function on a classic utility function, they used a cumulative approach, first proposed by Quiggin (1982) and Schmeidler (1989). What this model does is basically transforming the entire cumulative distribution function instead of

transforming each probability separately (Tversky and Kahneman). So we have a different weighting function to apply to the prospects. In particular will be used a specific weighting function for the gains and a specific one for the losses. How it works:

- when we are in the gains area the weight give to a prospect will be

  $\pi^{+}_{i} = w^{+}(1-F(x_{i+1})) - w^{+}(1-F(x_i))$

  This happens if the results are arranged so that x_i is better than x_j if $i < j$ and where w^+ is the weighting function for gains and F is the cumulative weighting function of probabilities.
- when we are in the losses area the weight given to a prospect will be

  $\pi^{-}_{i} = w^{-}(F(x_i)) - w^{-}(F(x_{i+1}))$

Also for this function the authors provided a functional solution:

$w^{+}(p) = p^{0.61}/(p^{0.61}+(1-p)^{0.61})^{1/0.61}$

$w^{-}(p) = p^{0.69}/(p^{0.69}+(1-p)^{0.69})^{1/0.69}$

This means that the weights function for the gains is the difference between the weighting function of the probability to obtain a better or equal result than x_i and the weighting function applied to the probability to have only a better result. For the losses, the weight will be given from the difference between to obtain a worst or equal result than x_i and the weighting function applied to the probability to have only a worst result.

The overall value of an uncertain prospect is: $V = \sum_{i=1}^{n} \pi_i v(x_i)$.

The weighting function for the cumulative probabilities will be:

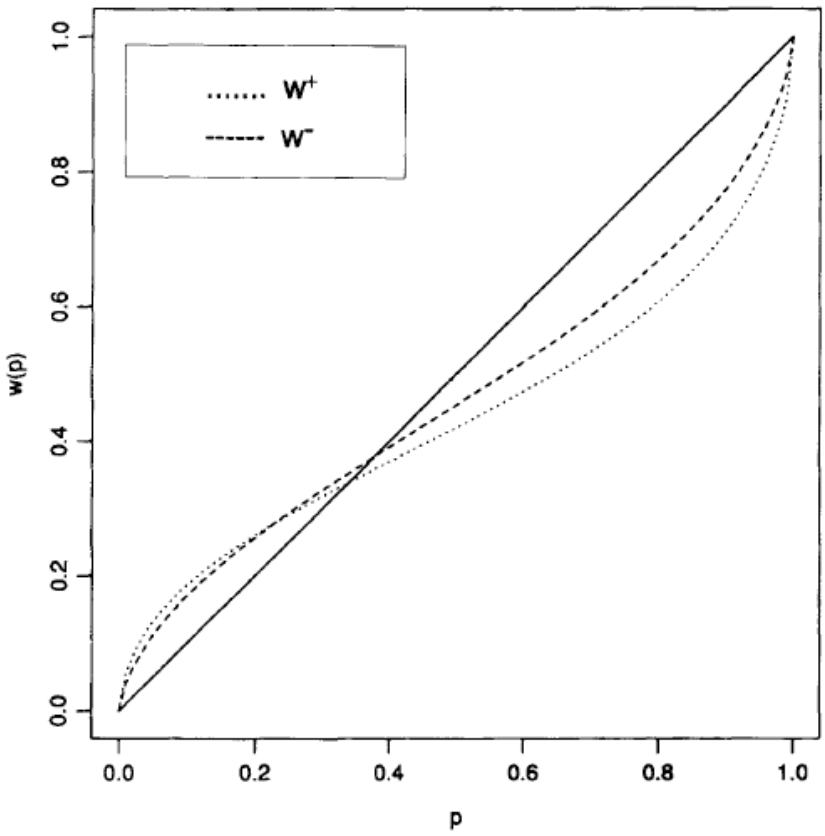

Figure 3. Weighting function for gains (w^+) and for losses (w^-).

(Tversky and Kahneman)

With this more detailed function, we are actually more accurate than with the PT. As a matter of fact, the behavior of individuals under uncertainty is very various and we can appreciate it better at the extremities of the function. The sensibility of the function is higher in those points, so the weight given to a potential 40% loss is lower rather when we have a potential loss of 99%.

Then we will have risk averse individuals when: the prospect has almost certain small gains. This situation is typical of financial investments (U. Rigoni, Teorie normative e descrittive della scelta in condizioni di incertezza 2016) and the prospect has almost impossible but very high losses (insurance policies).Whereas we will have risk seeker individuals when: the prospect has almost impossible but very high gains (lottery tickets and the prospect has almost certain small losses.

What we understand from this review on *Prospect Theory* is that the behaviour or individuals is not certain and it could vary dependently if the uncertain situation is based in the dominion

of losses rather than in the gains' dominion. But what is more important is that every single final choice depends on a wide range of uncertain and variable factors. If we think about the editing phase and all the mechanisms that interact each other in order to "clean" the data set of the prospect, we can already see how much our choices are the result of a process which has nothing to do with a rationale or optimum way to compute and manage data. In addition, we add the dependency of the reference point which is also a qualitative variable rather a quantitative one.

For these reasons our study will investigate weather, given particular conditions and background dependencies, there's a way to manage correctly the data set and avoid unconscious errors which are very common in this process. In particular, by doing a comparison between financial professionals and non-financial professionals attitude or response to very common behavioral biases, we will be able to have an insight of this irrational world and also to see if conditions typical of the financial world can determine a different and eventually better data set's managing process.

Furthermore our survey looks as the gap between two different approaches to behavioral finance and economics; Kahneman and Tversky are more prone to prove the validation of general laws rather than finding particular laws for particular events, which is what Lola Lopes have done and we will review that approach in the next chapter.

Chapter II: Motivational Approach

2.1 A different approach:

The literature regarding our behaviour under uncertainty is extremely wild, but, more or less it's orientated towards the same direction, which is the hypothesis that everyone has the same cognitive apparatus and so everyone is a victim of behavioural biases in the same way.

This particular approach, which is defined as *psychophysical*, has been used by Kahneman and Tversky to develop their theory. Their weight function is based on the psychophysical of changes. And that's why a change from an uncertain event to an impossible one or from a likely event to a certain one, is weighted more rather than changes between the extremities. In other words, the weight given to a change in the probabilities from 0.1 to 0 and from 0.9 to 1 is bigger than the one given for a change from 0.40 to 0.50.

At odds with this approach, we can find the *metaphysical* or *motivational* one. << Motivational theories construe the decision maker as analysing possible outcomes and assessing risks (by which is usually meant simply the probability of achieving some goals>> (Lopes.Lola.L 1986). This approach focuses on a completely different apparatus. First at all they distinguish between risky choices: this term can be considered in two different situations, risky choices with an element of danger and gambles, where gambles are based on choices between risks and choices between risks and sure things. This consideration is done because <<real world risks […] hardly ever have just two outcomes, […] more often they range essentially continuously over the outcome variable. >> (Lopes.Lola.L 1986). This means that it's doubtful that individuals make a separate decision every time they have to deal with uncertain choices or with choices under risk.

So for the motivational approach, the risk taking process has to be reconsidered. Lopes' point of view is that it's incorrect to think about risky situations where the output could be the "status quo" or the risky output: a twofold risk world is not sufficient.

Furthermore, Lopes, in the same paper (*ibidem)*, critics the experimental approach in general, arguing that it ends in reducing everything in a response to a stimulus. In Lopes' opinion it's necessary to invoke individual's differences and so, the motivational and emotional factors that give risky choice its experiential texture: individuals' hopes and fears.

This means that emotion and motivation pay an important role in risk taking and in decision making. But more important is that emotions and motivations are moved by an inner motivation

which depends on our expectations and on the context and on the situation. Our survey is calibrated in order to appreciate this discrepancy and to investigate if a particular context, education and financial knowledge can actually modify an individual's behaviour and choices. Another key point is the role played by personality. There's a lot of work done on personality traits and investor types and also on emotions and personalities. The point is that the motivational approach aims to give more importance to individualities and it's focused on finding single rules rather than general ones.

The motivational approach is based, as we have already wrote before, on different theoretical hypothesis. Lopes (*ibidem*) suggests to consider a different risk model to represent lotteries or games and prefer to use alternative statistical moments. She also gives importance to role of cognition in decision making process under uncertainty. But, as key point of her work, she points the spotlight on her *Two Factor Theory for Risky Choices.*

A feature of this theory is that this approach has been able to give more consistency in behavioural theories and furthermore it's explain particular behavioural traits that were still not clear in the *Prospect Theory*.

We will review in the next paragraphs these cornerstones of the motivational approach and, following the work done by Lopes on it, we will try to spot the differences with the theory developed by Kahneman and Tversky.

Before starting this process, it's important to state that there are not correct or incorrect behavioural theories. Rather than saying that the theory developed by Kahneman and Tversky is the only one that explains the behaviour of an individual under uncertainty or saying the same thing for the motivational approach, the best thing to do is to consider them as complementary: each theory completes the other and they give a consistent view of our behaviour under uncertainty if only consider together. Furthermore, since the human nature is so complex and articulated, the only way to have a complete view on the topic is to embrace theories that are at the odds of each other.

2.2 Cognition:

In 1986 the psychologist Lopes (1986) made an important progress in behavioural studies and researches. She has underlined the importance of cognition in the decision making process. She pointed out that one the differences between the two approaches is the degree to which they are cognitive. What Lopes says is that at the very beginning of the process we use our cognitive apparatus which has the role to process and acquire knowledge through our thought, experience and senses (oxforddictionaires n.d.).

After the activation of this apparatus we start to manage our data set and so we can choose appropriately between different options, and we can use our experience and knowledge to assess probabilities.

From Lopes point of view, psychophysical theories << […] have not been couched in cognitive terms […]>> (1986), even though there are clear references to cognition. While Kahneman and Tversky want to find psychophysical differences, Lopes prefers to pay attention to perceptual and attentional differences. What does this mean? It means that our cognition guides action to its intended goal, but action is incited by motivation which gives it direction. We can find a similarity with the editing phase described by Kaheneman and Tversky in their *Prospect Theory* (*see supra, 1.1*) and as already said, in that phase the role of cognition is extremely important.

The combination between cognition and motivation is the basic of Lopes' approach and it also helps to have a better understanding of the weighting function described by in the PT. What Lopes states is that, especially for extreme probabilities, people's tendency to treat small probabilities as zero might be justified cognitively in terms of the degree to which small probabilities can be expected to produce discernible impacts on how we choose to live our daily life. Infinitesimal probabilities, for example less than 0,001, can be treated as psychologically equal to zero (Daston 1980). That's why 1000 € worth more to a poor person rather than to a rich one and that's also why we use different reference points to assess a prospect.

What moves everything is our inner motivation which depends on our cognition of things.

2.3 Risk Representation:

Such a particular theoretical apparatus needs a different approach to risk representation, since individuals seem to respond more to changes in the type of lotteries rather than in changes in the amounts and probabilities of a single outcome.

The *Prospect Theory* is based on theories of risk perception and theories of risk preference which are based in turn on moment's models, which are described by statistical moments of distribution such as mean, variance and skewness. Lopes states that << […] such theories implicitly assume that moments have independent psychological reality.>> (1986). For example, high variance can be considered as bad, due to an increase of risk, a positive skewness can be compared to hope (this because in this situation there's a predominance of low outcomes with few high outcomes, for example lottery ticket) and a negative skewness can be compared to fear (high outcomes with a few low outcomes, example common life risk taking situations, for example changing the electricity provider).

As we discussed before, a key point is that we all use reference point to assess probabilities of

risky choices, and what we simply do is doing comparisons between to different states of the world. We might say "*what can happen if I do this rather than doing something else, will I be able to reach my goal or not?"*. Since this necessity to make comparisons, Lopes suggestion is to represent lotteries using Lorentz curves, which are cumulative graphs.

The reason for this choice is that Lorentz curves at the same time cumulate the lotteries and make it possible to compare either the low or the high outcomes.

This type of curve is plotted on the right and the abscissa represent the cumulative probability and the ordinate the cumulative proportion of the output.

