



Università
Ca' Foscari
Venezia

Corso di Laurea magistrale in ECONOMIA – ECONOMICS: Models and Methods in Economics and Management

Tesi di Laurea

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The Role of Regret in Decision Making

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Anno Accademico
2012 / 2013

TABLE OF CONTENTS

ABSTRACT.....	p.4
INTRODUCTION.....	p.5
CHAPTER 1: THE ORIGINS OF THE THEORY OF REGRET.....	p.9
1.1. Von Neumann-Morgenstern Expected Utility Theory.....	p.10
1.2. An alternative Theory of Rational Choice under Uncertainty.....	p.12
1.3. Minimax Regret Rule.....	p.15
1.4. Applications of Regret Theory: Behavioral Finance.....	p.18
CHAPTER 2: DECISION JUSTIFICATION THEORY, REGRET AND DISAPPOINTMENT	p.23
2.1. Decision Justification Theory.....	p.24
2.1.1. Counterfactual Thinking.....	p.25
2.1.2. Self-Blame.....	p.26
2.2. The Factor Action-Inaction in the Short-run and in the Long-run....	p.27

2.3. Regret and Disappointment Theories: Causes and Effects.....p.33

CHAPTER 3: CONSEQUENCES OF REGRET AVERSION ON
DECISION MAKINGp.39

3.1. Anticipation of Regret.....p.40

3.2. Anticipation of Regret on Purchase Decisions.....p.43

3.3. Regret Aversion and Risk Aversion.....p.44

3.4. Experiment 1: Regret Aversion and Expected Feedback on Risky
Decision Making - Analysis of Gains and Losses.....p.45

3.5. Experiment 2: Feedback Manipulation in Ultimatum Game: Levels of
Regret in Gains and Lossesp.55

CHAPTER 4: THE EFFECTS OF EXPERIENCED REGRET ON
FUTURE CHOICESp.64

4.1. Ratner and Herbst's Studies.....p.65

4.2. Experienced Regret on Consumer Behavior.....p.69

4.3. Regret: a Functional and Dysfunctional Mechanism.....p.71

CHAPTER 5: A NEUROECONOMIC PERSPECTIVE.....p.73

5.1. Neuroscientific Tools.....p.74

5.2. A Two-Dimensional Characterization of Neural Functioning.....	p.76
5.3. Orbital Frontal Cortex and Regret.....	p.78
5.4. Amygdala and Regret.....	p.85
CONCLUSIONS.....	p.87
REFERENCES	p.90

ABSTRACT

This thesis addresses the role of regret in decision making. The theory of choice under uncertainty can explain some frequently observed violations of expected utility theory. Regret is a negative, cognitively based emotion that we experience when we realize that if we had taken a different decision, our present situation would be better. Regret differs from disappointment in the causes and in the effects on future behavior. Two experiments were run. The first one was performed in order to answer the question of how anticipated regret, introduced by expectation of feedback, models choices both in the domain of gains and in the domain of losses. Participants made regret-minimizing choices rather than risk-minimizing ones. The second experiment was conducted to measure the different levels of regret forced by the manipulation of feedback in the context of ultimatum game. The experiments focus on gender and age differences in risk attitudes. The experience of regret leads to switching behavior and suboptimal decisions. Thanks to the recent neuroimaging techniques it is possible to outline the neural basis of decision making and of the emotion of regret.

INTRODUCTION

Emotions play a crucial role in decision making. Homo sapiens is an irrational species and taking decisions among alternatives is difficult (Sugden, 1985). Making a choice, whether of a vacation destination, a spouse, a medical treatment, or a career, can be an intensely emotional experience. Therefore it is not possible to explain human behavior as the neo-classical theory does, assuming the rationality of decision maker without taking into account the emotions she can feel that bias her choices. Behavioral economics improves the realism of the psychological assumptions underlying economic theory, promising to reunify psychology and economics in the process. Reunification should lead better predictions about economic behavior and better policy prescriptions (Camerer, 1999). Behavioral economics seeks to use psychology to inform economics, while maintaining the emphases on mathematical structure of explanation of field data that distinguish economics from other social sciences (Rabin, 1998). In the standard economics model, the individual has a stable, well-defined preferences and she rationally maximizes those preferences. A behavioral alternative called prospect theory (Tversky and Kahneman, 1992) suggested that a person's preferences are often determined by changes in outcomes relative to reference levels, not merely by absolute levels of outcomes. Let's focus on the following example: you are a participant of a game that consists on deciding whether to open box A or box B. Inside each box there is a sum of money. Suppose you decide to open box A. It contains \$500 and in the refused box there are \$5. You are very happy about your decision. Suppose now that the unchosen box B contains \$5000. In this case you are not very happy and you wish to go back in time and change your decision.

The negative emotion that you feel in this second scenario, based on the cognitive processes of counterfactual thinking and responsibility attribution, is called regret. An individual can feel regret upon discovering she would have obtained a better outcome choosing a different option (Zeelenberg, van Dijk, van der Plicht, Manstead, van Empelen and Reinderman, 1998). Regret is a more or less painful cognitive and emotional state of feeling sorry for misfortunes, limitations, losses, transgressions, shortcomings or mistakes (Landman, 1993). If we analyze our example from an expected utility theory perspective, winning \$500 should be the same in both scenarios, in fact the utility of the outcome should derive from its absolute value and should not be affected by the potential outcomes of the other scenarios. But in reality this is not the case, as everyone can easily agree. Preferences are not stable, they are often determined by changes in outcomes relative to reference levels, not merely by absolute levels of outcomes (Rabin, 1998). The peculiarity of regret is that it does not only influence the assessment of the outcomes but what plays an important role in our decisions is its anticipation. The anticipation of regret is a determinant of our decision making process, in fact we anticipate how we would feel if the decision taken is not the correct one or if other options would have led to preferable outcomes. In addition, the experience of regret can have negative effects on future decisions and can bias them leading to a switching behavior and suboptimal choices. This work gathers together the literature of regret from the first studies to the contemporary ones, giving emphasis to experiments in order to gain accurate data to explain the theory. This dissertation is enriched with the exposition of some important findings, thanks to the nascent field of neuroeconomics that seeks to ground economic decision making in the biological substrate of the brain. Studies apply functional neuroimaging techniques to investigate the relative contribution of cognitive and emotional processes to human social decision making. Decision research has only recently started to take seriously the

role of emotions in choices and decisions. The emotion that has received more attention from decision theorists is regret. Most people can readily recall or imagine situations in which a poor decision led to painful regret (Connolly and Zeelenberg, 2002). It is difficult to take decisions among alternatives and it is even more difficult to escape regret, that most of the times is inevitable. Think for example of betting on horse races. If you bet on a horse and the horse wins, then you will regret not having placed more money on it. On the other hand, if the horse does not win, then you will regret having placed money on it. Either way, you will regret having placed precisely the same amount of money on the horse (Humberstone, 1980). This thesis is divided into five chapters. The first chapter deals with the origins of regret theory and it presents the most important publications in the economic and psychological field. The second chapter analyzes the decision justification theory focusing on counterfactual thinking and self-blame. In addition it compares the emotion of regret with the emotion of disappointment, underlining the differences in the causes and in the effects. Chapter three is about the consequences of regret aversion on decision making. In this session the results and implications of two experiments are presented. The first experiment concerns the anticipation of regret. The focus is centered on understanding how much does the anticipated regret, introduced by expectation of feedback, model choices both in the domain of gains and in the domain of losses. Participants made regret-minimizing choices. In the second experiment, the participants are asked to play the role of proposers in the ultimatum game. The regret is introduced through the manipulation of feedback. In this way it was possible to measure the level of regret in four different scenarios. The innovation of this experiment consists on the analysis of four situations. In two of them, even if the proposer had proposed more money for herself, the receiver would have accepted the offer. In the other two scenarios, the receiver refused the division of money. In both experiments gender and age are variables analyzed in order to

describe any relevant difference on risk attitudes. Chapter four discusses to what extent does the experience of regret bias future decisions or choices. Chapter five describes the recent developments obtained thanks to the brain imaging techniques to determine and analyze the neural basis of decision making and regret.

CHAPTER 1

The Origins of the Theory of Regret

For several years decision researchers had constructed normative models of choice that include principles of rationality aiming at maximizing expected utility. In the last decades, the study of emotions linked to decision making increased a lot such that emotions have become crucial determinants of choices. The emotion of regret is the one that received most interest from researchers. With this word we refer to a negative feeling that we experience when we realize that if we had chosen differently, we would have obtained a better outcome. Despite regret has been studied since more than fifty years, there is no a universally accepted definition that unifies psychologists, economists and neuroscientists. For the economists, the condition for the origin of regret is the knowledge of the alternative outcome. In fact it is defined as the difference, in terms of value, between the obtained outcome and the best of the alternative ones. The greater the difference, the greater the regret. On the contrary, psychologists demonstrated that the knowledge of a better outcome is not necessary, it is sufficient to imagine that we could have obtained a better result. Psychologists characterized regret with a cognitive component and they categorize it as a counterfactual emotion (Kahneman and Miller, 1986). Roese and Summerville (2005) conducted an analysis concerning the regret that we feel in our life. Most of the regret (86,4%) we feel in our life is linked to six categories: education (32,2%), career (22,3%), love stories (14,8%), children's education (10,2%) improvement of ourselves (5,5%) and free time (1,4%). Beike, Markman,

and Karadogan (2009) demonstrated that regret is more frequent and stronger in the situation in which we could have done something in the past in order to avoid the present outcome, but this possibility has already vanished. Chapter two covers the concept of regret in the situation of actions and inaction making a distinction between the short and the long run. Why do we feel this painful emotion, even though we cannot change the past? Some studies suggest that emotions are signals (Lazarus, 1991) or guidance for the future action (Frijda, Kuipers and ter Schure, 1989). So counterfactual thinking exists to inform the person on how she could have behaved to obtain a better outcome. If a similar situation will occur in the future, the individual knows how to face it (Roese, 1997). Therefore, even though the experience of regret is painful, it often turns to be adaptive and functional (Lecci, Okun and Karoly, 1994).

1.1. VON NEUMANN-MORGENSTERN EXPECTED UTILITY THEORY

Our life is full of decisions to make. How to invest savings, choose the person to marry with, choose the house, whether to vaccinate our children for a rare disease are just examples of complex choices we face in our life. Before taking a decision, we evaluate alternatives, forecasting the possible outcomes and consequences. For years economic and psychological sciences adhered to the classical theory of decision or theory of rational decision (von Neumann and Morgenstern, 1947) as dominant model. This theory, also called expected utility hypothesis, describes the behavior of an ideal decision maker, endowed with coherent, stable and disinterested preferences. The ideal decision maker is therefore a totally rational agent, who takes decisions with the aim of maximizing expected utility. Her behavior follows four fundamental axioms (completeness, transitivity, continuity and independence) and it is not biased by any emotional factor.