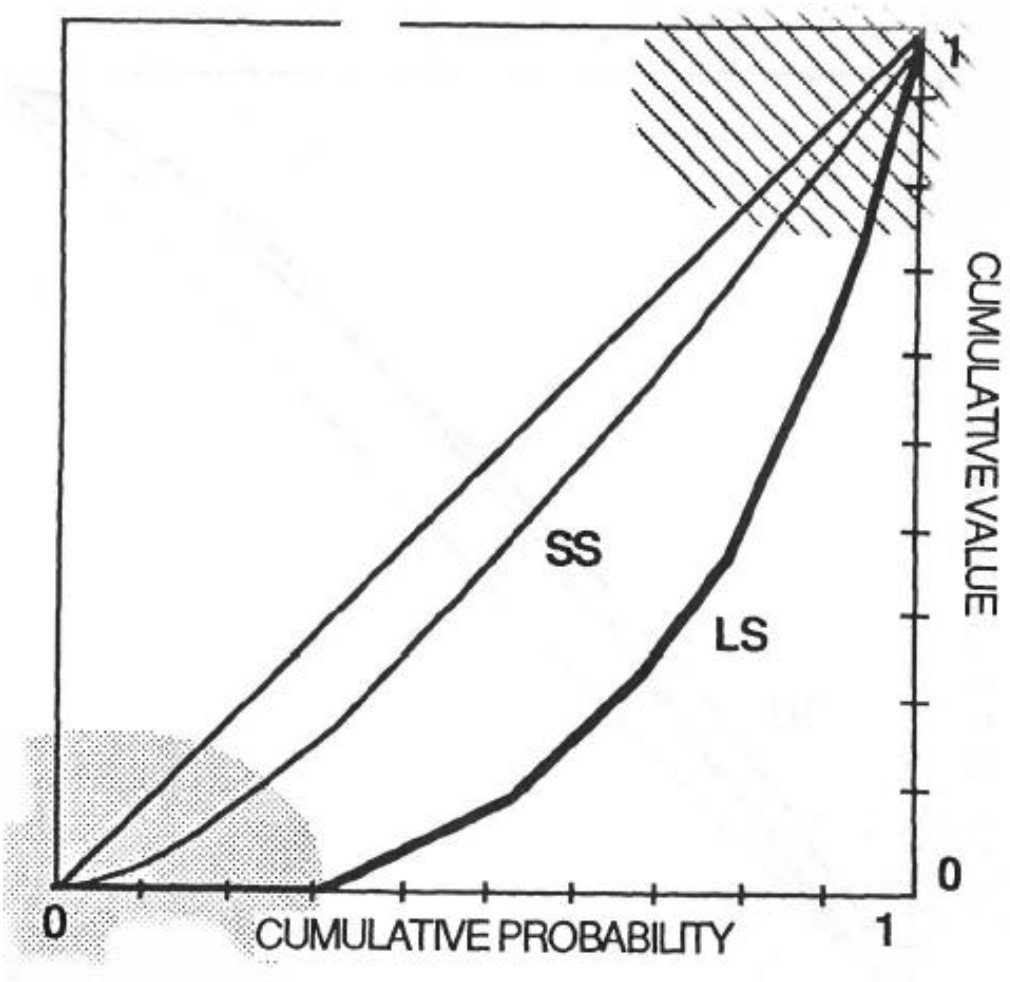

Figure 4. Lorentz Curve, (Lopes.Lola.L 1986)

What's the interpretation of this curve? Suppose we have a lottery with many tickets and the related chance to win a prize. On the diagonal we would see in this case a situation where each ticket has the same certain price or winning gift. In the low left angle is where there are the

small prizes or gifts and in the high right angle is where there are the big prizes. A curve like LS represents the tickets with a very high outcome or prize and that's why it is very steep in the upper side and very flat in the lower side, several high outcomes must be compensated by several low outcomes. On the other hand the SS curve represent a series of more certain tickets or events with lower prizes or outcomes.

Should we interpret it in terms of risk aversion or risk seeking? No, we should interpret it in terms of avoiding worst outcomes and seeking highest outcomes. Who's in the first case lies on the SS curve, while in the second situation represents the LS's curve.

It's extremely important to notice the crucial role given to the goal. As matter of fact, with these curves we can see that it's the goal which determines the choice and the attitude to uncertainty. But what influences the choices of the goal? This is the second part of Lopes' theory which we will review in the next chapter.

Another interesting point is that this type of plotting choices under uncertainty gives us a picture of our willingness to achieve a result or a prize and they also assess our willingness to assume risk in order to achieve it. But this comes only after we have expressed our goal. Rather than doing a comparison between uncertain outcomes and weight them, basically what is described by the cumulative prospect theory, we choose our goal and we act under uncertainty depending on it.

Another important feature is that Lorentz curve describes very well loss lotteries. In this situation, the curves will lie above the diagonal line because the biggest outcome is zero and the worst is a loss so, something below that level. The diagonal represents all sure negative outputs. Individual which are willing to obtain the best outcome will have a curve that lies above and far from the diagonal and who wants to avoid bad outcomes, so big losses, will have a curve that lies next to the diagonal. In both cases, as we can see below in *Figure 4.*, bad outcomes are situated in the lower left corner and good outcomes in the upper right corner.

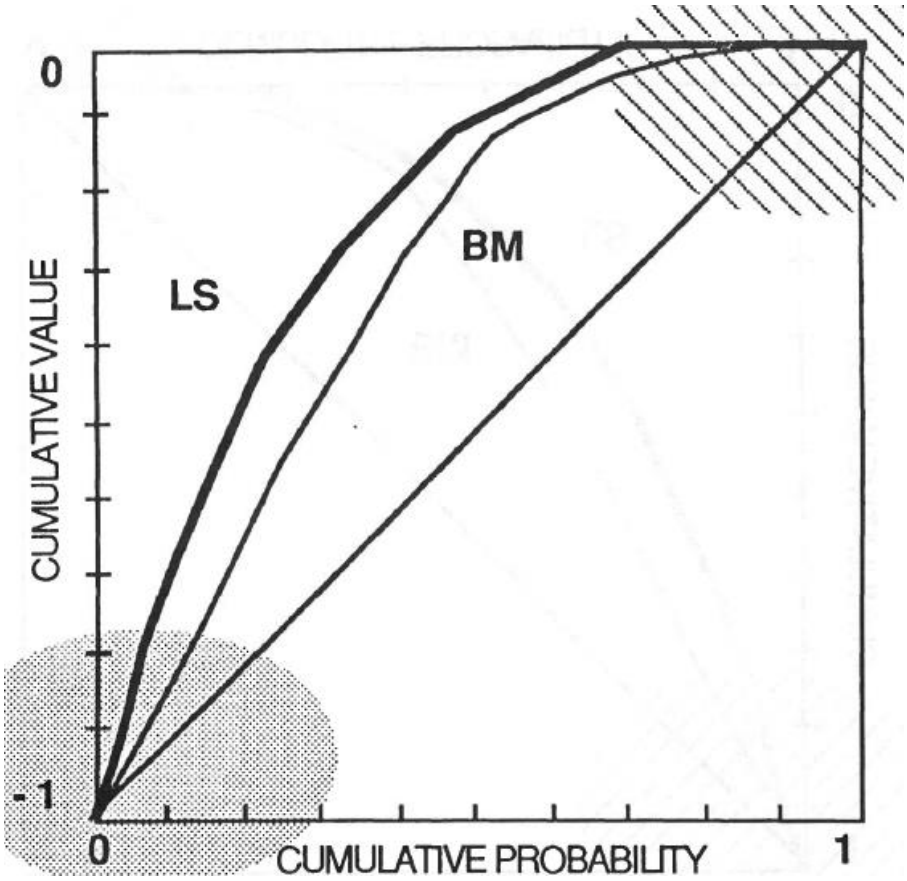

Figure 5. Lorentz Curve, (Lopes.Lola.L 1986)

As Lopes states, (*ibidem*), Lorentz curves have four virtues:

1. Subjects evaluate lotteries in term of inequalities.
2. Predict when people having different goals will agree or disagree about lotteries and when differences will be large or small.
3. The make it easier to find similarities among lotteries which could seem to be not similar at a first sight.
4. Facilitate comparisons between region of the curve, which appear important to people with different goals.

The psychologist also adds <<*The purpose of Lorentz curve representation is to deepen understanding of the functional stimulus […]*>> (Lopes.Lola.L 1986). This is because they are a way to represent lotteries rather than a function.

2.4 Two Factor Theory:

Two-Factor Theory is based on the assumption that our choices under uncertainty are driven by two different factors or conditions: one depends on the individuals' general willingness to achieve a certain outcome or need, like desire for security and desire for potential and the other one depends on the situation and individuals' response to immediate needs and opportunities. The combination of the two factors is our choice.

We can see our general willingness to achieve a certain need as our attitude to risk. Who is looking to satisfy her need of safety can be labelled as risk averse, whereas who is looking to satisfy her desire for potential is considered as risk seeker.

This factor is an inclination, something very close to our instinct. This explains why the need of security if far more common than the need of potential and it could be considered like every one's basic pattern. This inclination can be translated also in mathematical conditions and it will depend on the weight given to the outcomes: a risk seeker will attribute less weight to bad outcomes and more weight to good ones and a risk averse will weigh more bad outcomes. This difference between the weight given to different outcomes is not standardised and by saying this we mean that <<[…], *the fact that a person chooses, […], to minimize the likelihood of a bad outcome does not imply either that […] he underestimates the value of good outcomes or that he overestimates the probability of bad outcomes*>> (Lopes.Lola.L 1986). As a corollary to this statement, individuals are aware of the opposite situation, because their inclination only depends on their goals, which are not fixed and predetermined. Our goal could change and make us more averse or more risk seekers.

The second factor is influenced by the situation and it acts as a mutable variable. So if our attitude is, in a certain way, more close to our inner status and it depends on our goal, on the other had this factor is tailored by the circumstances. It reflects the aspiration level and the cost opportunity, as Lopes states (*ibidem*) it answers to the questions "what can I get" and "what do I need" from this situation or opportunity? Since its nature, this factor is exposed to influences which can be divided in three groups:

1. Context of the alternative choice set: in this situation a big role is played by certain outcomes. As per the *Prospect Theory*, individuals are attracted by certain outcomes rather than uncertain ones, even though this could affect the outcome. For example, people prefer to win 10 € rather than taking part to a lottery with 0.5 chances to get 0 and 0.5 chances to win 20 €. Lopes suggests that this happens because certainty allows

to get the rid of uncertainty in short term planning , and so resolve outcomes that may be no be resolved in the short future.

2. Assessment of what is reasonable or safe to hope for, which a sort of prudence first criteria.
3. Outside influence: individuals adapt their preferences and risk attitude depending on the situation, in particular as much as they are in a bad position they will prefer riskier moves (Lopes and Casey 1994), this happens in situation where someone has nothing to lose and the only way to get a good outcome is to take a very risky choice.

The main suggestion that can be done from this theory is that individuals are not divided in a binary world where someone can only be risk averse or risk seeker. Since our attitude towards risk is influenced by the situation and other factors, it's not possible to distinguish them clearly. This point is at the odds with the general psychophysical approach, where people are divided in two groups and where their attitude varies dependently on the result of the prospect. For Lopes, individuals shares the same way to process choices, even though their final choice may be significantly different (*ibidem*).

How is connected our behavior to our risk attitude, what is the feature that makes us be more or less risk seeker? This is a fair question because since we share the same decision making process and we have different responses to the same stimulus, it's necessary to know what creates this discrepancy. Lopes suggests that the answer is the *Safety First Principle*. Risk taking or seeking has not to be seen like an opportunity that can be only pursued by who is capable to afford it economically, in other words only by rich people. For the safety first principle, individuals prefers to reach safety first and then, once they have assured this goal, they can take more aggressive choices in terms of risk seeking. The logical consequence of this is that when you are far away from your safety status, you will tend to take more risk in order to reach that point. This explains the behavior that we have discussed before. We can say that in a certain way the safety first principle could be similar to the reference point described in the *Prospect Theory*. Obviously their meaning is different but, as we said before, if we consider the two theories together, we can see clearly how much is important the measurement we use to determine our choices.

2.5 Inner conflicts:

How many times happens to you to desire something that you can't afford or something that could make you lose your "safety first" option? This happens because we are surrounded by options and desires. Basics desires, such as health, sleep, hunger and others and more sophisticated desires, such as the desire for a new job, new house, desire for a certain income during the retired life and so on. Conflicts arise when our aspirations are not in line with our feelings or desires. Why there are so many conflicts? A reasonable answer could be that since the *Safety First Principle* forces our mind to assure safety first and then all the other needs, we will always fall in a conflictual situation when our desire for potential arises and makes decisions difficult to make. Let's do an example: say that you have a disposition towards security but the only way to get that security is very risky, for example this individual has low aspiration level compared to the expected returns of his/her investments. In this case she will choose the most certain option. On the other hand, let's suppose the goal of the investor is very high and bigger than what reality pays back with the available yields. In this particular case, the objective is completely out of range and not alienated, the only way to take correctly a choice is to change the objective and try to align our inner will with what is available from the context.

This conflict is extremely interesting because it something very common, and it afflicts all the possible choices we could take. As the task and choice become more complex and articulated, more the conflict is difficult to manage. Consider for example a situation where we have to decide about our future income and life style but we also have to decide how much money we have to save for our kids' university. Having a higher income and better lifestyle during retirement with no funds for university expenses or a lower income but with funds for university expenses? The answer could not be always easy and it depends on the context and on the situation. What is the consequence of this situation? It's that whatever choice we will take, it will always be suboptimal because it's the result of a change in our initial preferences. This could be a problem, both in our everyday life and in more complex situations, such as financial investments. Since high risks are payed off by high returns, when conflicts arise we could find our self, investing in a portfolio which is riskier than what we were disposed to take or invest, only because our desire for safety is not matched by the returns offered by the market.

The importance given to the context is crucial for the metaphysical approach as it shapes our decision-making process. Furthermore, our attitude and our response to the circumstances could

extremely vary because of changes in what surrounds us. This means that individuals are not divided in risk takers or in risk averse in certain dominions, as Kahneman and Tversky suggests in their studies, but rather that they mutate their behavior dependently on the situation and what they expect from that situation. That's why our survey wants to investigate whether certain conditions enable individuals to mutate their choices and the way the make choices, especially in the financial sector. Through the survey we will be able to directly compare directly professionals' choices and behaviours with non-professionals. If we strongly believe in the psychophysical approach, so we fully believe in the *Prospect Theory*, we would expect to see no difference between the sample. On the other hand, the motivational approach advises us to expect to see differences between the samples. We believe that the environment were financial professionals have to work conditions their decision-making process, but their cognitive apparatus is always submitted to cognitive biases. That's why we think that both the approaches are extremely exhaustive to understand our irrational choices, but we also think that the way we process information is strongly influenced by our biases, especially the one that we use in the *editing phase*. We expect to see few differences in the sample groups, but we also expect to see some differences in technical questions, were financial knowledge could play a significant role. We will analyse, explain and describe our methodology and survey in the next chapter.

Chapter III: Materials and Methods

3.1 Testable Predictions:

From the two approaches is possible to understand that if we consider the *Prospect Theory* approach we don't expect to observe any differences between the samples. This means that financial professionals are victim of behavioral biases in the same way non-professionals are, which leads to a series of consequences that are not desirable for their role and for the sector. On the other hand, if we consider the motivational approach, we can say that individuals behavior adapts to the situations, context. This means that professionals can adapt their behavior to their tasks and role and so avoid biases. For this contrast between the present theories, we want to test two main fields: the capability of financial professionals to avoid biases, so we expect them to have a better resilience than non-professionals, and we want to test their risk tolerance, which we expect to be higher for professionals.

3.2 Survey Structure:

We decided to use a survey to investigate behavioral biases between professionals and non-

professionals primary because there there's not available data on a direct comparison between the two samples, especially by using the same set of question to investigate biases. In particular there's not data on a comparison between the two theories using the dichotomy financial professional - non-financial professional. Furthermore the survey is a very adaptable instrument and easy to manage for the following reasons:

1. Topics: the survey enable us to investigate several biases at once and also to have control on the bias that we want to investigate.
2. Divulgation: a survey is easy to divulgate, especially through social media and emails.
3. Control: the survey enables us to convert qualitative answers into quantitative ones: by giving a numeric score to each qualitative answer, we can easily compute statistical analysis.

We have decided to divide the survey in two main questions groups: the first one is populated by socio demographic questions, the second one is populated by questions focused on particular biases.

3.2.1 Socio demographic group:

The aim of this group of questions is to know the characteristics of the samples.
We asked the participants to answer to the following questions:

1. Sex
2. Age
3. Nationality
4. Current country of residence
5. Profession
6. Highest Qualification Obtained

Question 1 allows us to divide the sample in men and women, and to see whether there are different responses to our stimuli. This comparison, between sexes, is very interesting, since we know that from existing literature women are more risk averse than men and also have less investing confidence than men (Fish 2012). With our survey, we are able to appreciate and investigate different behaviors between sex.
Question 2 allows us to divide the sample by the age. Also for this question, we expect to see differences between the age groups. This is something extremely easy and reasonable to

understand: we expect youngers to be more risk seekers than older groups: if we consider the life-cycle theory, developed by Modigliani (Modigliani 1986), young individuals use debt as a resource of their consumption, where debt is actually credit provided by older individuals. A big role could be played also by culture changes especially driven by developments in information technology. We expect to see the youngest groups to be risk seeker and the older groups risk averse.

Question 3 allows us to divide the sample by nationality. This is extremely important, because our sample is composed by several nationalities and culture varies a lot between each nationality, so behavior and stimuli could vary. We have to consider that a big role in the answers could be played by this factor. That's why we have decided to include also Question 4, current country of residence: we think that culture and behavior could change also because of the country where individuals live.

Question 5 is essential for our scope. This question is necessary to detect the profession of the interviewed, and then determine whether she or he is a financial professional. Since the financial sector is extremely wide and diversified, we have decided to give a kind of definition of "financial professional": we have considered as financial professional everyone working in the financial sector, independently from their position, so for example: financial consultants, auditors, HR specialists, asset managers, risk managers, middle-back-front office operators. We also didn't take in account the experience of the professional, since we can detect it from the age groups. Obviously, there could be the rare case were a young professional has more years of experience than someone who is older, but it is an exception rather than a rule.

Question 6 allows to have an insight of the general knowledge of the sample. The aim of this question is to be able to analyze the answers also by referring to knowledge, and also financial literacy of the respondent. We not that individuals with a more sophisticated culture or financial knowledge have a different attitude towards financial choices, in particular individual with less financial knowledge or even general knowledge tend to rely less or use less the services provided by a financial consultant and they have less diversified portfolios and more risk assumption. On the other hand, individual with a more sophisticated financial knowledge tend to rely and use more services of financial consultants and to have a well-diversified portfolio. This happens because more sophisticated individuals understand their limits and also appreciate more the services of a financial consultant. On the other hand, too much knowledge could lead

to an excess of optimism and overconfidence that could lead to an avoidance of financial consulters and to excessive risk assumption (U. Rigoni, Teorie normative e descrittive della scelta in condizioni di incertezza 2016). Especially because our survey wants to investigate differences between the two groups, professional and non-professionals, we need to have at a high level an idea of the knowledge of the sample. We expect professionals to have a higher knowledge in finance, since the sector requires it at curriculum level. This question will allow us to see if actually financial professional have better qualifications than non-professionals.

Socio demographic questions are extremely important in order to interpret the answers to the next group of questions, which are more focused on behavioral biases and behavior towards risky choices.

3.1.2 Behavioral biases and risk attitude:

The next group of question is basically the core of our study. It could be divided in two sub-groups, one specific for behavioral biases and one specific for risk tolerance and attitude toward risks. Has we will review later, each question has been formulated with the aim to give a specific point of view of each bias that we decided to investigate. At the same time, each question will merge into the overall profile of the interview. Answers to these questions will be evaluated at two different levels:

a) Answer level: we will compare, at aggregate level, the answer to each question and the differences between the professional and non-professionals' sample.
b) Profile level: we will create a professional's profile and we will compare it with a non-professional one.

Many questions were designed following examples already used for researches and theories. Few of them are actually the same questions which have been used for other famous studies. A large amount of the questions was formulated for this questionnaire: this group of question is based on existing examples, but it has been reformulated for the aim of the study, paying particular attention to the fact that we wanted to investigate biases in a sample of professionals and also non-professionals.

We have also decided to formulate as simple as possible questions, short and smart, attractive for the respondent, not time consuming and easy to understand. Because of this, we are aware that few questions could have lack of power to detect directly a response to a bias or a risk attitude, but at the same time we know which are our expectations and our objectives, and we think that is was necessary to give the same questionnaire to the samples, so we had to find a compromise between the understandability of the questionnaire for non-professionals, and

technical questions, more suitable for detect biases in the professionals' sample.

3.3 Biases Question Group:

The amount of biases, cognitive simplifications and behaviors toward uncertainty is extremely wide. So, we decided to investigate the main topics for two reasons:

1. The aim of our study is to investigate if financial professionals can avoid cognitive biases, so there's no reason to investigate specific biases closed to the professionals' world, especially the finance one.
2. Commonly, more specific biases, for example *the endowment effect*, can be explained from more general biases, such as *Status Quo* and *Loss Aversion.* That's why we have decided to cover few, but, from our point of view, crucial biases and behaviors.

The biases and behavior that we investigate with our survey are: *Loss Aversion, Endowment Effect, Status Quo, Overconfidence, Underconfidence, Representativeness Heuristic, Mental Accounting, Disposition Effect and House Money Effect.* The choice for this group of biases is due for the reasons that we have already explained before plus we think that they are also very common biases and not too much sophisticate.

3.3.1 Loss Aversion:

Loss aversion has been mainly studied and investigated by Kahneman and Tversky, in an article which can be defined as the *manifesto* of their entire studies: "*Prospect Theory: An Analysis of Decision under Risk* ", published in *Econometrica*, in 1971. As we have already discussed in chapter one (vedi *supra, 1.1*), for certain loss and gains, individuals are more or less risk averse. This is due the fact that losses weight more than gains and so individuals will always try to avoid them. Every transaction or every choice is influenced by a reference point which determines the loss or gain dominion (Kahneman, Knetsch e Thaler 1991). This behavior under uncertainty is extremely important and it explains many other behaviors and effects. For the aim of the study, we know that both professionals and non- professionals are exposed to choices where loss aversion plays a big role. This is also why we expect the two sample groups to have the same kind of answer to this type of questions. Obviously, what could really be an important component of the topic is the reference point that we give to the samples. Since we don't know a priori which is the economic wealth of our respondents and their culture, we have decided to use as a reference point a level of payoff and loss which could be affordable for almost every participant, without paying attention whether professionals could have a higher income than non-professionals. Our intention is to create a hypothetic situation where the attention to the

reference point could be secondary. The question used for this purpose is as follows: "*Which would you rather do: give me €100 upfront, or take a bet where there's a 50% chance you'll lose €0 and a 50% chance you'll lose €200?*".

In this situation, the loss dominion is represented by the chance to lose 200€. If we look at the expected return or gain of this question we can easily see that it's always the same: if we give upfront 100€ our loss, obviously, will be -100, if we decide to take the bet the value of the bet is again -100 (0.5*0 +0.5*-200 = -100). So, we are basically saying that at same level of losses, we want to how the individual approaches to this uncertain situation. A further specification must be done, since we decided to put a dichotomy answer to the question: take or not take a bet. We are aware that a rational individual would answer that the expected value of the games is the same and so it would have been better to put a third option. We voluntary refused to do it because a third option would make the respondent think that the game as a tricky solution, what actually is. Literature confirms this way of structuring the question, preferring to avoid a third option (Guillemette, Yao e James 2015). The same procedure has been followed for the gains' dominion: The question is formulated has follows: "*Which would you rather do: take €100 now, or take a bet where there's a 50% chance you'll win €0 and a 50% chance you'll win €200?*". Again, the gain dominion is represented by the chance to win 200€ and by a sure win of 100€. In both cases is offered certain option, which is a certain loss in the loss dominion and a certain gain in the gains' dominion. What we expect is to observe a difference between the professional and non-professional samples, since we think that professionals could have a higher risk tolerance than non-professionals. Another reason why we expect to observe differences is that, as we said before, the reference point could be perceived differently between the two groups and within the groups itself, since it's possible to have different reference point inside the same sample. For this reason, we will run statistical analysis and tests.

3.3.2 Endowment Effect and Disposition effect

This bias is extremely important, especially for the purpose of our study. This effect or bias can be described as the fact that people often demand much more to give up an object than they would be willing to pay to acquire it (R. Thaler 1980). This effect could be explained by loss aversion and the *status quo* bias. In the first case, it's easy to understand why an individual should prefer to keep what already have, and so eventually something which value represents a sure loss, because she or he is afraid of achieving a bigger loss. On the other hand, the *status quo* bias, which we are going to review shortly, help us to explain the *endowment effect* by

saying that individuals prefer to maintain the current situation rather than change it. For this particular topic, we had to find, again, a good compromise in order to represent correctly something that could be representative of the *endowment effect* for both the sample groups. Because of this, we have designed a question based on choice between to options, with about the same appeal to the respondents, but where we have a sunk cost, which should act as psychological perception of an endowment. The question is: "*You paid 120€ for a reservation in a very exclusive restaurant, where the waiting list for a table is about 3 months. Your best friend gives you a ticket for your favorite band/musician and the event occurs at the same time of the dinner in the restaurant***.** *Which would you prefer?"* The question wants to measure the respondents' availability to give up something that they have already paid for, so something that actually has a bigger value than the other option. We know again that a restaurant could eventually not be preferred to a concert in any case, but we expect the groups to keep their reservation at the table. We also want to investigate how professionals behave with this type of choices, since we know that, especially for traders and also for investors, this effect is very common and often leads to losses. In particular, when we talk about reluctance to realize losses, we are talking about the *Disposition Effect* (Shefrin e Statman 1985). So, this question, if correctly analyzed, could give us also a view on this particular effect.

3.3.3 Mental Accounting:

It's the mental process which individuals use to keep track of their expenses, profits, losses and expenses. It has been mainly studied and developed by Thaler (R. Thaler, Mental Accounting and Consumer Choice. 1985). We can find three different types of accounts (R. Thaler 1999): one for consumption, one for income accounts and one for wealth accounts. What we can see is that in consumptions' account often individuals tend to not detect small expenses, even though their total cost could be very large. In this situation, individual tend to keep different accounts for different expenses and also to treat differently profits and losses. This is something we know from *Prospect Theory,* in particular we value given to single losses in bigger that the sum of them (ex. -5 + -5 > -10) and the same for gains. The value of a single gain plus the value of a single loss is bigger than the sum of the loss and the gain (ex. +5-3> +2). When we talk about income accounts we have to keep in mind of often the income is: if we have a regular income we expect to see a higher consumption (Thaler e Shefrin 1988) and then as the income is less regular and becomes a *windfall*, the consumption disposition will decrease and so basically individuals will consider those incomes in different accounts. It's very interesting to investigate professionals' attitude toward this bias since we want to see if actually their mental

accounting is divided by different accounts or if they actually consider losses and gains within the same account. The compromise is again that in order to design an understandable question for non-professionals we have decided to create a windfall, represented by the win of a lottery ticket and an immediately loss, represented by a stolen bike of similar value. We ask to choose between three different options, which are associated to an emotional status. The question is: "*You have just won € 200 in the lottery, you exit the shop where you won and you find out that your bike has been stolen. You had paid 200€ for the bike previously. How do you feel?"* The answer's options are: *bad-indifferent-happy for the win.* We think that in this way we can easily capture three different attitudes:

1. If the answer is *Bad*, means that the individual has different accounts for the bike and for the ticket and in particular weight more losses than profits, which is something theoretically correct.
2. If the answer is *Indifferent*, means that the individual is using the same mental account for losses and profits and also, he is giving them the same weights.
3. If the answer if *happy for the win,* then we are in the same position as in point 1 but he's giving more weight to profits rather than losses or he is considering the win as a windfall.