These axioms are widely believed to represent the essence of rational behavior under uncertainty. Given some choice set X , a person is assumed to “ $Max_{x \in X} U(x)$ ”.

The first axiom of Von Neumann-Morgenstern expected utility is the axiom of Completeness. For any lotteries L, M exactly one of the following holds:

$$L < M, M < L, \text{ or } L = M$$

Completeness assumes that an individual has well defined preferences: either L is preferred, M is preferred, or there is no preferences.

The second axiom refers to Transitivity:

$$\text{If } L \leq M \text{ and } M \leq N, \text{ then } L \leq N$$

Transitivity assumes that preference is consistent across any three options.

The third axiom is Continuity. If $L \leq M \leq N$, then there exists a probability $p \in [0,1]$ such that:

$$pL + (1 - p)N = M$$

Continuity assumes that there should be a possible combination of L and N in which the individual is indifferent between this mix and the lottery M .

The fourth axiom is about the Independence of irrelevant alternatives. If $L < M$, then for any N and $p \in (0,1]$:

$$pL + (1 - p)N < pM + (1 - p)N$$

Independence of irrelevant alternatives assumes that a preference holds regardless of the possibility of another outcome.

1.2. AN ALTERNATIVE THEORY OF RATIONAL CHOICE UNDER UNCERTAINTY

Loomes and Sugden (1982) proposed the regret theory as an alternative theory of rational choice under uncertainty stating that people behave in ways that systematically violate these axioms. Kahneman and Tversky (1979) presented extensive evidence of such behavior in their “Prospect Theory”. Regret theory is linked to prospect theory but it is supposed to be simpler and more intuitive. An individual is considered in a situation where there is a finite number, n , of alternative *states of the world*, any one of which can occur. Each state j has a probability p_j where $0 < p_j \leq 1$ and $p_1 + \dots + p_n = 1$. The individual has to choose between *actions*. Each action has a n -tuple of *consequences*, one consequence for each state of the world. The notation x_{ij} refers to the consequence of the i th action in the event that the j th state occurs. The first assumption is that for any given individual there is a *choiceless utility function* $C(\cdot)$, unique up to an increasing linear transformation, which assigns a real-valued utility index to every possible consequence. “Choiceless” means that $C(x)$ is the utility that the individual would derive from the consequence x if he experiences it *without having chosen it*. Suppose that an individual experiences a particular consequence as a result of his choice. He has to choose between action A_1 and A_2 in a situation of uncertainty. He chooses A_1 and then the j th state of the world occurs. He therefore experiences the consequence x_{1j} . If he had chosen A_2 , and then the j th state of the world occurred, he would be experiencing x_{2j} .

The authors suggest that the psychological experience of pleasure associated with having obtained the consequence x_{1j} in these circumstances will not only depend on the nature of x_{1j} but also on the nature of x_{2j} . If x_{2j} is a more desirable consequence than x_{1j} , then the individual may experience *regret*: he may reflect on how much better his position would be if he had chosen differently and this reflection may reduce the pleasure that he derives from x_{1j} . Conversely, if x_{1j} is the more desirable consequence, he may experience what we shall call *rejoice*, the extra pleasure associated with knowing that he has taken the best decision. For example, the sensation of losing \$100 as a result of an increase in income tax rates, which we could have done nothing to prevent will be less painful and will inspire less regret than the sensation of losing \$100 on a bet on a horse race. If we compare instead the experience of gaining \$100 from an income tax reduction with that of winning \$100 on a bet, it turns out that the latter experience is more pleasurable. We shall incorporate the concept of regret and rejoicing into the theory by means of a modified utility function. Suppose that an individual chooses an action A_i in preference of an action A_k , and the j th state of the world occurs. The actual consequence is x_{ij} , while if he had chosen differently, x_{kj} would have occurred. We will write $C(x_{ij})$ as c_{ij} and we will say that the individual experiences the *modified utility* m_{ij}^k where:

$$m_{ij}^k = M(c_{ij}, c_{kj}). \quad (1)$$

The function $M(\cdot)$ assigns a real-valued index to every ordered pair of choiceless utility indices. The difference between m_{ij}^k and c_{ij} may be interpreted as an increment or decrement of utility corresponding with the sensation of rejoicing or regret. In this way, it is assumed that the degree of regret of rejoicing depends only on the choiceless utility associated with the

two consequences in question: “what is” and “what might have been”. Other important assumptions are that if $c_{ij} = c_{kj}$ then $m_{ij}^k = c_{ij}$, which means that if what occurs is exactly as pleasurable as what might have occurred, there is neither regret nor rejoicing. It is also natural to assume that $\partial m_{ij}^k / \partial c_{kj} \leq 0$: the more pleasurable the consequence that might have been, the more regret (less rejoicing) is experienced. Another assumption is that $\partial m_{ij}^k / \partial c_{ij} > 0$: other things being equal, modified utility increases with choiceless utility. The individual chooses between actions so as to maximize the mathematical expectation of modified utility. We can define the *expected modified utility* E_i^k of action A_i , evaluated with respect to an action A_k , by:

$$E_i^k = \sum_{j=1}^n p_j m_{ij}^k. \quad (2)$$

An individual facing with a choice between A_i and A_k will prefer A_i , prefer A_k or be indifferent between them according to whether E_i^k is greater than, less than, or equal to E_k^i .

We shall assume that the level of regret or rejoicing that a person experiences depends only on the difference between the choiceless utility of “what is” and the choiceless utility of “what might have been”. This allows us to define a *regret-rejoice function* $R(\cdot)$ which assigns a real-valued index to every possible increment or decrement of choiceless utility. So we can write:

$$m_{ij}^k = c_{ij} + R(c_{ij} - c_{kj}). \quad (3)$$

It follows from the assumptions we have made about $M(\cdot)$ that $R(0) = 0$ and $R(\cdot)$ is strictly increasing and three times differentiable.

Let's now suppose, as before, that an individual has to choose between the actions A_i and A_k . Referring to (2) and (3), the individual will have the weak preference $A_i \geq A_k$ if and only if:

$$\sum_{j=1}^n p_j [c_{ij} - c_{kj} + R(c_{ij} - c_{kj}) - R(c_{kj} - c_{ij})] \geq 0. \quad (4)$$

1.3. MINIMAX REGRET RULE

Savage (1951, 1954) introduced for the first time the concept of regret into theories of decisions with the minimax regret rule. According to the classical decision theory, in order to calculate the expected utility it is necessary to know the probabilities associated to the outcomes of the alternative options. However, not all the probabilities are known in real life. This strategy has the aim to minimize the maximum possible regret. In this scenario regret is defined as the difference in utility between the outcome achieved and the best possible outcome. In this model we need to transform the values of the utility of every possible outcome into values of regret. We should then subtract the value of each outcome from the value of the biggest outcome that we could obtain in this state of the world. An example will clarify the concept. Suppose we have to go out and we are not sure if it is going to rain or not. So we have to decide whether to take the umbrella or not. The possible states of the world are two: it will rain, it will not rain. Savage proposes to construct a matrix with values representing benefits and inconveniences.

CHOICES	STATES OF THE WORLD	
	Rain	Do not rain
Take the umbrella	4 (uncomfortable and wet feet)	5 (uncomfortable and light embarrassment)
Do not take the umbrella	-10 (dripping wet)	10 (inconvenience avoided)

Table 1.1: Matrix of the profits relative to choices and states of the world.

Subtracting the value of each cell from the possible maximum value that we can obtain in that state of the world, we will obtain the matrix of regret. The minimax regret rule will enable us to choose the alternative which guarantee the minimum possible regret. In our situation, it suggests to bring the umbrella (maximum possible regret if we decide to bring the umbrella is 5, whereas the maximum possible regret if we do not take it is 14).

CHOICES	STATES OF THE WORLD	
	Rain	Do not rain
Take the umbrella	0 (4-4)	5 (10-5)
Do not take the umbrella	14 [4-(-10)]	0 (10-10)

Table 1.2: Table of Regret.

This rule has been criticized over years because it violates the axiom of independence of the irrelevant alternatives. In addition it is too far from the real behavior of decision makers, in fact it is too pessimistic and it takes into consideration only the extreme values that we would obtain if the worst situations occur (Cohen and Jaffray, 1980). Nevertheless we have to recognize that Savage was the pioneer of the regret theory and he introduced the idea that the individual decision making is not only driven by the maximization of utility but also by avoiding unpleasant consequences. Moreover the utility of an outcome does not depend exclusively on its absolute value but also on the comparison with the other possible outcomes.

1.4. APPLICATIONS OF REGRET THEORY: BEHAVIORAL FINANCE

Parallel to behavioral economics, behavioral finance was born with the aim of explaining the irrational behavior of financial investors and institutions. The theory of regret has been included in several papers. In this paragraph we will investigate the role of regret and the so called “disposition effect”, that is the tendency of investors to sell winning stocks too early and riding losers too long. It has been known for years that individual decision makers do not behave in accordance with the axioms expected utility theory (Shefrin and Statman, 1985). One of the key findings of Kahneman and Tversky is that a person who has not made peace with her losses is more likely to accept gambles that would be unacceptable otherwise. The disposition effect is primarily due to three elements: prospect theory, mental accounting and regret aversion. Odean (1998) tested the disposition effect by analysing trading records for 10000 accounts at a large discount brokerage house. Investors demonstrated a strong preference for realizing winners than losers. This is precisely the loss aversion phenomenon. Loss aversion refers to the tendency of individuals to be more sensitive to reductions on their levels of well-being than to increases (Benartzi and Thaler, 1995). We can easily plot this concept in the following value function. In prospect theory, outcomes are interpreted as gains and losses relative to a reference point (Starmer, 2000). We may think of the reference point as status quo wealth. The characteristic of the present model is that gains and losses are evaluated differently. Outcomes are evaluated via a utility function with a shape represented on Figure 1.1.