3.3.4 Status Quo:

This bias can be described as the preference to keep things as they are, basically preferring the current situation to eventual new ones (Samuelson e Zeckhauser 1988). This bias is important because it could lead to losses very easily and it's extremely common between all individuals. Then, when we move into financial decisions, such as investments and so on, we know that sometimes changing our investment options is better than keeping it. In this case, we can say that both samples are exposed to this particular bias and that also we have to keep in mind that this bias affects transversally individuals. Testing this bias is extremely simple, because the main difficult is to create a default option or situation for the individual and then the next step is to ask her or him whether she or he prefers to switch to another option. For example, in a study done by Samuelson and Zeckhauser (Samuelson e Zeckhauser 1988), they noticed that individuals have difficulties to switch to another investment plan once they have chosen one. The so called *automatic enrollment plans*, where you are automatic enrolled in a standard pension scheme have partially resolved this issue. Individuals, rather than having as default the non-enrollment option, have this standard pension scheme option and if they want to change

they actively have to choose another option. This automatism prevents non-enrollment and so at least guarantees a default option. To test this bias we have decided to formulate a question closely to the financial world, since we think that for non-professionals there should be not much differences once a pre-set option has been individuated. The question is: **"***You are a fund manager. You have had a good year and you have met 40% of your target. However, you have not achieved enough for your bonus target. You are presented with a risky investment opportunity. You could lose the gains year to date or meet your bonus target. What do you do?"*. The status quo is represented by the fact that the target performance of the fund has been reached and the individual has to decide whether he wants to try to reach his or her bonus or not and by assuming risk. This question regards the status quo bias, but it's also inclusive of the *house money effect*, that we will review later. So, it's not purely about the status quo bias, but this doesn't influence our output, because we think this question is good for both the situations. For this question, we expect to see the professional group moving towards the non-status quo option and this for two reasons:

1. Contest: the financial contest has probably more references to bonuses based on performances.
2. Professionals are more used to assume risk in order to reach a target, and so they are less scared of moving from the status quo.

For this question, it would be extremely interesting if professionals prefer to keep the status quo.

3.3.5 House Money Effect:

<< The tendency for investors to take more and greater risks when investing with profits. The house money effect gets its name from the casino phrase "playing with the house's money.>> (Investopedia s.d.). This condition has been studied for the first time by Thaler and Johnson in 1990, and they focused on the effect of previous gains and losses in risky choices (Thaler e Johnson 1990). Another important result of their study is the so called breakeven point, when individuals assume more risk in order to breakeven their investment. In the financial world, where bonuses are based on better performances, that in order to be reached are commonly based on risk assumption, the house money effect is very common and dangerous. That's why we have decided to merge the *status quo bias* and the *house money effect* in one question. When

we added to the status quo's situation the option to reach the bonus target by assuming more risk we were basically saying: if the respondent moves from the status quo then he also wants to risk what he has gained until to reach the bonus target, otherwise he or she is fine with what already has. For the same reason above, we think that professionals will prefer to try to reach the bonus target.

3.3.6 Representativeness Heuristic:

Individuals evaluate probabilities by assessing how much an event or something is representative of a phenomenon (Tversky e Kahneman 1974). One of their biggest findings is that individuals order their judgements or prospects putting at the same level probability and similarity: this means that during the decision-making process we evaluate a situation or a prospect by assessing its similarity to the context. They run an experiment describing an individual, Steve, and asking if he was a librarian, a sales man, physician or airline pilot. The statement was "*Steve is very shy and withdrawn, invariably helpful, but with little interest in people, or in the world of reality. A meek and tidy soul, he has need for order and structure, and passion for detail."*[1] Individuals asses the probability that Steve is a librarian by the degree he is similar to the stereotype of a librarian. What happens is that individuals don't apply correctly the Bayes' Rule, making their probabilistic judgment wrong. In same study, the authors also show the results of another experiment, inherent with the representativeness' heuristic. In this situation, they observed that when there are no specific evidence, prior probabilities are correctly used and the opposite when evidence are specific and prior probabilities are omitted. They asked to the interviewed to assess the probability of an individual to be an engineer or a lawyer. They once said that the professional sample was composed by 70 engineers and 30 lawyers and vice versa. When they gave particular description of the hypothetical lawyer or engineer, they noticed that respondents were paying more attention on the given descriptions, and so they were trying to see how much the description was representative of the stereotype of a lawyer or an engineer, not applying correctly the prior information. On the other hand, when the description was general and less specific, respondents applied correctly the prior information and Bayes' Rule. This effect or bias leads to wrong judgments, which are actually the result of a simplification of a problem,

[1] (Tversky & Kahneman, Judgments under Uncertainty: Heuristics and Biases, in Science Vol. 185, p. 1124, 1974)

as this is the nature of heuristics. Plus, this heuristic is often followed by two other simplification processes called "*The law of small numbers*" and "*The gambler's fallacy".* The law of small numbers implies that individual wrongly rely on statistical evidence based on small samples (Tversky e D.Kahneman 1971). Their study was focused on the fact that many scientists publish results based on poor statistical basis, starting from the size of the sample, which implies also a misleading observation of a phenomena. In particular, they correctly argue that a sample, especially if small, could not be representative of a phenomenon. This is something very similar to what they called after few years the representativeness heuristic. The other important process is the *Gambler's fallacy*, which is the wrong application of the mean regression concept, developed by Galton in the mid '800's, where processes regress to the mean value, Galton's study was based on the regression toward hereditary stature, (Galton 1886), but it has been used for many important developments. The gambler's fallacy is the belief in a systematic regression to a mean level: so, for example, after a high return we expect to see a lower one and so on. These three simplifications are systematic and occurs in everyone. We wanted to test if financial professionals are or not able to avoid this kind of data processing, especially because they have to deal with probabilistic judgments in almost everyday tasks, and also because their culture and knowledge background should allow them to avoid this kind of error. So, what we expect is to observe a significant difference between our samples and in particular we expect the non-professional group to be more prone to probabilistic simplifications and the professional one to be more prone to avoid them. To test this particular topic we have decided to use two different questions. In the first one we asked: "*You flip a coin 10 times: write out example results of 10 coin flips (Heads) or (Tails)*". This question is same used by Kahneman and Tversky in 1974[2] to assess representation heuristic. An individual who is applying that heuristic should write out as an example of 10 flips where the percentage of Heads and Tails is 50% or close to it. The reason is that individuals know that a probability of 50% is representative of a coin's flip result, but they ignore that a small sample of ten throws is not representative of this general low. What we expect is the non-professional sample to apply law of small numbers and also the representativeness heuristics. As we said before, we think that professionals, because of their supposed better financial knowledge, will consider correctly probabilities and will not rely on the law of small numbers. We find this question very simple to be understood for both the sample, since it doesn't require particular financial knowledge. The second question follows the same path of the previous one, but it is more

[2] (Tversky & Kahneman, Judgments under Uncertainty: Heuristics and Biases, 1974)

technical, since it involves a trading system. This question also has been formulated Kahneman and Tversky in the study previously cited. It composed by two different questions, very similar each other, the first one is as follows: "*Suppose a trading system gives signals, in a certain time period, that makes possible to beat the market in the 60% of the cases. In the last 2 months the system produces 10 signs. How many of these signals do you think could have been positive ones?".* Similar for before, also in this question a "biased" answer should be 6, since individuals think that the 60% is a reliable law. In this situation, closer to the financial world than the previous one, we are expecting the professionals to be, again, more cautious is assessing probabilities judgments rather than the non-professional group, which we expect to see again a victim of the law of small numbers and the representativeness heuristic. In the second question, we can see that the structure is the same, but the observation period of the trading system is of six months, and the positive signals are 30: "*Suppose in the last six months there have been 30 buy signals, how many of these do you think have brought a profit?".* Again, in a biased answer we should see as result a number equal or close to 18 and in a hypothetical correct answer would be that it's not possible to state an exact number of positive signals since the sample is too small and representative of the phenomena. As per the previous answer we expect the professional group to be more able to give a correct answer and this can be also due to the fact that actually they have practical experience of trading systems. We also believe that in our survey and for the purpose of the study is not necessary to have further information regarding these effects, also because the interviewed would be suspicious of more and similar questions and this could influence their answer.

3.3.7 Overconfidence and Under-confidence:

This bias is very popular and common between all individuals. We know that self-esteem could vary between each individual and that it could also depend on different personalities. From this point of view, many studies have been conducted and have produced interesting findings, in particular studies in the investor's types has demonstrated that overconfidence could vary and be more or less intensive (Pompian 2012). For example, Pompian (*ibidem*), suggests that an "*accumulator"* type, someone who is interested in accumulating wealth and is confident in his/her investing abilities, is easily a victim of overconfidence, whereas a "*preserver*", someone who is loss averse and emotional, is insecure of his/her abilities and more easily victim of under-confidence. Apart from personalities, these two biases depend also from the typology of the available information: with few but clear information individuals feel more confident to make a decision under uncertainty since, because of the representativeness heuristic, they rely on the

"poor" statistical evidence. One of the main results of overconfidence is the underestimation of result's variability and also it has been demonstrated that also risk professionals are victim of this bias (U. Rigoni 2016). In order to test *overconfidence* in our study, we take into account both of the two aspects above. This means that we have created two different conditions for our measurement: one is based on a self-assessment to pick better performing stocks and the other one on two hypothetical situations where we ask to the interviewed to go for or not an investment dependently on the given information. The first question is "*Please indicate, in a scale of 1(low) to 5 (high), your assessment of your ability to pick better performing stocks.*" The other two questions are: "*You are an equity research analyst and you are interested in buying shares of a company whose CEO has just declared a bond issue in the next semester. He hadn't disclosed further information. What would you do? – Buy- Not Buy- "*. The second one is "*In another situation the CEO has alluded many times to a bond issue but he has never given clear information about it. Would you invest with the same confidence of the previous situation? Yes- No".* Both the questions are strongly related to the financial world and at a first sight it may look like they could be difficult to be understood by the non-professional group, but we believe that in order to have a good comparison and measurement of professionals' overconfidence it's necessary to tide the question into this particular frame. Another reason is that overconfidence occurs more often in individuals with no particular investing knowledge or experience (in other words non-professionals), and << [...] *therefore more prone to display overconfidence.*>> (D.Kahneman, E.Higgins. e Riepe 1998). The authors also add that financial professionals have more calibrated probabilistic judgements since they face similar problems every day and they have << […], *precise feedbacks on outcomes.*>>[3]. So overconfidence in financial choice is a common matter between the groups, and it's worth to evaluate it with a more technical question. *Under-confidence*, on the other hand occurs when we have many and not clear information. To create a hypothetical situation for under-confidence we have designed the above question. In the first situation we have a strong and clear information about the future financial decision of a CEO (new bond issue). In the second one the CEO as alluded many times and not officially to an eventual bond issue (many but non clear info). We expect both the groups to be overconfident, and so to buy shares, in the first option and under-confident in the second one.

[3] (*D.Kahneman, Higgins e Riepe, Aspects of Investor Psychology: Beliefs, preferences, and biases investment advisors should know about, in Journal of Portfolio Management, Vol. 24, pp. 52-65, 1998*)

3.3.8 Risk Tolerance:

A large portion of our survey is made by risk tolerance related questions. Before analyzing the questions, it's important to clarify few points. The first one is reason we wanted to run a comparison between professionals and non-professionals' risk tolerance, which can be easily explained by the fact that financial professional have to deal every day with risk, by measuring it, by being exposed to it or by simply calculating returns related to a certain risk level. Because of this, we could observe that actually professionals do have a higher risk tolerance than non-professionals, thing that we also expect to be in reality. The second point regards how we do this analysis. Literature and best practices, suggest a very vast universe of risk tolerance questionnaires, which are mainly used by financial advisors, banks and insurance companies. One big discussion point is the quality of the measurement, which is related to the length of the questionnaire. A low number of questions could make extremely various the result of a test, for example with 5 question, each question could explain 20% of the individual's risk tolerance, so as many question we have, we reduce the chance that a single answer could vary the overall risk tolerance (Rigoni 2016). As Rigoni suggests (*ibidem*), a questionnaire with only 15-20 questions would not be reliable. Overall, our questionnaire includes three questions, a number that would not be considered as reliable. The explanation of this "low" number is that our survey is focused on behavioral biases, some of them includes risk aversion and so on, and we only want to have a high level idea of the respondents risk tolerance. Our aim is to observe whether the interviewed shows the same behavior toward risk during the questionnaire or if it changes dependently on the topic. In the hypothetical situation where we observe a change of the behavior we will consider that these question could not be reliable since we may be apply the *law of small numbers*. So how did we design our questions? First at all, we want to measure the risk tolerance of a hypothetic investing scenario. To do so we have designed a multiple choice question, as it follows: "*Which Investment would you choose?"*

- *An investment that certainly returns me 3% per year*.
- *An investment that returns 0 with a probability of 50% and 9% with a probability of 50%.*
- *An investment that returns me -3% with a probability of 50% and 6% with a probability of 50%.*
- *An investment that returns me -6% with a probability of 50% and 12% with a probability of 50%.*
- *Indifferent.*

As can observe, the expected value of each possible investment choice is the same, 3%, so we are actually measuring each individual risk tolerance with all return equals. In this question, we expect professional to be more prone to answer indifferent, because they can easily calculate the expected return, and this because they face every day this kind of situations. The second question is more open, and not related to the financial world, it asks to describe to the respondent her/his risk tolerance and to choose between low, medium or high. Since the two questions are subsequent, we expect to see the answers moving together, so an answer of a low risk tolerance in the first question would be followed by a low tolerance in this question. The third question could be consider off topic: "*Do you think your tolerance changes dependently upon the circumstances or situation?"* The answer would be *yes-maybe-no.* With this question we want to see if our groups, especially the professional's one, believe that their risk tolerance could vary on the situation. This is extremely important because we may observe a certain belief that our risk tolerance depends on what is the environment and the situation we have to face, thing that is completely according with Lopes' theory. Another important suggestion is the that we will also be able to measure the strength of risk tolerance's self-assessment. If someone asses to have a high risk tolerance and that the risk tolerance could not vary upon the circumstances means that he/her is very confident of her statements and beliefs.

*3.3.9 Financial Knowledge***:**

Financial knowledge is the main discriminator between the samples and probably and the main reason why the results between the two samples will diverge. It's also fair to consider that this is only an assumption, and so, in order to measure the level of financial knowledge we will use the results of the *"Highest Qualification Obtained*". Another important consideration is that it's also not easy to get, with the same survey for professionals and non-professionals, a good measure of financial knowledge. To be clearer, it would be difficult to insert the same questions to measure financial knowledge, since financial professionals should have a higher level at priori. So we will measure it with the highest qualification obtained and with a self-evaluation of interviewed financial knowledge. The possible answers are: *basic-intermediate-sophisticated.* We expect professionals to have a higher qualification and also a sophisticated financial knowledge.

3.2 Procedures and Implementation:

The questionnaires has been created via Google Forms, https://www.google.com/intl/it/forms/about/ and it has been translated in Italian and in English.

The divulgation of the questionnaire has followed two different methodologies:

A. Link to the questionnaire sent via email: the questionnaire, in both languages, has been sent to a sample of one hundred professionals, working for an asset management company in Dublin, Ireland. The invitation email was standardized for every-one. For further information please see "Appendix A".
B. Link shared via Social-Networks by the researchers: we shared the link via Facebook® and via WhatsApp®.

The link to the questionnaire has been opened for 31 days and then closed.

The data set has been analyzed and processed with STATA®.

3.4 **Sample size, composition and response rate:**

Because of the divulgation method, we couldn't now a priori the size of the sample and consequently the response rate. The only information we have about the response rate is regarding the "asset management" group, which could be considered as sufficiently satisfying: we have 52 responses on 100 invitations, so a 52% response rate. Out of this 52, 36 were Italian speakers, or preferred to respond with the Italian version, and 16 English speakers. *Number* are women and *number* men.

Chapter IV: Results

4.1 Socio-demographic sample description:

Obviously, only after closing the questionnaires we were able to know the exact amount and composition of our samples. Overall, the total amount of responses is 182. Out of 182, 97 are professionals and 85 non-professionals, 89 men and 93 women. Our general sample is very young: 64% of the respondents are in the 18-30 age range (118), 14% in the 30-40 range (26), 12% in the 50-50 range (21), 8% in the 50-60 range (14) and 1% is >60 (3). When we will review all the results and run comparisons between professionals and non-professionals, we must consider this particular feature of the sample, since many behaviors could be explained by ages. Another note is that this particular composition is mainly due to the fact that the link has been shared via Social-Networks where there are more chances to reach younger individuals. From a nationality perspective, our sample is mainly composed by Italians 91% (167), 7% are Irish (14) and 2% are Spanish (1). As current living country, 77% lives in Italy (141), 34 in Ireland (18 %), 3 in the United Kingdom, 1 in Germany, 1 in France, 1 in Australia and 1 Austria. So, to summarize, a fifth of the participants live in Ireland and the majority is currently living in Italy. It's also important to notice that all the participants that live in Ireland are professionals. The education of our sample is very high: 1% (3) middle-school, 22% (40) high school degree, 39% (72) declares to have a bachelor's degree, 29% (54) a master's degree or certifications such as CFA® or FRM®, 7% (13) a PhD. Now it will be analyzed the professionals sample and the non-professional's one since it's necessary to have a good knowledge of the differences between the groups from a socio-demographic point of view.

4.2 Non-professionals sample:

As showed before, the number of non-professionals is 85, only twelve less than the professionals' sample. 61,18% are women (52) and 38,14% men (33). This group is also very young: 78,82% (67) are in the age range 18-30, 10% in the 50-60 and the others are equally distributed between >60 and 30-40. 50 % of the group has a bachelor's degree and 36% a high school degree, 7% a master's degree and the other equally distributed between PhD (2) and middle-school degree (3). All non-professionals are Italians currently living in Italy (98%), the remaining two percent is divided between Austria (1), Australia (1) and U.K (1).

4.3 Professionals sample description:

The number of professional participants is 97. As said before, it has been considered as professional anyone working in the financial sector, independently from the role: so, there's no difference between an HR specialist or a Financial Risk manager, the main objective was to focus on the financial professional figure in general. 61,86 % of the sample are men (60) and 38,14% are women. 52,58% are in the age range 18-30, 23,71% in the range 30-40, 16,49% in the 40-50, 6% in the 50-60 range and 1% is >60. The majority of the sample is Italian, 84,54%, 14,43% are Irish and 1% Spanish. 62, 89% currently lives in Italy, 35,05% in Ireland and 1% in U.K and 1% in Germany. Under the education perspective, this sample presents 11,34% of professionals has a PhD (11), 49.48% a master's degree, 29,9% a bachelor's degree and 9,28% a high school diploma.

It's possible to say that both the samples are very similar each other in terms of magnitude and nationality of the participants. A slightly difference has been noticed in:

- Age peer group: professionals tend to be older than non-professionals.
- Sex: the proportion of males and females are inverted between the samples; 60% females and 40% males in non-professionals' sample and 60% males and 40% females in professionals' sample.
- Education: Professionals have higher qualifications rather than non-professionals. This is something that could be explained from the fact that the financial sector is very competitive and requires high qualifications to work in it.

The difference in the age group it is a big dependency, since the difference is minimal and not significant while the different sex composition could be significant, as it was state before that women tend to be more risk averse than men. Since the research it is based on the evaluation of a financial professional to avoid or not behavioral biases, this difference in sex composition of the sample can be placed in a secondary position.
Now all the questions' results will be analyzed and compared between the two samples.

4.4 Results, analyses and comparisons:

Now all the non-socio-demographic answers to the survey will be reviewed, described and compared paying particular attention to the dichotomy professional non-professional.

- *Question: You paid 120€ for a reservation in a very exclusive restaurant, where the waiting list for a table is about 3 months. Your best friend gives you a ticket for your favorite band/musician and the event occurs at the same time of the dinner in the restaurant. Would you prefer? (Restaurant or Concert).*

  As said before, the expectation for this question is to see a substantial loss aversion in both the samples which could be explained by the *endowment effect and* the *disposition effect.* 75,29% of non-professionals choose the concert (24,71% the restaurant) whereas 61.86% of professionals choose the concert and 38,14% the restaurant. The results of the two-sample test proportion are the following:

```
Two-sample test of proportions                    0: Number of obs =       85
                                                  1: Number of obs =       97
------------------------------------------------------------------------------
    Variable |       Mean   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
           0 |   .2470588   .0467812                      .1553694    .3387483
           1 |   .3814433   .0493195                      .2847788    .4781078
-------------+----------------------------------------------------------------
        diff |  -.1343845   .0679772                     -.2676173   -.0011517
             |  under Ho:   .0692299    -1.94   0.052
------------------------------------------------------------------------------
        diff = prop(0) - prop(1)                                  z =  -1.9411
    Ho: diff = 0

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(Z < z) = 0.0261         Pr(|Z| < |z|) = 0.0522          Pr(Z > z) = 0.9739
```

Figure 6.

It's possible to observe that the proportions are statistically different from each other at any level greater than 5.52%, which is a marginal significative difference with P-Value 0.1.

- *Question: You have just won € 200 in the lottery, you exit the shop where you won and you find out that your bike has been stolen. You had paid 200€ for the bike previously. How do you feel? (Bad-Indifferent-Good for the Win)*

The score given to each answer is 1 for bad, 2 for indifferent and 3 for good for the win.

Below it's possible to see the average scores for the samples:

Variable	Obs	Mean	Std. Dev.	Min	Max
	85	1.411765	.7447294	1	3

Figure 7.

The mean value for non-professionals is 1.411765

Variable	Obs	Mean	Std. Dev.	Min	Max
	97	1.484536	.7515734	1	3

Figure 8.

The mean value for professionals is 1.48453. Looking in more details at the scores for each single answer, it's possible to notice that 74,12% of non-professionals and 67,01% of the professionals feel bad. So, as noticed in *Figure 8.*, professionals tend to feel better than non-professionals. The difference in the mean level is only of 0,072.

	Freq.	Percent	Cum.
1	65	67.01	67.01
2	17	17.53	84.54
3	15	15.46	100.00
Total	97	100.00	

Figure 9. Professionals

	Freq.	Percent	Cum.
1	63	74.12	74.12
2	9	10.59	84.71
3	13	15.29	100.00
Total	85	100.00	

Figure 10. Non-Professionals

- *Question: Which would you rather do: take €100 now, or take a bet where there's a 50% chance you'll win €0 and a 50% chance you'll win €200? (Take 100€ (0) or Take a bet (1)).*

  The mean value for the non-professionals is .2117647 and for professionals is .185567. In percentage terms, as it's possible to see in *Figure 11.* and in *Figure 12.* 78,82% of non-professionals and 81,44% of professionals prefer to take 100€.

Variable	Obs	Mean	Std. Dev.	Min	Max
	85	.2117647	.4109837	0	1

Figure 11. Mean value for non-professionals

Variable	Obs	Mean	Std. Dev.	Min	Max
	97	.185567	.3907764	0	1

Figure 12. Mean value for professionals

	Freq.	Percent	Cum.
0	67	78.82	78.82
1	18	21.18	100.00
Total	85	100.00	

Figure 12 A. Non-Professionals

	Freq.	Percent	Cum.
0	79	81.44	81.44
1	18	18.56	100.00
Total	97	100.00	

Figure 13. Professionals

The results of the two-sample proportion test are below:

```
Two-sample test of proportions                    0: Number of obs =       85
                                                  1: Number of obs =       97
------------------------------------------------------------------------------
    Variable |       Mean   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
           0 |   .2117647   .0443144                       .12491    .2986194
           1 |    .185567   .0394723                     .1082028    .2629313
-------------+----------------------------------------------------------------
        diff |   .0261977    .059345                    -.0901164    .1425118
             |  under Ho:    .059183     0.44   0.658
------------------------------------------------------------------------------
        diff = prop(0) - prop(1)                                  z =   0.4427
    Ho: diff = 0

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(Z < z) = 0.6710         Pr(|Z| < |z|) = 0.6580          Pr(Z > z) = 0.3290
```

Figure 14.

It's possible to notice that the results are not significant at any conventional level of statistical significance.

Question: You flip a coin 10 times: write out example results of 10 coin flips.

A score of 0 has been assigned to all the answer with a causal series of results and a score of 1 to all series with a distribution between 40%-60% of heads and tails. Few answer to this test has not been considered as acceptable because the answer itself was not satisfactory or useful. The results for the professional group are below:

	Freq.	Percent	Cum.
.	9	9.28	9.28
0	77	79.38	88.66
1	11	11.34	100.00
Total	97	100.00	

Figure 15.

Non-professionals' results are:

	Freq.	Percent	Cum.
.	18	21.18	21.18
0	62	72.94	94.12
1	5	5.88	100.00
Total	85	100.00	

Figure 16.

- *Question: Please indicate, in a scale of 1(low) to 5 (high), your assessment of your ability to pick better performing stocks.*

  In this question, 51,76% of non-professionals indicated 1, 11,76% indicated 2, 12,94% indicated 3, 16,47% indicated 4, 5,88% indicated 6 and 1,18% 7. The results are below:

	Freq.	Percent	Cum.
1	44	51.76	51.76
2	10	11.76	63.53
3	11	12.94	76.47
4	14	16.47	92.94
5	5	5.88	98.82
6	1	1.18	100.00
Total	85	100.00	

Figure 17.

Different results have been noticed for the professionals' sample as it is possible to see below:

	Freq.	Percent	Cum.
1	19	19.59	19.59
2	12	12.37	31.96
3	23	23.71	55.67
4	27	27.84	83.51
5	15	15.46	98.97
6	1	1.03	100.00
Total	97	100.00	

Figure 18.

A score from 1 to 7 has been given to each question, so it's possible to compare the mean value and min or max value assigned between the samples, which is 2,164706 for non-professionals and 3,103093 for professionals.

-> Professione = 0

Variable	Obs	Mean	Std. Dev.	Min	Max
	85	2.164706	1.421326	1	6

-> Professione = 1

Variable	Obs	Mean	Std. Dev.	Min	Max
	97	3.103093	1.380553	1	6

Figure 19.

- *Question: Which would you rather do: give me €100 upfront, or take a bet where there's a 50% chance you'll lose €0 and a 50% chance you'll lose €200? (Give me upfront 100€ (0) or take a bet (1)*

  The mean value for the non-professionals is .7058824 and for professionals is .6494845. In percentage terms, as it's possible to see in *Figure 20.* and in *Figure 21.* 70.59 % of non-professionals and 64.95% of professionals prefer to take the bet.