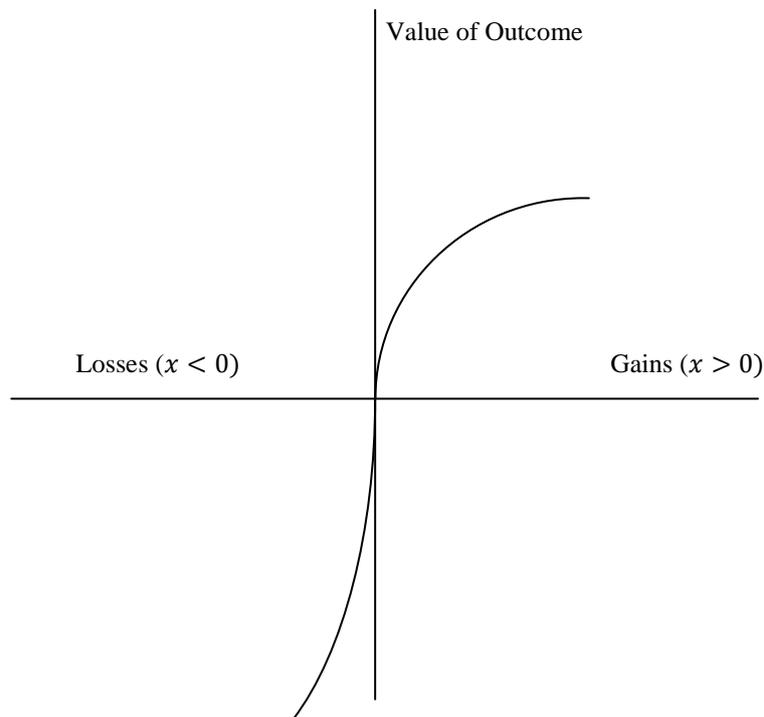


Figure 1.1: The valuation of outcomes in Prospect Theory: “S”-shaped value function. Source: Kahneman and Tversky, 1979.

In the status quo $x = 0$ the utility function changes concavity. It is concave for gains and convex for losses and it is steeper in the domain of losses. This feature has some effects that Tversky and Kahneman (1992) had interpreted as implications of two more general properties of perception and judgment: diminishing sensitivity and loss aversion. Diminishing sensitivity refers to the psychological impact of a marginal change that decreases as we move further away from a reference point. For example, relative to the status quo, the difference between a gain of 10\$ and 20\$ seems larger than the difference between a gain of \$110 and \$120. More generally, the assumption of diminishing sensitivity applied to the outcome domain entails diminishing marginal utility for gains (i.e., $u''(x) \leq 0$ for $x \geq 0$) and diminishing marginal disutility for losses (i.e., $u''(x) \geq 0$ for $x \leq 0$). Loss

aversion, as mentioned above, is the principle that “losses loom larger than corresponding gains” (Tversky and Kahneman, 1992). The intuition is that most people find symmetric bets distinctly unattractive. Loss aversion is modeled by imposing $u'(-x) \geq u'(x)$ for all $x > 0$ which means that the slope of the utility function at each loss is at least as large as the slope of the utility function at the absolutely commensurate gain (Wakker and Tversky, 1993).

Investors might choose to hold their losers and sell their winners not because they are reluctant to realize losses but because they believe that today's losers will soon outperform today's winners. If future expected returns for the losers are greater than those for the winners, the investors' belief would be justified and rational. If, conversely, future expected returns for losers are not greater than those for winners, but investors continue to believe they are despite persistent evidence to the contrary, this belief would be irrational.

Another evident behavior of investors is that they do sell more losing investments close to the end of the year. This is in contrast with optimal tax-loss selling for taxable investments. For tax purposes investors should postpone taxable gains by continuing to hold their profitable investments. They should capture losses by selling their losing investments. Shefrin and Statman (1985) propose that investors choose to sell their losers in December as a self-control measure. They reason that investors are reluctant to sell for a loss but recognize the tax benefits of doing so. The end of the year is the deadline for realizing these losses. So each year, investors postpone realizing losses until December when they require themselves to sell losers before the deadline passes. The reluctance of realizing losses can also be explained through the fact that U.S. tax code distinguishes between

short-term gain (losses) which are taxed as ordinary income and long-term gains (losses) which are taxed at a lower rate. Thaler (1985) argues that people tend to segregate different gambles into separate mental accounts. These are evaluated separately differently for gains and losses. The main idea underlining mental accounting is that decision makers tend to segregate the different types of gambles faced into separate accounts, and then apply prospect theoretic decision rules to each account by ignoring possible interactions (Shefrin and Staman, 1985). Therefore, one reason investors might choose to sell winners rather than losers is that they anticipate a change in the law under which capital gains rates will rise.

Another reason is the regret aversion which causes investors to be more loath to realize their greatest losses, and, due to tax consequences, they postpone realizing their greatest gains. In addition, investors may experience regret if they sell winning stocks which then will appreciate more. They are loath to sell losing stocks because they are regret averse in the sense that they want to avoid them to appreciate right after having sold them. Regret aversion plays an important role in influencing investors not to buy additional shares of big winners. For example, let's suppose that an investor buys 100 shares of stock A at \$100 per share. Then stock A appreciates to \$150. The investor may believe stock A will continue to appreciate but he may still refrain from buying 100 additional shares, because if he does buy more shares, he will regret that he did not buy them at \$100 per share earlier. The greater the difference between the original and additional purchase prices, the greater is the potential regret (Odean, 1998). Investors may postpone the realization of a loss because it stands as proof that their first judgment was wrong. Moreover, the regret at having erred may be exacerbated by having to admit the mistake to others (Shefrin and Statman, 1985). Hanging on too long to losing stocks may partly be accountable to

regret-minimizing strategies. Investors might wait to sell stocks that have gone down in order to avoid the pain and regret of having made a bad investment. As long as the stock is retained, the financial loss is only virtual, stock may still go up and regret may not be experienced. However, in their effort to avoid current regrets, such investors may increase the likelihood of future regrets (Zeelenberg and Pieters, 2004). Regret is an emotional feeling associated with the ex post knowledge that a different past decision would have fared better than the one chosen. The opposite of regret is pride. While closing a stock account at a loss induces regret, closing at a gain induces pride. The desire of pride and the avoidance of regret lead to a disposition to realize gains and defer losses. Thaler (1985), Kahneman and Tversky (1992), argue that there is an asymmetry between the strength of pride and regret (regret is stronger). This leads inaction to be favored over actions, as we will prove in chapter two.

CHAPTER 2

Decision Justification Theory, Regret and Disappointment

Negative emotional states often evolve in response to unfavorable outcomes of decisions. Regret is experienced when it turns out, in retrospect, that you should have chosen something different (Zeelenberg and Beattie, 1997). Regret is an aversive state, and it is therefore not surprising to see that we do not sit and wait for this emotion to occur. Regret is a counterfactual emotion (Kahneman and Miller, 1986) that occurs when one recognizes that a negative outcome was caused by one's own actions, and indeed, self-blame is the critical element that distinguishes regret from closely related emotions such as disappointment (Zeelenberg, van Dijk and Manstead, 1998). People expect narrow margin of loss, or a "near miss" to exacerbate self-blame, and thus they expect that margin exacerbate regret as well. People anticipate feeling more regret when they lose by a narrow margin than when they lose by a wide margin (Gibert, Morewedge, Risen and Wilson, 2004). Kahneman and Tversky (1982) offered the following scenario to a number of people: "Mr. Crane and Mr. Tees were scheduled to leave the airport on different flights, at the same time. They traveled from town in the same limousine, were caught in a traffic jam, and arrived at the airport 30 minutes after scheduled departure time of their flights. Mr. Crane is told that his flight left on time. Mr. Tees is told that his flight was delayed, and just left five minutes ago. Who is more upset, Mr. Crane or Mr. Tees?" Participants of this scenario had no doubt at indicating Mr. Tees as the one who experienced more regret. Focusing on these two situations, it is

easier to think that things could have turned out better for the individual that was closer to reach his target: the temporal proximity between the real outcome and an alternative but more desirable outcome facilitates the production of counterfactual thoughts. Miller and Taylor (1995), proposed a scenario in which two people, Mr. K and Mr. T, are asked to sell their lottery tickets. Mr. K received the proposal two weeks before the final draw, whereas Mr. T received the proposal one hour before the final draw. Most of participants agreed that Mr. T is more loath to send his ticket because would feel more regret if he found out that his ticket was the winning one. As in the Kahneman and Tversky scenario, the only difference between the two individuals is the temporal proximity between the real outcome and the counterfactual one. Therefore, regret does not just arise in the situations where the negative outcome is caused by inappropriate decisions, but whenever there exists a counterfactual alternative, like in the cases where we were very close to obtain a better outcome. “Man rather than machine is responsible for error, and human action is the ‘easiest’ factor to modify” (Giroto, Legrenzi and Rizzo, 1991).

2.1. DECISION JUSTIFICATION THEORY

The debate on the responsibility that causes regret is the base for the birth of *decision justification theory* (DJT) (Connolly and Zeelenberg, 2002). As Sugden (1985) earlier proposed, DJT postulates two core components of decision-related regret, one associated with the comparative evaluation of the outcomes, the other with the feeling of self-blame for having made a poor choice. In every choice, people carefully think about alternatives and the possible consequences of the outcomes. In addition to this important cognitive considerations, there are strong emotional factors. When taking a decision, the individual has feelings about the decision itself and

expectations about the feelings she may experience later. After the fact, the individual will experience emotions that may or may not track with the earlier expectations. Therefore, the overall feeling of regret at some decision is a combination of these two components: counterfactual thought and self-blame. For the onset of regret, it is sufficient one of the two main components. We may therefore experience regret in absence of perceived responsibility (outcome regret), when for example a necessary vaccine causes unexpected side effects. We may also experience regret in absence of a negative outcome (self-blame regret), for example when we realize that we acted in a reckless manner but luckily we did not have any serious consequences, as having driven drunk.

2.1.1. COUNTERFACTUAL THINKING

Regret is a cognitively mediated emotion triggered by our capacity to reason counterfactually. Counterfactual thinking is the mechanism by which we compare “what is” with “what might have been”. Contrary to mere disappointment, which is experienced when a negative outcome happens independently of our decision, regret is an emotion strongly associated with a feeling of responsibility (Camille, Coricelli, Sallet, Pradat-Diehl, Duhamel and Sirigu, 2004). Counterfactual thinking involves mentally mutating one or more aspects of a past event. It includes thoughts in which current reality is changed into what might, could, would, or should have been. By mentally simulating what happened and comparing it to what might otherwise have happened, an individual can come to an understanding of how reality came about. An individual can rerun what has happened, while changing aspects of his or her own actions, and see if, and how, this would have made a difference. In this simulations one can also change aspects of the situation and examine whether these differences could have prevented something

from happening, or would have promoted the occurrence of other events. In this way counterfactual thinking may influence an individual's attributions for the current reality (Kahneman, 1992; Kahneman and Miller, 1986; Wells and Gavanski, 1989). Counterfactual thinking has also been shown to influence individuals' emotional reactions to outcomes and events (Boles and Messick, 1995; Kahneman and Tversky, 1982; Medvec, Madey and Gilovich, 1995). For example, if an individual wins a small prize in a lottery, satisfaction with this prize is not easily predicted. How satisfied one feels depends very much on which alternative to reality (or default) comes to mind. Where winning a larger prize is the alternative to reality, one would be less satisfied than if winning no prize at all is the alternative to reality. This concept of relative versus absolute reminds to the prospect theory status quo where every outcome is compared to the initial state or reference point and it is never evaluated in absolute value. Thus, by constructing alternatives with which reality is contrasted, counterfactual thoughts can influence the intensity of an emotional reaction; this has been referred to as emotional amplification (Kahneman and Miller, 1986).