Variable	Obs	Mean	Std. Dev.	Min	Max
	85	.7058824	.4583492	0	1

Figure 20. Mean Value for non-professionals

Variable	Obs	Mean	Std. Dev.	Min	Max
	97	.6494845	.47961	0	1

Figure 21. Mean Value for Professionals

	Freq.	Percent	Cum.
0	25	29.41	29.41
1	60	70.59	100.00
Total	85	100.00	

Figure 22. Non-Professionals

	Freq.	Percent	Cum.
0	34	35.05	35.05
1	63	64.95	100.00
Total	97	100.00	

Figure 23. Professionals

The results of the two-sample proportion test are below:

```
Two-sample test of proportions                    0: Number of obs =       85
                                                  1: Number of obs =       97
```

Variable	Mean	Std. Err.	z	P>|z|	[95% Conf.	Interval]
0	.7058824	.0494217			.6090177	.802747
1	.6494845	.0484454			.5545334	.7444357
diff	.0563978	.0692059			-.0792432	.1920388
	under Ho:	.0695421	0.81	0.417		

```
        diff = prop(0) - prop(1)                                  z =   0.8110
    Ho: diff = 0

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(Z < z) = 0.7913         Pr(|Z| < |z|) = 0.4174          Pr(Z > z) = 0.2087
```

Figure 24.

It's possible to notice that the results are not significant at any conventional level of statistical significance.

- *Question: You have the option to invest a portion of your saving in a risky start-up venture. You could lose all your investment or make a substantial profit (5 times) on your investment. How much would you invest in a scale of 0% - 100%?*

  Below there are the results for professionals and non-professionals. Please note that under column Q is possible to see in percentage the amount invested and under column Percent. it's possible to observe the percentage of professionals and non-professionals that choose to invest a certain amount under column Q.

Q	Freq.	Percent	Cum.
0,00	9	9.28	9.28
0,02	1	1.03	10.31
0,04	2	2.06	12.37
0,05	7	7.22	19.59
0,07	1	1.03	20.62
0,08	1	1.03	21.65
0,10	17	17.53	39.18
0,15	3	3.09	42.27
0,20	12	12.37	54.64
0,25	3	3.09	57.73
0,30	6	6.19	63.92
0,35	1	1.03	64.95
0,40	6	6.19	71.13
0,50	15	15.46	86.60
0,55	1	1.03	87.63
0,60	5	5.15	92.78
0,70	2	2.06	94.85
0,75	1	1.03	95.88
0,80	1	1.03	96.91
0,85	1	1.03	97.94
1,00	2	2.06	100.00
Total	97	100.00	

Figure 25. Professionals

Q	Freq.	Percent	Cum.
0,00	5	5.88	5.88
0,05	1	1.18	7.06
0,10	5	5.88	12.94
0,15	3	3.53	16.47
0,20	11	12.94	29.41
0,25	5	5.88	35.29
0,30	15	17.65	52.94
0,33	2	2.35	55.29
0,40	8	9.41	64.71
0,50	12	14.12	78.82
0,60	6	7.06	85.88
0,65	1	1.18	87.06
0,70	3	3.53	90.59
0,75	1	1.18	91.76
0,76	1	1.18	92.94
0,80	2	2.35	95.29
0,90	1	1.18	96.47
1,00	3	3.53	100.00
Total	85	100.00	

Figure 26. Non-professionals

- *Question: You are a fund manager. You have had a good year and you have met 40% of your target. However, you have not achieved enough for your bonus target. You are presented with a risky investment opportunity. You could lose the gains year to date or meet your bonus target. What do you do? (Nothing (0) or Risky Investment (1)).*

The mean value for the non-professionals is .1647059 and for professionals is .185567. In percentage terms, as it's possible to see in *Figure 27.* and in *Figure 28.* 83.53 % of non-professionals and 81.44% of professionals prefer to do nothing.

Variable	Obs	Mean	Std. Dev.	Min	Max
	97	.185567	.3907764	0	1

Figure 27. Mean value for Professionals

Variable	Obs	Mean	Std. Dev.	Min	Max
	85	.1647059	.3731162	0	1

Figure 28. Mean value for Professionals

	Freq.	Percent	Cum.
0	71	83.53	83.53
1	14	16.47	100.00
Total	85	100.00	

Figure 29. Non-Professionals

	Freq.	Percent	Cum.
0	79	81.44	81.44
1	18	18.56	100.00
Total	97	100.00	

Figure 30. Professionals

The results of the two-sample proportion test are below:

```
Two-sample test of proportions                    0: Number of obs =       85
                                                  1: Number of obs =       97
```

Variable	Mean	Std. Err.	z	P>|z|	[95% Conf.	Interval]
0	.1647059	.0402314			.0858538	.2435579
1	.185567	.0394723			.1082028	.2629313
diff	-.0208611	.0563615			-.1313277	.0896055
	under Ho:	.0565574	-0.37	0.712		

```
        diff = prop(0) - prop(1)                                  z =  -0.3688
    Ho: diff = 0

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(Z < z) = 0.3561         Pr(|Z| < |z|) = 0.7122          Pr(Z > z) = 0.6439
```

Figure 31.

It's possible to notice that the results are not significant at any conventional level of statistical significance.

- *Question: Suppose a trading system gives signals, in a certain time period, that makes possible to beat the market in the 60% of the cases. In the last 2 months, the system produces 10 signs. How many of these signals do you think could have been positive ones?*

  It has been assigned a score of 1 to results around 6, a score of two to answers that stated an impossibility to assign a result and 0 to random questions. 16.47 % of non-professionals gave an incomplete answer, 4.71% stated an impossibility to assign a result, 64.71 % stated a result equal or around 6 and 14.12% gave a random answer. 6.19% of

professionals gave an incomplete answer, 19.59% gave a random answer and 64.95% stated a result equal or around 6 and 9.28% stated an impossibility to assign a result. The results are below:

	Freq.	Percent	Cum.
.	6	6.19	6.19
0	19	19.59	25.77
1	63	64.95	90.72
2	9	9.28	100.00
Total	97	100.00	

Figure 32. Professionals

	Freq.	Percent	Cum.
.	14	16.47	16.47
0	12	14.12	30.59
1	55	64.71	95.29
2	4	4.71	100.00
Total	85	100.00	

Figure 33. Non-Professionals

- *Question: Suppose in the last six months there have been 30 buy signals, how many of these do you think have brought a profit?*

  Below are the results for professionals and non-professionals. Under column Q it's possible to see the amount answered by professionals and non-professionals Under column percent is possible to observe the percentage of professionals and non-professionals that answered a certain amount. The mean value for non-professionals is 12,24706 and for professionals is 13,79381.

Q	Freq.	Percent	Cum.
.	18	21.18	21.18
10	4	4.71	25.88
12	4	4.71	30.59
13	1	1.18	31.76
14	1	1.18	32.94
15	6	7.06	40.00
17	4	4.71	44.71
18	28	32.94	77.65
19	1	1.18	78.82
20	4	4.71	83.53
25	1	1.18	84.71
27	1	1.18	85.88
3	2	2.35	88.24
30	2	2.35	90.59
5	4	4.71	95.29
6	3	3.53	98.82
9	1	1.18	100.00
Total	85	100.00	

Figure 34. Non-Professionals

Q	Freq.	Percent	Cum.
18	1	1.03	1.03
.	13	13.40	14.43
0	1	1.03	15.46
10	7	7.22	22.68
12	1	1.03	23.71
14	1	1.03	24.74
15	16	16.49	41.24
16	3	3.09	44.33
18	37	38.14	82.47
20	3	3.09	85.57
22	1	1.03	86.60
24	3	3.09	89.69
25	3	3.09	92.78
4	1	1.03	93.81
5	4	4.12	97.94
8	1	1.03	98.97
9	1	1.03	100.00
Total	97	100.00	

Figure 35. Professionals

- *Question: You are an equity research analyst and you are interested in buying shares of a company whose CEO has just declared a bond issue in the next semester. He hadn't disclosed further information. What would you do? (Buy (0) or Not Buy (1))*
  The mean value for the non-professionals is .7411765 and for professionals is .5979381. In percentage terms, as it's possible to see in *Figure 36.* and in *Figure 37.* 74.12 % of non-professionals and 59.79% of professionals prefer to not buy.

Variable	Obs	Mean	Std. Dev.	Min	Max
	85	.7411765	.4405878	0	1

Figure 36. Mean value for non-professionals

Variable	Obs	Mean	Std. Dev.	Min	Max
	97	.5979381	.4928614	0	1

Figure 37. Mean value for Professionals

	Freq.	Percent	Cum.
0	22	25.88	25.88
1	63	74.12	100.00
Total	85	100.00	

Figure 38. Non-Professionals

	Freq.	Percent	Cum.
0	39	40.21	40.21
1	58	59.79	100.00
Total	97	100.00	

Figure 39. Professionals

The results of the two-sample proportion test are below:

```
Two-sample test of proportions                    0: Number of obs =       85
                                                  1: Number of obs =       97
------------------------------------------------------------------------------
    Variable |       Mean   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
           0 |   .7411765   .0475065                      .6480654    .8342875
           1 |   .5979381   .0497839                      .5003635    .6955127
-------------+----------------------------------------------------------------
        diff |   .1432383   .0688135                      .0083663    .2781104
             |  under Ho:   .0701337     2.04   0.041
------------------------------------------------------------------------------
        diff = prop(0) - prop(1)                                  z =   2.0424
    Ho: diff = 0

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(Z < z) = 0.9794         Pr(|Z| < |z|) = 0.0411          Pr(Z > z) = 0.0206
```

Figure 40.

It's possible to notice that the proportion are statistically different each other from any level above 4,1%, which means there is a significative difference, so professionals and non-professional have not answered in the same way at this question.

- *Question: In another situation, the CEO has alluded many times to a bond issue but he has never given clear information about it. Would you invest with the same confidence of the previous situation***?** (Yes (0) or No (1))

The mean value for the non-professionals is .8705882 and for professionals is .87628871. In percentage terms, as it's possible to see in *Figure 41*. and in *Figure 42*. 87.06 % of non-professionals and 87.63 % of professionals answered no.

a	Freq.	Percent	Cum.
0	12	12.37	12.37
1	85	87.63	100.00
Total	97	100.00	

Figure 41.

a	Freq.	Percent	Cum.
0	11	12.94	12.94
1	74	87.06	100.00
Total	85	100.00	

Figure 42.

Variable	Obs	Mean	Std. Dev.	Min	Max
	97	.8762887	.3309624	0	1

Figure 43. Mean score for Professionals.

Variable	Obs	Mean	Std. Dev.	Min	Max
	85	.8705882	.3376472	0	1

Figure 44. Mean score for Non-Professionals.

The results of the two-sample proportion test are below:

```
Two-sample test of proportions                    0: Number of obs =       85
                                                  1: Number of obs =       97

    Variable |       Mean   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+--------------------------------------------------------------
           0 |   .8705882   .0364069                       .799232    .9419445
           1 |   .8762887   .0334305                      .8107661    .9418112
-------------+--------------------------------------------------------------
        diff |  -.0057004   .0494273                     -.1025762    .0911753
             |  under Ho:   .0493664    -0.12   0.908
-------------+--------------------------------------------------------------
        diff = prop(0) - prop(1)                                  z =  -0.1155
    Ho: diff = 0

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(Z < z) = 0.4540         Pr(|Z| < |z|) = 0.9081          Pr(Z > z) = 0.5460
```

Figure 45.

It's possible to notice that the results are not significant at any conventional level of statistical significance.

- *Question: Which Investment would you choose? (An investment that certainly returns me 3% per year (1), An investment that returns 0 with a probability of 50% and 9% with a probability of 50% (2), An investment that returns me -3% with a probability of 50% and 6% with a probability of 50% (3), An investment that returns me -6% with a probability of 50% and 12% with a probability of 50% (4), Indifferent (5).*

The mean value for the non-professionals is 1.823529 and for professionals is 1.876289. Results in percentage terms are below:

Variable	Obs	Mean	Std. Dev.	Min	Max
	85	1.823529	.9658018	1	5

Figure 46. Mean value for non-professionals

Variable	Obs	Mean	Std. Dev.	Min	Max
	97	1.876289	.7939581	1	5

Figure 47. Mean value for Professionals

i	Freq.	Percent	Cum.
1	34	40.00	40.00
2	42	49.41	89.41
3	3	3.53	92.94
4	2	2.35	95.29
5	4	4.71	100.00
Total	85	100.00	

Figure 48. Non – Professionals

i	Freq.	Percent	Cum.
1	28	28.87	28.87
2	60	61.86	90.72
3	4	4.12	94.85
4	3	3.09	97.94
5	2	2.06	100.00
Total	97	100.00	

Figure 49. Professionals

- *Question: Describe you risk tolerance: Low (1), Medium (2), High (3).*

  The mean value for the non-professionals is 1.494118 and for professionals is 1.659794. Results in percentage terms are below:

	Freq.	Percent	Cum.
1	44	51.76	51.76
2	40	47.06	98.82
3	1	1.18	100.00
Total	85	100.00	

Figure 50. Non-Professionals

	Freq.	Percent	Cum.
1	40	41.24	41.24
2	50	51.55	92.78
3	7	7.22	100.00
Total	97	100.00	

Figure 51. Professionals

- *Question: Do you think your tolerance changes dependently upon the circumstances or situation**?** Yes (1), Maybe (2) and No (3).*

  The mean value for the non-professionals is 1.529412 and for professionals is 1.463918. Results in percentage terms are below:

	Freq.	Percent	Cum.
1	49	57.65	57.65
2	27	31.76	89.41
3	9	10.59	100.00
Total	85	100.00	

Figure 52. Non-Professionals

	Freq.	Percent	Cum.
1	60	61.86	61.86
2	29	29.90	91.75
3	8	8.25	100.00
Total	97	100.00	

Figure 53. Professionals

- *Question: Rate your level of financial knowledge: Basic (1), Intermediate (2) and High (3).*

  The mean value for the non-professionals is 1.247059 and for professionals is 1.876289. Results in percentage terms are below:

	Freq.	Percent	Cum.
1	67	78.82	78.82
2	15	17.65	96.47
3	3	3.53	100.00
Total	85	100.00	

Figure 54. Non-Professionals

	Freq.	Percent	Cum.
1	32	32.99	32.99
2	45	46.39	79.38
3	20	20.62	100.00
Total	97	100.00	

Figure 55. Professionals

The results of the proportional test are below:

```
Two-sample test of proportions                    0: Number of obs =       85
                                                  1: Number of obs =       97
------------------------------------------------------------------------------
    Variable |       Mean   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
           0 |   .8117647   .0423991                      .7286641    .8948653
           1 |   .3298969   .0477391                        .23633    .4234638
-------------+----------------------------------------------------------------
        diff |   .4818678    .063849                      .356726    .6070096
             |  under Ho:   .0738367     6.53   0.000
------------------------------------------------------------------------------
        diff = prop(0) - prop(1)                                  z =   6.5261
    Ho: diff = 0

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(Z < z) = 1.0000         Pr(|Z| < |z|) = 0.0000          Pr(Z > z) = 0.0000
```

Figure 56.

It’s possible to notice that the proportions are statistically different each other from any level above 0%, which means there is a significative difference, so professionals and non-professional have not answered in the same way at this question.

Chapter V: Discussion of Results

5.1 Comments:

5.1.1: Risk Tolerance:

The results obtained are very interesting, since they show that there are, in some cases, behavioral differences between professionals and non-professionals. At a high level, it's possible to say that in most cases, professional and non-professionals tend to have the same response to the same given stimulus, which, in this situation, is the answer that has been given to them. The first thing that it is important to analyse and compare is the risk tolerance and risk attitude of the two samples. The initial expectation was that professionals would have shown as more risk tolerant, and so risk seeker, than non-professionals. The main explanation was the fact that since they work in an environment full of risky choices and uncertainty, they should feel more confident when they have to deal with risk than non-professional feel: it could be said that they should be "used" to risk. The results are very surprising. It has been possible to notice that professionals and non-professionals have answered very similarly to the risk tolerance question and also to the question that was asking them whether or not their risk tolerance would change dependently on the situation. In the first one it has been observed a mean value of 1.823529 for non-professionals and 1.876289 for professionals. So it's possible to say that the difference is infinitesimal and it's also possible to notice that almost 62% of professionals showed a medium-low risk tolerance versus 50% of non-professionals. So rather than showing a high risk tolerance, data shows that professionals have a low risk tolerance, but if compared to non-professionals is higher. This result could be explained by the fact that individuals are generally risk averse. Now, the expectation was to appreciate a more significant difference in the response between the groups, but it's important to notice that this could also be due to the fact that the sample size is not so big, and in order to avoid the "*Law of Small Numbers* "this dependency must be noticed. Another interesting consideration must be done regarding the question on the self-description of the respondent's risk tolerance. With a score from 1 to 3, the mean value for professionals is 1.659794 and for non-professionals is 1.494118. 51.766% of non –professionals stated a low risk tolerance versus the 41.24% of the professionals. 47.06% of non-professionals stated a medium risk tolerance (51.55% professionals) and 1.18% of non-professionals stated a high risk tolerance (7.22% professionals). This means that professionals believe to have a medium-high risk tolerance and non-professionals a medium low one. These

results are very interesting because they denote an inconsistency in professionals' responses: when directly asked to state their risk tolerance their risk tolerance is high but when indirectly asked to state their risk tolerance, it becomes very low. This could be due to overconfidence of professionals given by their status and role. Overconfidence will be later analyzed. The last point regarding risk tolerance is to know if the respondents think that their risk tolerance could vary dependently on the situation. As said before (*vedi supra 3.1.2.1*), with this it's possible to "measure" the strength of the risk tolerance's assessment. With a score from 1 to 3, the mean value for non-professionals is 1.529412 and for professionals is 1.463918. This means that non-professionals are more prone to say that their risk tolerance could not vary in different situations and that professionals are more prone to say that is more likely that their risk tolerance varies dependently on the situation. 61.86% of professionals said that their risk tolerance varies with the situation, versus 57.65% of non-professionals. 10.59% of non-professionals believe that their risk tolerance doesn't change versus 8.25% of professionals. This means that non-professional have a strong belief that their low risk tolerance is generalized and could not vary and also, that professionals believe that their risk tolerance could vary with different situations. This could be reasonable, since they could display a different tolerance in a working situation rather than in a common life one. But this answer doesn't explain why they state a different risk tolerance of the one noticed in the question to pick a certain investment. The solution could be individuated in the overconfidence level.

5.1.2 Overconfidence:

As said before, we tested both overconfidence and underconfidence. The results indicates that professionals, as it could have been easily predicted, stated a higher confidence in picking good performing shares than non-professionals. Anyway, the difference is not so big. In a range from 1 to 7 the mean value for professionals is 3,103093 and for non-professionals is 2,164706, with a delta which is less than one. The main group of professionals stated a level of confidence around 3 and 4, whereas non-professionals mainly choose 1 (44%). The reason behind this could be that professionals are more used to shares and related info and so they believe that they are good in picking better shares. On the other hand, non-professionals show awareness of the fact that they are not confident on this topic, which is reasonable, since they do not have to deal with the financial world directly or if they have to, they do it for hobby and not professionally. On the other hand, is also important to consider that professionals stated a low level of confidence: an average value of 3 in a scale from one to seven means that in aggregate

they have stated a medium-low level of confidence. This result is against the expectations done and it also shows that the financial profession influences only marginally the confidence of the interviewed. The other interesting topic is the response to under-confidence of the samples. As said in chapter 3.2.1.2, as much as the available information is less clear, there's more space to under-confidence and uncertainty, whereas when the information available is very clear, overconfidence is more prone to be individuated. To replicate this situation it has been asked the availability to buy or not a share of the company only by nothing that the CEO has declared a bond issue, which means a decrease in the shares values. As expected, professionals were less confident to buy the shares, probably because aware of the fact that an increase in the debt level would lead to a decrease of the shares value. In both the samples the majority doesn't feel comfortable to buy the shares. Another interesting point is that this difference is statistically different for each level above 4.1%, which means that statistically professionals and non-professionals answered differently to this question. Then, it has been asked to the respondents to decide whether to buy or not the same share with an information set that reflected many but not clear information. The vast majority of the respondents answered that they would have not bought that share with the same confidence as before. In particular 87.63% of professionals stated that feeling and also 87.52% of non-professionals. So clearly the different data set influenced the response in both cases and also it has been not stated any statistical difference between the groups, so under-confidence affected in the same way both the samples.

5.1.3 Loss Aversion:

The aim of the study was to understand whether or not financial professionals are able to avoid behavioral biases because of the environment in which they work, their experiences and also their expositions to particular factors. By doing this, the biggest comparison that has been done was between the *Prospect Theory* and the *Motivational Approach.* The expectation was to find substantial differences between the groups, especially for biases or effects that professionals' knowledge and experience should have theoretically allowed to avoid them. The results are very interesting and sometimes surprising. The first important condition or bias to be investigated is *loss aversion*. The two questions to measure *loss aversion* were: "*Which would you rather do: take €100 now, or take a bet where there's a 50% chance you'll win €0 and a 50% chance you'll win €200? (Take 100€ (0) or Take a bet (1))"* and "*Which would you rather do: give me €100 upfront, or take a bet where there's a 50% chance you'll lose €0 and a 50% chance you'll lose €200? (Give me upfront 100€ (0) or take a bet (1).* The question is the same, but it changes when it's considered the loss or the gain dominion. The expectation was to

observe a difference between the samples since it has been supposed, and partially confirmed, that financial professionals have a higher risk tolerance than non-professionals. The results show that professionals and non-professionals have answered in the same way, because there is not a statistical difference in the proportional test. From the results, it's also possible to see that professionals are less willing to take the bet than non-professionals, so this is in contrast with the higher risk tolerance detected previously (mean value for professionals is .6494 and non-professionals 0.705). In any case they behave according to the hypothesis of the *Prospect Theory* because they are risk seeker in the loss dominion. The expectation was to observe a difference between the samples since it has been supposed, and partially confirmed, that financial professionals have a higher risk tolerance than non-professionals. The results show that professionals and non-professionals have answered in the same way in the loss dominion, because there is not a statistical difference in the proportional test. From the results, it's also possible to see that professionals are less willing to take the bet than non-professionals, so this is in contrast with the higher risk tolerance detected previously (mean value for professionals is .6494 and non-professionals 0.705). In any case they behave according to the hypothesis of the *Prospect Theory* because they are risk seeker in the loss dominion. The results for the gain dominion confirms the finding of the previous question. Again, professionals show a conservative attitude toward risk also in the gain dominion, whereas non-professionals are again risk seekers. As before, the is not a statically difference in the proportion test, which means that the two sample answered in the same way and also according to the *Prospect Theory*, because the mean values are very low (0.2117 for non-professionals and 0.1855 for professionals). In any case, it's possible to say that professionals tend to behave more accordingly to the *Prospect Theory* than non-professionals. This result could be very meaningful for other biases such as the *status quo* and the *endowment effect* which are mainly explained by *loss aversion.*

5.1.4 The Endowment Effect:

This effect is extremely important when there's a comparison between professionals and non-professionals. This effect could lead to a reluctance to realise losses, very common between traders, which is called *disposition effect.* The question was "*You paid 120€ for a reservation in a very exclusive restaurant, where the waiting list for a table is about 3 months. Your best friend gives you a ticket for your favorite band/musician and the event occurs at the same time of the dinner in the restaurant***.** *Which would you prefer?"* The results show a statistically difference between the sample at any level greater than 5.2%. In particular, the mean value for professionals is 0.38144 and for non-professionals is 0.247. This means that non-professionals

showed a clear preference for the concert. So, it's possible to affirm that professionals are more reluctant to give up the restaurant and so the magnitude of the *endowment effect* is bigger for them. This is coherent with the findings in literature, but it's important to say that this question is related to the private world, because all the respondents have to decide with their money and not the one of the clients. So a good consideration will be that professionals and non-professionals showed a different attitude towards this question which is regarding their personal wealth. A confirmation of this attitude are the answered obtained by the question: "*You have the option to invest a portion of your saving in a risky start-up venture. You could lose all your investment or make a substantial profit (5 times) on your investment. How much would you invest in a scale of 0% - 100%?".* As it's possible to observe in the result sectoin, the vast majority of both samples prefer to invest less than 50% of their savings, which also reflect the presence of loss aversion and confirm the low risk tolerance of the sample

5.1.4 Status Quo Bias:

The expectation for this bias was to find no difference between the samples since it affect transversally all the individuals. The same question has been utilized to investigate also the *House Money Effect.* The question was: "*You are a fund manager. You have had a good year and you have met 40% of your target. However, you have not achieved enough for your bonus target. You are presented with a risky investment opportunity. You could lose the gains year to date or meet your bonus target. What do you do? (Nothing (0) or Risky Investment (1))".* The mean value for professionals is 0.1855 and for non-professionals is .1647. For both the samples, it's possible to notice that they prefer to maintain the status quo and so, doing nothing. This is also confirmed by the two proportion test, which shows clearly that there is not a statistically difference between the answer of the samples. Looking at the *House Money Effect,* the obtained results shows that professionals and non-professionals prefer not to gamble with the gains already obtained. The results could be also explained by the low risk tolerance of both the groups.

5.1.5 Mental Accounting:

As foot the previous topic, also for the mental accounting there was the expectation to observe no difference between the samples, since this particular effect or bias is common to everyone. What is very interesting is to observe if the magnitude of this bias changes for professionals

and non-professionals. The question was "*You have just won € 200 in the lottery, you exit the shop where you won and you find out that your bike has been stolen. You had paid 200€ for the bike previously. How do you feel? (Bad-Indifferent-Good for the Win)".* With a scale form one to three, the mean value for professionals is 1.4845 and for non-professionals is 1.4117. This means that 67% of professionals felt bad for the bike and the same for 74% of non-professionals. Professionals tend also to be more indifferent, 17% versus 11%, and also slightly more happy for the win, 15.46% versus 15.29%. So professionals, as non-professionals seem to utilize mainly different mental accounts for windfalls and losses, but professionals also seem to feel more indifferent for the win, since they put losses and gains in the same account and the win emotionally neutralize the loss of the bike. This result could be explained by the fact that financial professionals are more used to put losses and gains in the same mental account, also, they could be more rational when thinking about incomes and outcomes. On the other hand, this little preference for the indifferent choice is in contrast with the strong presence of the endowment effect in the professionals' sample. As they prefer to keep their paid reservation for the restaurant they should feel also bad for the stolen bike. This situation in true only for a small portion of professionals' sample but this portion is bigger than the one of the non-professionals.