2.1.2. SELF-BLAME

We have seen that regret arises from counterfactual thoughts where our behavior has changed. Sugden (1985) attributes to responsibility a fundamental role for regret. As stated above, regret is formed by two components. The first is about the evaluation of our own choices based on the comparison between actual outcome and alternative ones. The second is given by feelings of responsibility and self-blame and by subjective evaluation of the quality of our own choices. According to Sugden, the intensity of regret depends on how much do we feel responsible of our choice. Self-blame also referred as self-recrimination or repentance is the

state of mind we have when we come to believe that a previous decision involved an error of judgment, that it was wrong at the time we made it. This state of mind may be felt even when our decision turns out well.

2.2. THE FACTOR ACTION-INACTION IN THE SHORT-RUN AND IN THE LONG-RUN

Mr. Paul owns some shares of the society A. During last year he took into consideration the possibility to change the investment to the society B, but at the end he decided to keep all the shares of the society A. He now discovers that if he had moved the investment to the society B, he would be \$1200 richer. Conversely, Mr. George used to own shares of society B. During last year he transferred his investment to society A. He now discovers that if he had kept the shares of society B, he would have 1200\$ more. Who does feel more regret? Kahneman and Tversky (1982) proposed this scenario to their participants. Most of the people agreed that Mr. George feels more regret. Yet they both obtained the same result, they lost the opportunity to gain \$1200. What differs here is the emotional reaction of the two investors, caused by their respective action or inaction. It is easier to imagine of not having acted than imagine to having acted. Kahneman and Miller (1986) interpreted the factor action-inaction as the factor normal-exceptional, according to which the exceptional events are considered as more changeable than normal events. Usually actions are perceived as more exceptional facts than inactions and therefore it is easier to build counterfactual thoughts and imagine outcomes different from reality. The factor action-inaction has been studied deeply (Baron and Ritrov, 1994; Gleicher, Kost, Baker, Strathman, Richman and Sherman, 1990; Landman, 1987) and it is considered as one of the most robust effect in the literature of counterfactual thinking. Gilovich and Medvec (1994) obtained opposite

results by introducing a temporal variable. These two researchers have observed that people more frequently commemorate regret associated to actions in the short-run (for example last week), but in the long-run (for example last year) inactions give rise more frequently to regret. In order to explain this concept the authors set up a scenario where the choices of two students, Dave and Jim are presented. Dave and Jim are not happy with their university choice and they want to move away. The two students took different decisions: Dave decided to remain at the university, whereas Jim moved away. None of them is happy about the decision, Dave thinks he should have moved away and Jim thinks that he should have remained at the first university. Participants of the Gilovich and Medvec's experiment agreed that in the short-run, Jim, the student who acted, would experience more regret, whereas in the long-run, Dave, the student who did not act, will experience more regret. According to the authors, this time reversal phenomenon is caused by emotional factors that arise in the long-run, aiming at reducing the dissonance generated by actions and by cognitive factors, such as the comparison with counterfactual alternatives, that in the case of inactions are potentially infinite. Byrne and McEleney (2000) had proposed an explanation for the effect action-inaction based on mental models. The authors argue that most of the action mutability derives from the fact that people have a more explicit representation of the action than of the inaction. Recalling the Gilovich and Medvec's (1994) example, in order to represent the decision taken by Jim, the participants of the experiment have to construct two models: a factual and a counterfactual one (Table 2.1).

FACTUAL	New University	Very Unsatisfied
COUNTERFACTUAL	Initial University	Moderately Satisfied

Table 2.1: Factual and Counterfactual model in the Gilovich and Medvec (1994) scenario: Jim's decision.

A unique model is instead sufficient in order to represent Dave decision, since he actually do not choose (Table 2.2).

FACTUAL	Initial University	Very Unsatisfied
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Table 2.2: Factual model in the Gilovich and Medvec (1994) scenario: Dave's decision.

Only Jim's set of models contains explicitly a counterfactual model, hence it in his case it is easier to compare what actually happened to what could have happened. When, instead, people are asked to judge who will feel more regret in the long-run, they need more information on Dave's situation. They will therefore construct a more complete representation of Dave's decision, making explicit the two possible outcomes relative to Dave's decision to change university. The complete representation of Dave's decision is shown on Table 2.3. The presence of a counterfactual model in which Dave changes university and he is happy, explains the reversal phenomenon of the effect action-inaction in the long-run.

FACTUAL	Initial University	Very Unsatisfied
COUNTERFACTUAL	New University	Very Unsatisfied
COUNTERFACTUAL	New University	Satisfied

Table 2.3: Factual and Counterfactual model in the Gilovich and Medvec (1994) scenario: Dave's decision.

Zeelenberg, Van den Bos, van Dijk and Pieters (2002) had proposed another explanation for the factor action-inaction based on the motivation of the action. When there is no presence of good motivators to act, action is considered an abnormal behavior (recall Kahneman and Tversky's two investors scenario). If, instead, there are good reasons to act, inaction is considered abnormal. In another study (Zeelenberg et al., 2002), participants were asked how much regret would a soccer coach feel if his team lose after he either changed or did not change the team. Mr. A and Mr. B are two soccer coaches whose teams are both defeated in the match. Mr. A had changed his team from the regular one. Mr. B did not change the regular team. Who would feel more regret? If we know that both teams had a winning record, Mr. A (active coach) would feel more regret. Conversely, if both teams had a losing record, Mr. B (inactive coach) would feel more regret because he did not act to avoid losing again. We therefore understand that the degree of regret in these scenarios is driven by both the past performance of the teams and by the decisions of the relative coach to act or to do not act. If there are good reasons to act and someone fails to act, the regret would be very strong.

	SHORT-RUN	LONG-RUN
HIGH REGRET	<ul style="list-style-type: none"> - ACTIONS (generally) - ACTIONS (despite the good reasons to not act) - INACTIONS (despite the good reasons to act) 	<ul style="list-style-type: none"> - INACTIONS (generally) - INACTIONS (despite the good reasons to act) - ACTIONS (despite the good reasons to not act)

Table 2.4: Regret in Short-run and Long-run due to Actions and Inactions.

Regret requires imagination: we cannot experience regret unless we can somehow imagine what it would be like to have done something differently in the past. The intensity of regret is linked to the vividness of our imaginative picture of “what might have been”. Let us consider this set of examples (Sugden, 1985):

Example 1A: An individual always travels to and from work by car, leaving work at 6.10 p.m. His working hours are flexible, so he is free to leave earlier if he wish. One evening he had an accident traveling home because a tree has fallen on the road. If he had left work at 6.00 p.m. he would have avoided the accident.

Example 1B: The story is the same of example 1A, except that the individual has known for some time that his car tyres are bald and he has postponed buying new ones to save money. He know that he would have been able to avoid the accident if had replaced his tyres.

Example 1C: Until one particular day, the individual had always left work at 6.00 p.m. On this day he chooses to spend ten minutes longer at work. The story continues as in the example 1A.

In all these three scenarios, the choice the individual made had led to an accident. In retrospect, he knows that this accident would not have happened if he had chosen differently. But, would they all give rise to the same amount of regret? Sugden's intuition is that regret would be more painful in Example 1B than in the Example 1A. In Example 1A there were no reasons to leave work ten minutes before than usual on the particular day that the tree fell down. A posteriori he will wish he had done so, but he can tell himself that the decision he made was perfectly sensible at the time. Therefore, there is no cause for self-recrimination. On the contrary, in the Example 1B it is difficult for the individual not to blame himself. Of course there was some reason not to change the tyres, but the possibility of an accident was a strong reason pointing in the opposite direction. In addition, most people would find regret more painful in Example 1C than in the Example 1A. The reason why the two scenarios should be different is a bit of a puzzle since in both cases the decision taken was quite unjustifiable at the time: there was no way the individual could have foreseen the implications of leaving work ten minutes earlier or later. Nevertheless, it does seem that mere routine is an antidote to regret (Sugden, 1985). It is much easier to imagine having done something that we often do, than something that we rarely do. In Example 1A the action that would have avoided the accident is one that it is rarely difficult to imagine having chosen, not because it is unreasonable but because the individual has never chosen it. In Example 1C, in contrast, it is very easy to imagine having chosen the action that would have avoided the accident.

2.3. REGRET AND DISAPPOINTMENT THEORIES: CAUSES AND EFFECTS

Regret and disappointment are emotions that can be experienced in response to an unfavorable outcome of a decision (Zeelenberg, van Dijk, van der Pligt, Manstead, van Empelen and Reinderman, 1998). Both emotions are related to the process of counterfactual thinking. In fact they both stem from a comparison between “what is” and “what might have been”. But there is a difference between them since regret is assumed to be originated from comparisons between the factual outcome and an outcome that might have been *had you chosen another action*. Instead, disappointment is assumed to be originated from a comparison between the factual outcome and an outcome that *might have been had another state of the world occurred*. The decision research has shown that both regret and disappointment have clear behavioral consequences. These consequences may arise from both the anticipation of these emotions and from their experiences. Different sorts of counterfactual thinking give rise to regret and disappointment as it is shown below. Appraisal theorists state that each emotion can be related to specific patterns of evaluations and interpretations of events (“appraisals”). Zeelenberg et al. (1998), in their studies, focused on the appraisal pattern of several different negative emotions. They asked participants to recall situations in which they felt strong regret or strong disappointment and subsequently assessed their appraisals. Eight different appraisal dimensions were included: unexpectedness, motivational state, situational state, probability, control potential, legitimacy, problem source, and agency (measured by three items such as self agency, other-person agency, circumstances-agency). Roseman, Wiest, and Swartz (1996) found that these appraisal items differentiated clearly between different emotions. Significant differences between regret and disappointment arose on five

appraisal dimensions, namely: unexpectedness, motivational state, control potential, legitimacy, and self agency (self-agency and circumstances-agency). Disappointment received higher ratings with respect to unexpectedness, wanting something pleasurable, thinking that one was morally right, and causation by circumstances beyond anyone's control. Regret, on the other hand, received higher ratings with respect to thinking that one could have done something about the event, and self-causation. In their studies, Zeelenberg et al. (1998), also focused on the phenomenological experience of regret and disappointment (Table 2.5), asking participants to indicate what they felt, thought, felt like doing, did and wanting during this experience. They asked about these five aspects of an emotional experiences (i.e. feelings, thoughts, action tendencies, actions, and motivations). It turns out that there are significant differences between regret and disappointment in each category. These differences were more pronounced for action tendencies (referring to what participants felt like doing during the experience) and for motivations (referring to specific emotional motives or goals that participants had during the experience). From the results, the experience of regret can be differentiated from the experience of disappointment in that the former involves feelings more intensely that one should have known better, thinking about what a mistake one has made, feeling a tendency to kick oneself and to correct one's mistake, wanting to undo the event and to get a second chance (Zeelenberg et al., 1998). Conversely, feeling of disappointment, involves feeling powerless, feeling a tendency to do nothing and to get away from the situation, actually turning away from the event, and wanting to do nothing. Table 2.6 shows the results of one of the study performed by Zeelenberg et al. (1998). Participants were asked to recall and describe an event from their own lives in which they experienced either intense regret or intense disappointment.

Response Type and Item	Regret	Disappointment	F(1,311)	P
Feelings				
1. Feel a sinking feeling?	5.38	5.59	0.56	n.s.
2. Feel powerless	5.84	7.08	26.53	.001
3. Feel that you should have known better?	7.32	5.75	41.41	.001
4. Feel that you lost control?	5.97	6.27	1.35	n.s.
Thoughts				
1. Think about what a mistake you made?	7.09	5.51	34.84	.001
2. Think about what you missed out on?	5.85	6.38	3.44	n.s.
3. Think about a lost opportunity?	5.81	6.01	0.45	n.s.
4. Think about how bad things could get?	5.01	5.23	0.61	n.s.
Action Tendencies				
1. Feel the tendency to kick yourself?	7.11	5.16	56.90	.001
2. Feel the tendency to get away from the situation?	5.47	6.16	6.11	.014
3. Feel the tendency to correct your mistake?	6.80	4.89	42.71	.001
4. Feel the tendency to do nothing?	3.36	4.14	8.56	.004
Actions				
1. Do something differently?	5.42	5.86	3.20	n.s.
2. Turn away from the event?	4.54	5.23	6.34	.012
3. Change the situation?	5.82	5.64	0.48	n.s.
4. Become inactive?	3.75	4.05	1.36	n.s.
Emotivational Goals				
1. Want to undo the event?	7.71	6.89	12.44	.001
2. Want to be far away from what happened?	5.77	6.20	2.28	n.s.
3. Want to get a second chance?	7.57	6.77	10.73	.001
4. Want to do nothing?	2.97	3.63	8.16	.005

Table 2.5: Regret versus Disappointment. Means for each response item per emotion recalled. Participants could answer from 1 (*not at all*) to 9 (*to a very great extent*). Source: Zeelenberg, van Dijk, Manstead, van der Pligt, 1998.

Dependent Variables	Condition		F(1,128)	p<
	Regret	Disappointment		
Emotions				
Regret	8.32	4.65	76.51	.001
Disappointment	6.49	9.02	64.35	.001
Guilt	7.48	4.03	54.52	.001
Shame	6.66	4.43	18.15	.001
General Affect	3.28	3.26	0.01	ns.
Attributions				
Responsibility	7.85	5.15	35.60	.001
Internal attribution	7.75	4.92	39.93	.001
External attribution	5.29	7.28	19.68	.001

Table 2.6: Means for the dependent variables in the regret and disappointment conditions. (Zeelenberg et al., 1998, results of study 1).

They were next asked to undo the event by generating four counterfactuals. They expected that regret participants would predominantly mutate things that were under their control, whereas disappointment participants would predominantly mutate things that *were not* under their control. They assessed ratings of emotions felt during the experience of the event. As expected, regret participants reported a high level of regret, and disappointment participants reported a high level of disappointment. Entries for regret and disappointment, guilt and shame are mean answers on 10-point scales with endpoints labeled *none* (1) and *very much* (10). Entries for general affect are mean answers on a 11-point scale, with endpoints labeled *very good* (-5) and *very bad* (5). Entries for attributions are mean answers on a 11-point scale, with endpoints labeled *not responsible* (1) and *very responsible* (10), and mean answers “to what extent did you cause the event?” and “to what extent did external factors cause the event?” measured on a 10-point scale with endpoints labeled a *very small extent* (1) and a *very*

great extent (10). Participants in the regret condition reported more regret than did those in the disappointment condition, and participants in the disappointment condition reported more disappointment than those in the regret condition. The high level of regret and disappointment reported in the corresponding conditions show that participants did indeed recall events in which they experienced intense regret or disappointment. It is interesting to underline that in both conditions the recalled events were associated with the same level of general affect. Participants who recalled an experience of intense regret reported having experienced more guilt and shame than did participants who recalled an experience of intense disappointment. This suggested that guilt and shame are more closely related to regret than to disappointment (Zeelenberg et al., 1998).

After having analyzed the causes of regret and disappointment, we now focus on the behavioral consequences following the experience of these two emotions. Why would the focus on specific emotion be so important? Researches in emotion theory have shown that the specific emotions have idiosyncratic behaviors and behavioral tendencies (Frijda, Kuipers, and ter Schure, 1989; Roseman et al., 1994). Regret and disappointment have distinct behavioral consequences associated with their experience (Zeelenberg and Pieters, 1999). In their study, the emotional and behavioral responses of consumers who experienced unsatisfactory service delivery have been analyzed. The three dominant behavioral responses to dissatisfaction are switching, complaining, and word-of-mouth communication (Olivier, 1997; Richins, 1987; Zeitham, Berry, and Parasuraman, 1996). *Switching* refers to leaving the relationship with the service provider and either initiating a relationship with another service provider or refraining from the service altogether. Switching is the opposite

of loyalty, which refers to choosing to remain in the relationship with the service provider despite dissatisfaction. *Complaining* occurs when customers communicate their negatively disconfirmed expectations to the firm. *Word-of-mouth* communication covers interactions with members of one's social and professional network about the failed service encounter, usually by talking to family members, friends, relatives, fellow customers, and the like. It refers to all communications concerning the evaluations of goods and services rather than to formal complaints to the organization or its personnel (Anderson, 1998). Whereas switching and complaining responses are observable to the firm, word-of-mouth generally remains unobservable. Zeelenberg and Pieter's (1999) experiment showed that consumers who experienced regret tended to switch to a new service provider whereas the behavior of consumers who experienced disappointment was more associated with word of mouth and complaining. A deeper analysis on this topic will be covered in chapter four.

CHAPTER 3

Consequences of Regret Aversion on Decision Making

The effects of regret on the decision making process have been widely studied. One of the topic that attracts more attention is the anticipation of regret, the assumption that people can foresee regret that they would feel as a consequence of their choices. People use this information as a crucial determinant of their final decisions as many researchers have demonstrated (Wong and Kwong, 2007; Hoeltz and Loewenstein, 2005; Hetts, Boninger, Armor, Gleicher and Nathanson, 2000; McConnell, Niedermeier, Leibold, El-Alayli, Chin e Kuiper, 2000; Zeelenberg, 1999b). One can anticipate regret, by imaging how she might experience the various outcomes of a decision. The important assumption is that people are regret averse and they make decisions trying to avoid anticipated future regret (Bell, 1982; Loomes and Sugden, 1982; Zeelenberg and Pieters, 2007). It has been shown that anticipated future regret influences people's current decisions in a variety of domains (e.g. Connolly and Reb, 2012; Larrick and Boles, 1995; Reb and Connolly, 2009; Simonson, 1992; Zeelenberg, 1999b; Zeelenberg, Beattie, van der Pligt, and de Vries, 1996). Since people are regret averse, they try to regulate it in a variety of ways. Zeelenberg and Pieters (2007) developed a framework to understand the various strategies that people can employ to reduce current regret and to avoid potential future regret. One common way to avoid future regret is to avoid feedback on foregone alternatives. There is a variety of evidence that people tend to choose options that protect them from potential regret (Zeelenberg, 1999; Larrick and Boles, 1995;

Zeelenberg and Beattie, 1997; Zeelenberg et al., 1996; Ritrov, 1996). For example, Zeelenberg and Beattie (1997) performed an experiment asking participants to evaluate two financial investments: a safer and a riskier one. The safer option provides a modest profit whereas the riskier option can result in a large profit or no profit at all. Half of the participants expected to have feedback only on the chosen option and the other half expected to get feedback on the risky option irrespective of their choice. The results showed that participants preferred the safer investment over the risky one if there was feedback only on the chosen option. Choosing the risky option would make decision makers vulnerable to regret since the outcome of the safe option would be known anyhow. On the contrary, participants who always expected feedback on the risky option preferred the risky option over the safer one.

3.1. ANTICIPATION OF REGRET

The psychologists Janis and Mann (1977) focused on the psychological aspects of anticipated regret. They elegantly expressed how decision makers' fear for future regret influences their behavior. Janis and Mann argue that the anticipation of regret induces us to make more rational choices, that is, anticipated regret causes people to think more elaborately before making a final decision. They state that: "Before undertaking any enterprise 'of great pith and moment', we usually delay action and think about what might happen that could cause regret ... Anticipatory regret is a convenient generic term to refer to the main psychological effects of the various worries before any losses actually materialize ... Such worries, which include anticipatory guilt and shame, provoke hesitation and doubt, making salient the realization that even the most attractive of the available choices might turn out badly".

Now, that we have established that anticipation of regret influences decision making, the next necessary step is to study the conditions under which people anticipate regret. Janis and Mann (1977) describe five conditions that might determine the anticipation of regret.

1. *The most preferred alternative is not necessarily superior to another alternative.* When there is a dominant alternative, the decision maker does not spend much time thinking about the possible drawbacks of this alternative. Since it is a dominant alternative, it minimizes future regret by definition. The more difficult a decision is, the more likely it is that people take regret into account when deciding (Sugden, 1985).
2. *The same negative consequences that might ensue from the decision could start to materialize almost immediately after the decision is made.* Decision makers might discount the possible regret that a decision can cause, when the outcomes of a decision are not realized quickly. This could be relevant for intertemporal choices showing that decision makers have a tendency to discount outcomes that are distant in time and that they base their decisions on outcomes that are more proximal (Loewenstein, 1992; Roelofsma, 1996).
3. *Significant persons in the decision maker's social network view the decision as important and will expect him or her to adhere to it.* The more important an outcome is, the more likely it is that the decision maker engages in the anticipation of regret, because more important decisions will result in more intense regret when things go awry (Zeelenberg, 1999).
4. *New information concerning potential gains and losses can be obtained.* Post-decisional feedback is a central determinant of experienced and anticipated regret. When feedback is present,

people can imagine and anticipate regret, whereas when there is no feedback, regret does not play a significant role in the decision process.

5. *Significant persons in the decision maker's social network who are interested in this particular decision are not impatient about his current state of indecision and expect him to delay action until he has evaluated the alternative more carefully.* Several empirical evidences (Beattie et al., 1994; Thaler, 1980) show that anticipated regret promotes decision aversion, that is the tendency to delay or avoid decisions. The delay can be justified when the individual wish to gather more information in order to make a more accurate choice or when he wants to avoid the negative outcome of a decision and the responsibility for these consequences.