5.1.6 Representativeness Heuristic*:*

The first question to test the Representativeness Heuristic is: "*You flip a coin 10 times: write out example results of 10 coin flips (Heads) or (Tails)*". The expectation is to observe the non-professional sample to apply law of small numbers and also the representativeness heuristics. As said before, professionals, because of their supposed better financial knowledge, will consider correctly probabilities and will not rely on the law of small numbers. The results confirm the hypothesis, because 77% of professionals gave a casual answer versus 62% of non-professionals. This reflects that professionals are more aware of the fact that 10 coin flips are not representative of the general law of 50-50 results. It's also important to notice that 21.18% of non-professionals gave a not acceptable answer versus the 9.28% of professionals. For this question, the experience obtained from professionals played an important role. The second question to test this heuristic is: "*Suppose a trading system gives signals, in a certain time period that makes possible to beat the market in the 60% of the cases. In the last 2 months the system produces 10 signs. How many of these signals do you think could have been positive ones?"* For this answer the results were surprising, because 64.95% of professionals answered by applying the law of small numbers versus 55% of non-professionals. As per the previous

question, 16% of non-professional gave an unsatisfactory answer, versus 6% of professionals. It's important to notice that also 64% of non-professionals applied the representativeness heuristic, so the two sample answered in the same way to this question and in contrast with the initial hypothesis. The following question is very similar but it extends the observation period: "*Suppose in the last six months there have been 30 buy signals, how many of these do you think have brought a profit?"* Again, most of the professionals answered applying the law of small numbers (54%) while 18% of non-professionals have not been able to give a satisfactory answer. These results are very interesting, especially because there are not aligned. What is more interesting is that in more "financial" questions such as the trading system, professionals showed a very important reliance on the law of small numbers. Overall, and this is reasonable, they have shown a better understanding of the question.

5.1.7 Financial Knowledge:

A good indicator of the sample's self-esteem, overconfidence and, eventually, a good estimator of the reason why this sample is so risk averse, is the financial knowledge. The expectation for this topic was to observe a difference between the two samples, with financial professionals stating a higher and more sophisticated financial knowledge than non-professionals. The question was: "*Rate your level of financial knowledge: Basic (1), Intermediate (2) and High (3)"*. The results confirm the initial hypothesis, since the mean value for the non-professionals is 1.247059 and for professionals is 1.876289. The proportional test shows also a statistically difference between the samples, which confirms that non-professionals stated a lower financial knowledge than professionals. What is very interesting to notice is that even though there a statistical difference, the overall result stated by professionals is on average below 2, which means that they mainly stated a basic/intermediate financial knowledge. This result could explain why professionals showed a low overconfidence and also showed a very prudent attitude toward risky choices.

Chapter VI: Conclusions

6.1 Conclusions:

The initial expectation was to observe differences between the samples for particular biases and effects because of the influence of professionals' working environment. The main topic was the comparison between two different approaches, the metaphysical and the motivational. What the results of this survey suggest is that both the approaches are correct but alone, none of them would have been able to explain the detected results. What has been observed is that professionals believe to have a higher risk tolerance than the one they actually have and also they are evidently more conservative than non-professionals. This is a good thing if it's considered that financial professionals often manage clients' savings and so on. This clear lack of overconfidence is then in contrast with the clear dependency of professionals for the endowment effect. As said before, this could be explained by the fact that interviewed were asked to respond considering their own money or savings. What is surprising is that professionals have a strong appliance of the law of small numbers, especially in question regarding the financial world. What this survey suggest is that professionals and non-professionals are humans after all, and they share the same limits and thoughts but, although professionals tend to behave very similarly to non-professionals, they showed that they also behave more accordingly to what their profession require, so they are more conservative, less risk seeker, more rational. This survey suggest there's a small difference between the samples which should be investigated with a wider and more sophisticated sample. Another important consideration is the size of the survey, which is enough big to produce some interesting statistical consideration, but too small to detect a trend or a generic pattern. There is a big open space for improvements regarding behavioral biases for professionals, because generally, for the 90% of the questionnaire, the gap between professionals and non-professionals is very small, which means that the professional sample is a potential victim of biases that could lead to expensive errors or wrong behaviors. Strong procedures and internal controls are a deterrent for biases and unconscious errors that can be costly for the professional and for the clients. In conclusion, the initial hypothesis has not been confirmed and so professionals are not able to avoid behavioral biases, but these results are conditioned by the small size of the sample, so, in order to avoid the law of small numbers, a further and wider survey should be done so that it will be more clear if those little differences in the responses are an indicator of a different behavioral pattern for professionals or if they are due to the particular composition of the sample. In any case, these results do not confirm the metaphysical approach, because the

inconsistencies individuated in the fields of risk tolerance and overconfidence could only be explained by the fact that professionals behavior and attitudes changes dependently on the context in which they are.

Appendix

Questionnaire for Master Thesis

*Campo obbligatorio

1. **Sex** *

   Contrassegna solo un ovale.

   - Male
   - Female

2. **Age** *

   Contrassegna solo un ovale.

   - 18-30
   - 30-40
   - 40-50
   - 50-60
   - >60

3. **Nationality** *

4. **Current Residence (Country)** *

5. **Profession** *

6. **Highest Qualification Obtained** *

7. **You paid 120€ for a reservation in a very exclusive restaurant, where the waiting list for a table is about 3 months. Your best friend gives you a ticket for your favorite band/musician and the event occurs at the same time of the dinner in the restaurant. Would you prefer?** *

   Contrassegna solo un ovale.

   - Restaurant
   - Concert

8. **You have just won € 200 in the lottery, you exit the shop where you won and you find out that your bike has been stolen. You had paid 200€ for the bike previously. How do you feel?** *

   Contrassegna solo un ovale.

   - Bad
   - Indifferent
   - Good for the Win

9. **Which would you rather do: take €100 now, or take a bet where there's a 50% chance you'll win €0 and a 50% chance you'll win €200?** *

Contrassegna solo un ovale.

- ◯ Take 100€
- ◯ Take a bet

10. **You flip a coin 10 times: write out example results of 10 coin flips (Heads) or (Tails)** *

11. **Please indicate, in a scale of 1(low) to 5 (high), your assessment of your ability to pick better performing stocks.** *

Contrassegna solo un ovale.

- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5

12. **Which would you rather do: give me €100 upfront, or take a bet where there's a 50% chance you'll lose €0 and a 50% chance you'll lose €200?** *

Contrassegna solo un ovale.

- ◯ Give me upfront 100€
- ◯ Take a bet

13. **You have the option to invest a portion of your saving in a risky start-up venture. You could lose all your investment or make a substantial profit (5 times) on your investment. How much would you invest in a scale of 0% - 100% ?** *

14. **You are a fund manager. You have had a good year and you have met 40% of your target. However, you have not achieved enough for your bonus target. You are presented with a risky investment opportunity. You could lose the gains year to date or meet your bonus target. What do you do ?** *

Contrassegna solo un ovale.

- ◯ Nothing
- ◯ Risky Investment

15. **Suppose a trading system gives signals, in a certain time period, that makes possible to beat the market in the 60% of the cases. In the last 2 months the system produces 10 signs. How many of these signals do you think could have been positive ones?** *

16. **Suppose in the last six months there have been 30 buy signals, how many of these do you think have brought a profit?** *

17. **You are an equity research analyst and you are interested in buying shares of a company whose CEO has just declared a bond issue in the next semester. He hadn't disclosed further information. What would you do?** *

Contrassegna solo un ovale.

- Buy
- Not Buy

18. **In another situation the CEO has alluded many times to a bond issue but he has never given clear information about it. Would you invest with the same confidence of the previous situation?** *

Contrassegna solo un ovale.

- Yes
- No

19. **Which Investment would you choose?** *

Contrassegna solo un ovale.

- An investment that certainly returns me 3% per year.
- An investment that returns 0 with a probability of 50% and 9% with a probability of 50%.
- An investment that returns me -3% with a probability of 50% and 6% with a probability of 50%.
- An investment that returns me -6% with a probability of 50% and 12% with a probability of 50%
- Indifferent

20. **Describe you risk tolerance :** *

Contrassegna solo un ovale.

- Low
- Medium
- High

21. **Do you think your tolerance changes dependently upon the circumstances or situation?**

Contrassegna solo un ovale.

- Yes
- Maybe
- No

22. **Rate your level of financial knowledge:** *

Contrassegna solo un ovale.

- Basic
- Intermediate
- Sophisticated

Questionario per Tesi di laurea Magistrale

Gentile partecipante,

Chiediamo la tua disponibilità a partecipare ad un progetto di ricerca ideato da Luca Corazzini, Professore Ordinario presso il Dipartimento di Economia dell'Università Ca' Foscari di Venezia, e da Leonardo Corletto, studente presso l'Università ca' Foscari di Venezia.
Ti invitiamo a completare il seguente questionario. Non ci sono risposte corrette o errate e non sarai valutato. Il questionario per essere compilato richiede circa 5-7 minuti del tuo tempo.
Il questionario è anonimo e i dati saranno trattati in modo aggregato, analizzati attraverso un'analisi statistica e inclusi in pubblicazioni.
Per eventuali informazioni potete contattare gli ideatori del questionario ai seguenti indirizzi: Luca Corazzini (https://sites.google.com/site/lucacorazzini1/) e Leonardo Corletto (865736@stud.unive.it)

*Campo obbligatorio

1. **Sesso** *
   Contrassegna solo un ovale.
   - Uomo
   - Donna

2. **Età** *
   Contrassegna solo un ovale.
   - 18-30
   - 30-40
   - 40-50
   - 50-60
   - >60

3. **Nazionalità** *

4. **Stato di Residenza** *

5. **Professione** *

6. **Titolo di Studio o migliore Certificazione conseguita** *

7. **Hai pagato120€ per riservare un tavolo in un ristorante esclusivo dove la lista di attesa è di 3 mesi. Allo stesso tempo il tuo migliore amico ti ha regalato un biglietto per il concerto del tuo gruppo/musicista preferito. L' orario del concerto e della cena coincidono e non puoi andare ad entrambi. Cosa scegli?** *

Contrassegna solo un ovale.

- Ristorante
- Concerto

8. **Hai appena vinto alla lotteria 200€, esci dal negozio dove hai vinto e scopri che ti è stata rubata la bicicletta che ti è costata200€. Come ti senti?** *

Contrassegna solo un ovale.

- Male
- Indifferente
- Felice per la Vincita

9. **Cosa preferiresti fare: prendere 100€ ora o fare una scommessa in cui hai il 50% di possibilità di vincere 0€ e il 50% di vincere 200€?** *

Contrassegna solo un ovale.

- Accettare 100€
- Accettare la Scommessa

10. **Lanci una moneta dieci volte: scrivi un esempio dei risultati di dieci lanci di moneta. (T) o (C)** *

_____

11. **Indica in una scala da 1 a 7 la tua capacità di scegliere titoli azionari con le migliori performance** *

Contrassegna solo un ovale.

- 1
- 2
- 3
- 4
- 5
- 6
- 7

12. **Cosa sceglieresti tra darmi 100€ dal tuo portafoglio o partecipare ad una scommessa dove puoi avere il 50% di possibilità di perdere 0 e il 50% di possibilità di perdere 200€?** *

Contrassegna solo un ovale.

- Accetto di dare 100€
- Partecipo alla scommessa

13. **Hai l'opzione di poter investire una parte consistente dei tuoi risparmi in una startup. Potresti perdere il tuo intero investimento o quintuplicare il suo valore. In una percentuale da 0% a 100%, quanto saresti disposto ad investire?** *

14. **Un software permette di comprare nel 60% dei casi, in un certo periodo di tempo, azioni con un rendimento sopra la media. Negli ultimi due mesi ha dato 10 segnali di acquisto. Quanti di questi segnali pensi abbiano portato a dei risultati positivi?**

15. **Supponi che negli ultimi 6 mesi abbia dato 30 segnali di acquisto, quanti di questi segnali hanno portato ad un profitto?**

16. **Sei un gestore di fondi. Hai avuto un buon anno e hai raggiunto il 40% del tuo obiettivo, però non hai guadagnato abbastanza per ottenere il bonus di performance. Ti viene presentata un'opzione di investimento rischiosa. Potresti sia perdere i guadagni fino ad ora ottenuti sia raggiungere il bonus. Cosa fai?** *

Contrassegna solo un ovale.

- Niente
- Scelgo l'investimento rischioso

17. **Sei una/o analista finanziaria/o e vorresti comprare le azioni di una Società il cui CEO ha dichiarato che la Società effettuerà un'emissione obbligazionaria. Non ha reso note ulteriori informazioni. Cosa faresti?** *

Contrassegna solo un ovale.

- Compro
- Non compro

18. **In un'altra situazione il CEO ha alluso molte volte ad un'emissione obbligazionaria ma non ha mai fornito informazioni chiare a riguardo. Compreresti le azioni della Società con la stessa sicurezza della domanda precedente?** *

Contrassegna solo un ovale.

- Sì
- No

19. **Quale Investimento sceglieresti** *

Contrassegna solo un ovale.

- Un investimento che sicuramente mi restituisce il 3% annuo
- Un investimento che mi restituisce 0 con probabilità del 50% e 9% con probabilità del 50%
- Un investimento che mi restituisce -3% con probabilità del 50% e 6% con probabilità del 50%
- Un investimento che mi restituisce -6% con probabilità del 50% e 12% con probabilità del 50%
- Indifferente

20. **Descrivi il livello della tua tolleranza al rischio:** *

Contrassegna solo un ovale.

- Basso
- Medio
- Alto

21. **Pensi che la tua tolleranza possa cambiare in base alle circostanze o alle situazioni?** *

Contrassegna solo un ovale.

- Sì
- Forse
- No

22. **Indica il livello delle tue conoscenze finanziarie** *

Contrassegna solo un ovale.

- Base
- Intermedio
- Alto

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