How the anticipation of regret can influence real life decisions can be illustrated by the success of the Dutch postal code lottery. In this lottery the winning number is a randomly selected postal code. If your postal code is selected and you have bought a lottery ticket, you win 15,700,000 Dutch Guilders (prize in May 1997, equal to approximately \$8,000,000). The lottery ticket only costs 10 Guilders. The decision whether or not to buy a ticket might be based on regret aversion (Zeelenberg and Beattie, 1997). Imagine the following situation: your postal code is selected. You did not buy a ticket, whereas your neighbor did. How would you feel? You will probably feel a painful regret. The crucial point of this discussion is that if you anticipate this possibility of regret before deciding to buy a ticket or not, it might prompt you to buy a ticket and be protected by severe regret (Zeelenberg and Beattie, 1997). The same situation does not apply to normal lotteries because in these you will never know whether you would have won if you did not play. The organizers of the postal code lottery built their advertisement having in mind the great power of regret. In fact they stated

the following: “Don’t you have any ticket? Then your neighbors will win everything. So make sure to buy some now”. Moreover, since the lottery was connected to a nationwide broadcast TV game show, the feedback was hard to avoid. Thus, the impossibility to avoid feedback and the anticipation of a painful regret, might explain why so many people play this lottery.

3.2. ANTICIPATION OF REGRET ON PURCHASE DECISIONS

The previous scenario has shown that simply asking people to imagine regret they might experience in the future can influence their decisions (Richard, van der Pligt and de Vries, 1996). Consumers often anticipate how they would feel if their decisions yielded negative or less positive outcomes (Baron, 1991). Simonson (1992) studied the role of anticipated regret and responsibility in decision making and how it might apply to the problems of purchase timing and choices between brand name and price. The author demonstrated that consumers’ choices between alternatives can be systematically influenced by asking them to anticipate regret and responsibility they would feel if they made the wrong decision. This question made consumers more likely to make choices that minimizes regret, for example they preferred to purchase a currently available item on sale rather than wait for a better sale and they were more likely to prefer a higher-priced, well-known brand over a less expensive, lesser-known brand. This research has some important implications. First of all, preferences can be influenced by making the possibility of failure more salient. In fact the anticipation of regret is an efficient strategy used to persuade individuals to buy an insurance policy (Hetts, Boninge, Armor, Gleicher and Nathanson, 2000). The anticipation of future regret, on the other hand, can be reduced by the “Low Price Guarantee” policy, which makes consumers more satisfied and more likely to buy (McConnell, Niedermeier, Leibold, El-Alayli, Chin and Kuiper, 2000). For example, in 1990, Chrysler offered the

“Guaranteed Rebate”, which assured buyers that they would be compensated for any rebate offered in 1990 that was greater than the current rebate. Similarly, some stores adopt the policy of guaranteeing the price for a certain amount of days. If the store or other stores offer a better price during that period, the buyer is reimbursed for the difference.

Richard, van der Pligt, and de Vries (1996) demonstrated how the anticipation of regret can be exploited in order to promote prevention behaviors. In their studies, people who anticipated regret after having unprotected sex, put in place more prevention measures in the following months compared to the control group. Similar results have been noticed in the prevention of road accidents (Parker, Stradling and Manstead, 1996), and in the promotion of physical activity (Abram and Sheeran, 2004), strengthening the idea that regret aversion is an important determinant of the decision making process.

3.3. REGRET AVERSION AND RISK AVERSION

Larrick and Boles (1995) demonstrated that the anticipation of regret, due to the manipulation of expected feedback, can lead to risk-seeking behaviors. The participants of the experiment were exposed to a negotiation scenario where they had to haggle with the company ALPHA to obtain an advantageous offer, knowing that they will know the offer of the competing company BETA in a second moment, regardless of the outcome of the negotiation. Participants who were not expecting a feedback on the competing company offer, were less likely to risk, asking less and easily reaching an agreement with company ALPHA. Conversely, participants who were expecting a feedback were more exposed to regret because they found out that they could have received a more convenient offer and

therefore they were more reluctant to find an agreement with the company ALPHA. Avoiding the feedback of the alternative choices, protects the individual from the possibility of feeling regret. The anticipation of regret in the moment of the decision leads the individual to prefer alternatives that minimize the possibility of feeling this painful emotion, it does not necessarily lead to the less risky alternative. The relation between the anticipation of regret and risk attitudes is widely discussed in the two experiments below.

3.4. EXPERIMENT 1: REGRET AVERSION AND EXPECTED FEEDBACK ON RISKY DECISION MAKING - ANALYSIS OF GAINS AND LOSSES

The experiment was run to answer the question of how anticipated regret affects risky decision making. Previous studies have linked the anticipation of regret to risk-aversion. The present study aims at showing that anticipated regret, caused by expectation of feedback, can result in risk-averse and risk-seeking choices depending on which of the two is the regret-minimizing option (Zeelenberg, 1999).

3.4.1. Method: Participants, Experimental Design and Procedure

100 students of Ca' Foscari University of Venice, voluntarily participated to the experiment. The sample is composed by 42 males and 58 females. The scenario was presented via social network. Therefore participants received in their Facebook mail box the link to participate to the experiment composed by multiple choice questions between equally valued alternatives. The questionnaire asked the participants to report their age and gender for a more complete analysis of results. There were four questions representing

four different scenarios. In the first question, individuals were asked to choose between winning €500 for sure or to accept a risky gamble where they had 50% probability of winning €1000 and the other 50% of winning nothing. By hypothesis, the outcome of the safe choice is known. The outcome of the risky option was discovered only if the individual chose that option. The second scenario represented the same situation but the individual would have known the outcome of the risky choice, regardless of the choice made. The third question was about a choice between losing €500 for sure or to accept a risky gamble with 50% probability of losing €1000 and 50% of losing nothing. The outcome of the risky option was discovered only if the individual chose that option. The fourth scenario proposed the same situation of the third question, with the difference that the individual would have received the outcome of the risky choice, regardless of the choice made. Answering these four questions required less than 5 minutes. All data are analyzed with the statistic software Stata.

3.4.2. Expected Results

According to prospect theory, the expected behavior of individuals would be characterized by risk-aversion in the domain of gains and risk-seeking in the domain of losses (Kahneman and Tversky, 1992). With the introduction of expected feedback, the behavior of participants in question 1 would be different from question 2, even though the majority of the answers should be in line with risk-aversion. In the scenarios proposed in questions 3 and 4, a risk-seeking attitude is expected, justified by the fact that we are in the domain of losses. The introduction of expected feedback would provoke a switching behavior of some individual. An important question to be answered is whether there are any significant gender and age differences on risk attitudes. An important point of this research would be to understand

whether the introduction of total feedback impacts more on the domain of gains or on the domain of losses.

3.4.3. Results and Discussion

This research demonstrated, as expected, that the anticipation of regret can promote risk-aversion but also risk-seeking tendencies, depending on which option is regret-minimizing (Zeelenberg, 1999).

Condition	Decision	
	Risky Option	Safe Option
Partial Feedback	8%	92%
Total Feedback	17%	83%

Table 3.1: Percentage of participants deciding for the risky and safe option in condition of partial feedback and total feedback (Domain of Gains).

The table represents the results obtained in the scenario 1 and 2. Partial feedback denotes the situation described in the first scenario, where the feedback on the outcome of the safe option is known by hypothesis (winning €500) and the outcome of the risky option would have been known only choosing that option. Total feedback condition characterizes the second scenario where regardless of the selected option, the individual will know the outcome of both options. Thus, he will know how much he has or would have won. In the domain of gains, a risk-averse attitude emerges, because people prefer a sure gain rather than risk. The introduction of feedback

changes the behavior of some participant. Even though the majority of individuals chooses the regret-minimizing option, that in this case is represented by the safe option, more people decide to risk in this second scenario compared to the first one (in partial feedback condition 8% of participants chose the risky option whereas 17% chose it in the total feedback condition). People minimize regret to protect their self-esteem. When choosing between a risky and a certain gain, the certain gain is the regret-minimizing option, since one will always win something (Josephs, Larrick, Steele, Nisbett, 1992). The effect of the anticipated regret, introduced by expectation of feedback, have generated the effect of switching 9% of population toward the risky option. Participants who made this different choice between partial and total feedback condition, justified their actions saying that they prefer to risk and feel no regret afterwards; or that they wanted to try to win €1000 to not be disappointed.

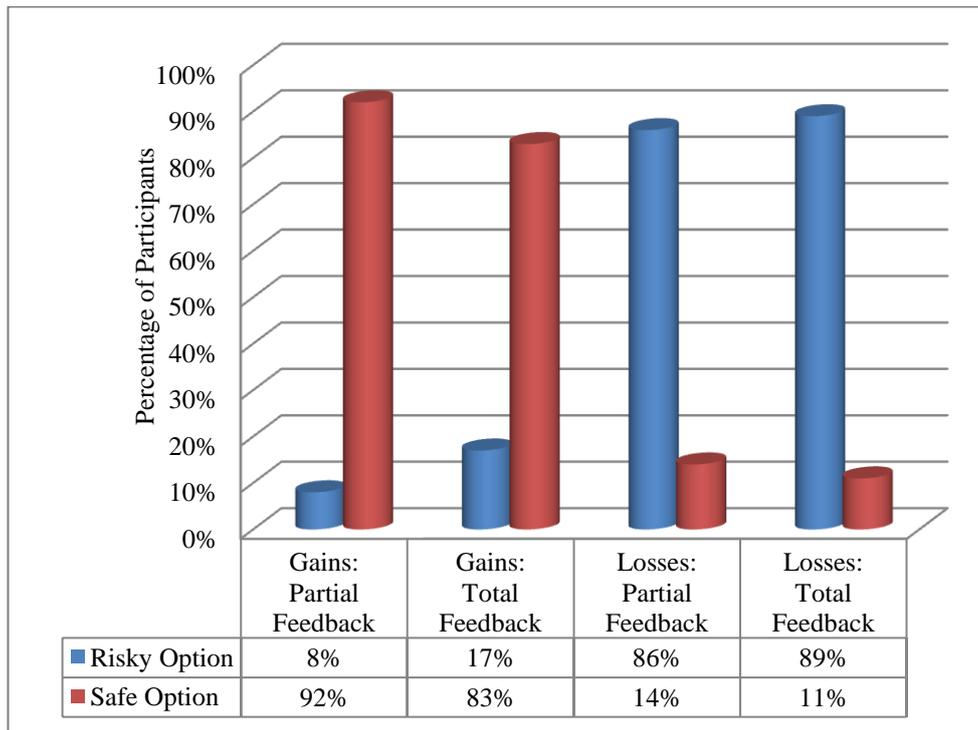
Condition	Decision	
	Risky Option	Safe Option
Partial Feedback	86%	14%
Total Feedback	89%	11%

Table 3.2: Percentage of participants deciding for the risky and safe option in condition of partial feedback and total feedback (Domain of Losses).

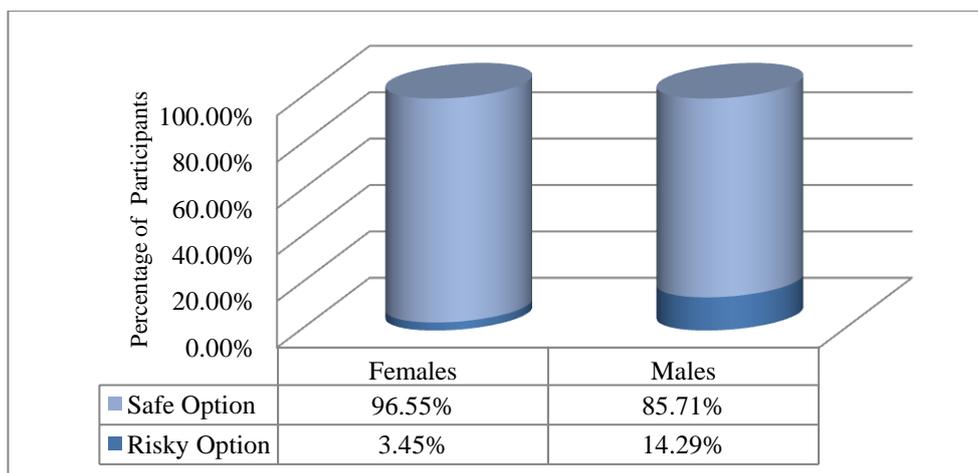
In the domain of losses, a preference reversal phenomenon is outlined. People show a risk-seeking behavior as predicted by Kahneman and Tversky (1992). The table represents the results obtained in the third and

fourth scenarios. Partial feedback denotes the situation described in the third scenario, where the feedback on the outcome of the safe option is known by hypothesis (losing €500) and the outcome of the risky option would have been known only choosing that option. Total feedback condition denotes the fourth scenario where regardless of the selected option, the individual will know the outcome of both options. Thus, he will know how much he has or would have lost. In the domain of losses, a risk-seeking attitude emerges, because people prefer an unsure loss rather than a sure one. The introduction of feedback does not change the behavior of participant significantly. This can be justified by loss-aversion. Only 3% of people switched from the sure option to the risky one and so even more people than before chose the risky option. The phenomenon of regret aversion, due to total feedback condition, has greater impact on the domain of gains, since more people switches from the safe to the risky option compared to the rather small switching registered in the domain of losses.

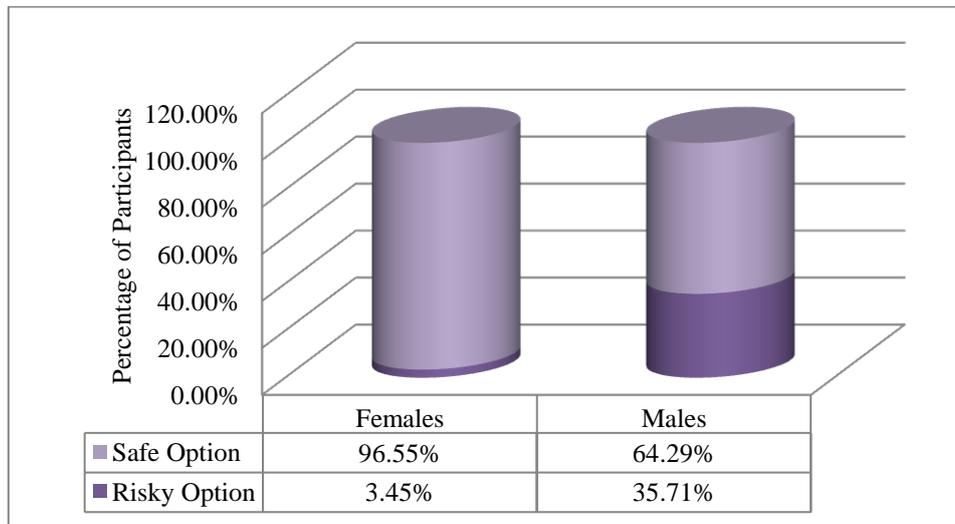
Interesting findings of this research are the gender differences in risk behavior. Considering the first scenario of partial feedback 96.55% of females chooses the safe win whereas only 3.45% chooses the risky one. Looking at males, a lower percentage chooses the safe option (85.71%) and a bigger (14.29%) chooses the risky one. Comparing these results, we discover a significant difference in gender. In particular, even though the preferred choice for males and females is the regret-minimizing one, and thus the safe option, a bigger percentage of males tends to prefer the risky option (it is statistically significant at the 5% level, $t(98) = 1.9909$, $p\text{-value} = 0.0246$).



Graph 3.1: Risk attitudes in the domain of gains and losses in partial and total feedback conditions.



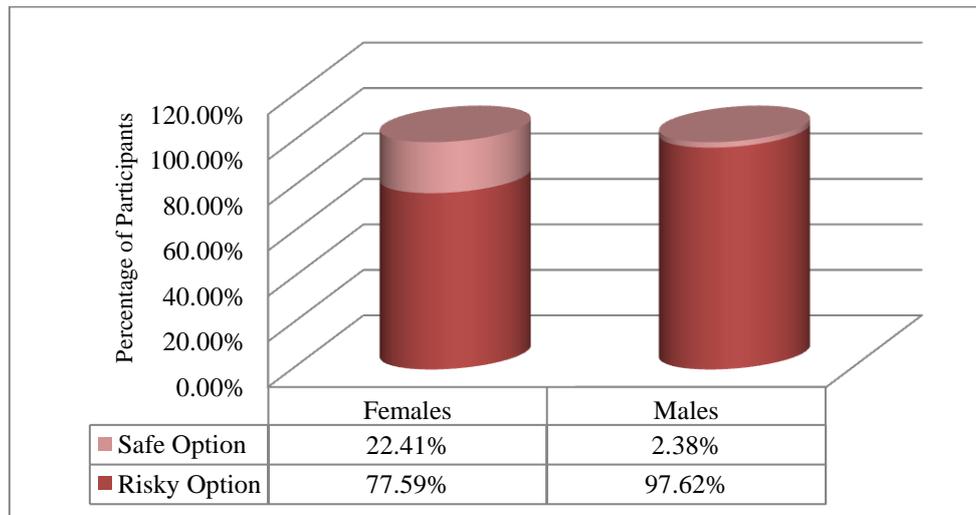
Graph 3.2: Gender Differences in Risk Attitudes: Domain of Gains – Partial Feedback (Question 1).



Graph 3.3: Gender Differences in Risk Attitudes: Domain of Gains – Total Feedback (Question 2).

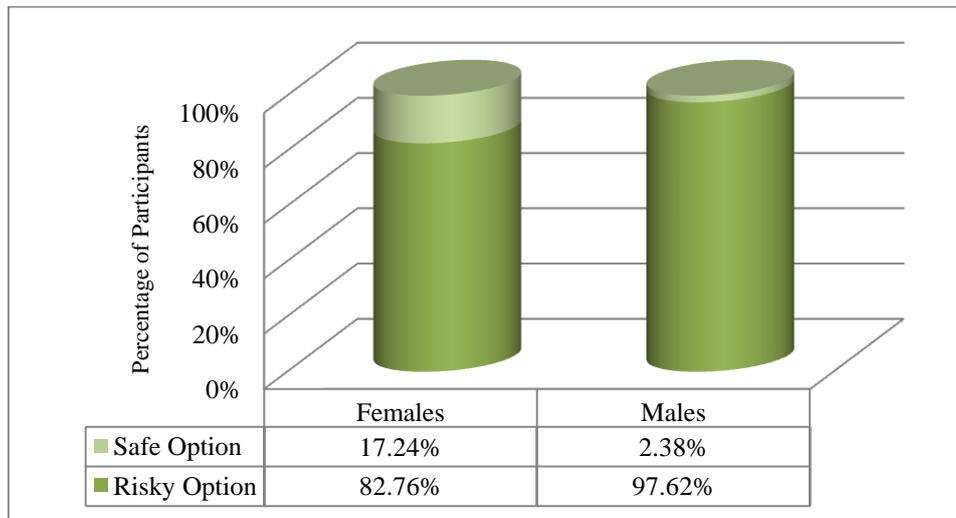
The analysis of results relative to the second scenario, shows how the introduction of total feedback shapes risk attitudes across gender. Surprisingly, females do not change their preferences. If they had chosen the safe option in the first scenario, they chose the safe in the second. Thus, the introduction of feedback has no effect on female preferences. Instead, it has important effects on males. Therefore gender differences are relevant, regret aversion caused by expectation of total feedback leads men to make riskier decisions, whereas it has no effect on women (it is statistically significant at the 1% level, $t(98) = 4.6340$, $p\text{-value} = 0.0000$).

Above we have seen that the situation is reversed for losses because people are risk-loving in this domain. Moreover, the introduction of total feedback does not have important implications on the individual preferences. What is interesting now is to investigate on the difference across gender. As in the domain of gains, females turned out to be more risk-averse than men.



Graph 3.4: Gender Differences in Risk Attitudes: Domain of Losses – Partial Feedback (Question 3).

Even though it is evident that the majority of participants prefers the risky choice, women are more risk-averse, because a greater number of women than men is willing to pay €500 to avoid the risk of losing €1000. In the domain of losses, there is no regret-minimizing choice: opting for a sure loss is threatening to self-esteem because it represent failure; opting for the risky loss can result in regret when having lost more than in the sure loss option, which again is threatening to self-esteem (Josephs et al, 1992). Males are more risk-seeking than females in the partial feedback condition, 97.62% of males chooses the risky option versus the 77.59% of females. Gender differences significantly, men risk more then women (it is statistically significant at the 1% level, $t(98) = 2.9429$, $p\text{-value} = 0.0020$).



Graph 3.5: Gender Differences in Risk Attitudes: Domain of Losses – Total Feedback (Question 4).

Men exactly behaved as in the previous situation, 97.62% chose the risky option and 2.38% the safe one. Therefore they were not affected by the anticipation of feedback, as women are. A minimal percentage of women switched from the safe option toward the risky one. They justified their behavior saying that in the previous situation they were willing to pay €500 in order not to know whether they could have lost nothing, whereas in this situation they were willing to incur the risk and chose the risky option because they would know its outcome anyway. It is a way to minimize regret, since they had chosen to pay €500 and then it turned out that they would not have lost anything, the regret would have been very high. Also here, we can outline a significant difference in behavior between males and females. Male are more risk-seeking than women (it is statistically significant at the 1% level, $t(98) = 2.3871$, $p\text{-value} = 0.0095$).

While there are significant differences across gender, there are not significant differences across ages linked to risk preferences and regret-minimizing choices.

To summarize, the results of the experiment show that anticipation of regret, caused by the expectation of feedback on foregone options, can promote risk-averse and risk-seeking choices (Zeelenberg et al,1996). This finding contradicts the claim that the anticipation of regret only results in risk-aversion (Kardes, 1994). Participants show regret aversion, making choices to minimize future regret. These choices can be relatively risk-seeking or relatively risk-avoiding. People show risk-aversion in the domain of gains and risk-seeking behavior in the domain of losses, independently from the condition of partial or total feedback. Expectation of feedback have effects on a percentage of men who switched from the safe to the risky option in the domain of gains, whereas it does not have any consequences on women. There are significant differences across gender, in particular men show more risk-seeking attitudes than women in the domain of gains. As far as the domain of losses is concerned, the situation is reversed. The majority of people opts for the risky option, as predicted by prospect theory, regardless of the feedback condition. In the domain of losses there is no regret-minimizing choice. Expectation of feedback does not have substantial effects. It does not have any effect on the male behavior, whereas a small percentage of females switched from the safe to the risky option. Men are more affected by the expectation of feedback in the domain of gains, whereas women are more affected (even though less than men) by the expectation of feedback in the domain of losses. There are also important differences in risk attitude across gender in the domain of losses. As in the domain of gains, men show significantly more risk-seeking behavior than women. No correlations are registered between age and risk attitudes.

3.5. EXPERIMENT 2: FEEDBACK MANIPULATION IN ULTIMATUM GAME: LEVELS OF REGRET IN GAINS AND LOOSESS

The second experiment was performed in order to measure the different levels of regret in the context of ultimatum game. The regret is introduced through the manipulation of feedback following the participant's proposal. Whereas the previous experiment has analysed the behaviour of people in a purely individual context, the present experiment tests how decisions are made in an interpersonal context. The ultimatum game is played by the following procedure. Two players are allotted a sum of money, €100. Player 1 (the participant of the experiment/the Proposer) has to propose the division of money to Player 2, the Responder (for example €60 for herself and €40 for Player 2). If the Responder accepts, he gets €40 and the Proposer gets the rest. If the Responder rejects the offer, both players get nothing. Economic theory would predict that the Responder should accept any amount of money greater than zero, since it corresponds to more than they would get by rejecting the offer. Player 1, knowing this, should propose the following division: €99,9 for herself and just €0.01 for Player 2. However, previous researches, have shown that people hardly offer the other player one cent. If they do so, the other player would refuse the proposal (Zeelenberg, 1999). Commonly the average proposals are in the regions of 55-65%, with a 50-50 split as the mode. Proposals of more than 80% are frequently rejected (Camerer and Thaler, 1995).

3.5.1. Method: Participants, Experimental Design and Procedure

100 students of Ca' Foscari University of Venice, voluntarily participated to the experiment. The sample is composed by 42 males and 58 females. The scenario was presented via social network. Therefore participants received

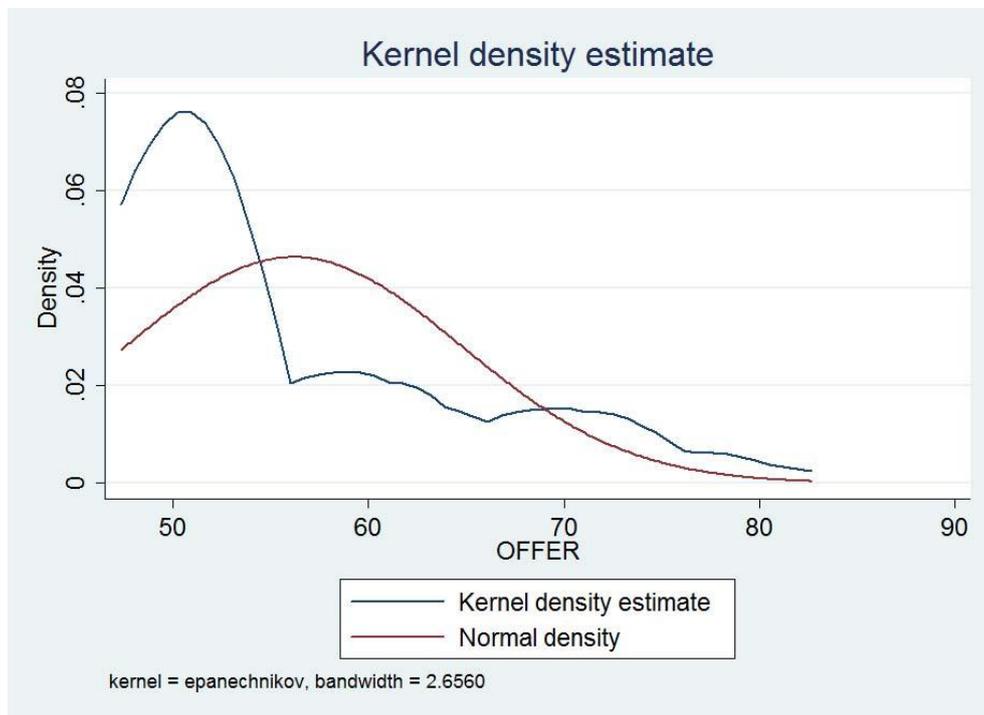
in their Facebook mail box the link to participate to the experiment composed by 5 questions which 4 are multiple choice. The questionnaire asked the participants to indicate age and gender for a more complete analysis of results. The participant is asked to indicate to the amount of money that she proposes to keep for herself. Therefore there were four questions representing four different scenarios. In the first question, the individual was noticed that the Respondent accepted her proposal, but he would have accepted it also if she had asked €2 more. Thus, the participant is asked to indicate her level of regret for not having proposed and therefore not obtained €2 more, on a scale from 1 (indicating the absence of regret) to 10 (indicating the highest level of regret). In question two the participant was told that Player 2 accepted her offer, but he would have accepted it also if she had asked €10 more. Thus, the participant is asked to indicate her level of regret for not having proposed and therefore obtained €10 more, on a scale from 1 (indicating the absence of regret) to 10 (indicating the highest level of regret). In the third scenario the Responder refuses the proposal. Therefore the individual got nothing. But she was told that Player 2 would have accepted if she had proposed €2 less. Thus, the participant is asked to indicate her level of regret for not having proposed €2 less, on a scale from 1 (indicating the absence of regret) to 10 (indicating the highest level of regret). The fourth scenario describes a situation where the Responder refuses the proposal. Therefore the players got nothing. Player 1 was told that Player 2 would have accepted if she had proposed €10 less. Thus, she is asked to indicate her level of regret for not having proposed €10 less, on a scale from 1 (indicating the absence of regret) to 10 (indicating the highest level of regret). Answering these five questions required less than 5 minutes. All data are analyzed with the statistical software Stata.

3.5.2. Expected Results

Player 1 can regret two things, proposing too much money when the offer is rejected and proposing too little when the offer is accepted (Zeelenberg, 1999). The expected mean proposal would be around €55, because none would propose less than the 50% split, and none would ask to keep too much (more than 80%). There are two reasons why regret about proposing to keep less money is less severe than regret about proposing a lot of money. First, when Player 1 proposes to keep for herself an amount of money close to the 50-50 split, she still has money, because the Respondent will accept with a very high probability. On the contrary, when Player 1 proposes to keep a lot of money for herself, there are high probabilities that the offer will be refused. Therefore the regret-minimizing option for the Player 1 is to propose to keep an amount close to the 50-50 split, in order to maximize the probabilities of acceptance. After the Proposer has made her offer, he will discover the Responder's minimal acceptable offer. This is the way in which regret is introduced into our experiment. Feedbacks of this kind can make regret about a proposal that is too low more severe. Proposers who expect this feedback might anticipate the possible regret, and move away from the 50-50 split (Zeelenberg, 1999). A higher level of regret is expected when the proposal was too high that the Responder refused it, and Player 1 is told that if he had proposed few Euros less, Responder would have accepted. For this reason regret should be high, because Proposer was very close to get all the money that Responder was willing to renounce, instead of getting nothing. Then, a high level of regret, but not as high as the situation just described, is expected when the Responder accepted the offer but he would have accepted it also if the participant would have proposed €10 more. Conversely, the levels of regret in the other two scenarios are not expected to be very high because getting €2 more would not change a lot the utility of

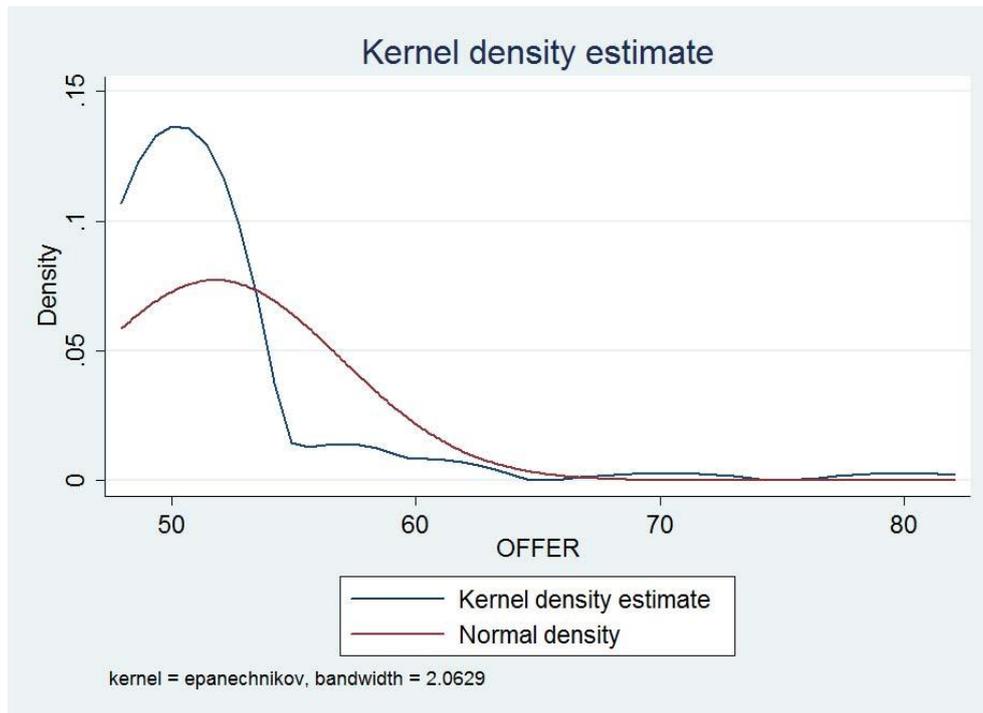
Proposer and knowing that the offer was refused by €10 would mean that the Responder's minimal acceptable offer was very far from the actual proposal. An interesting point would be analyzing the behaviors of individual according to their gender and ages.

3.5.3. Results and Discussion



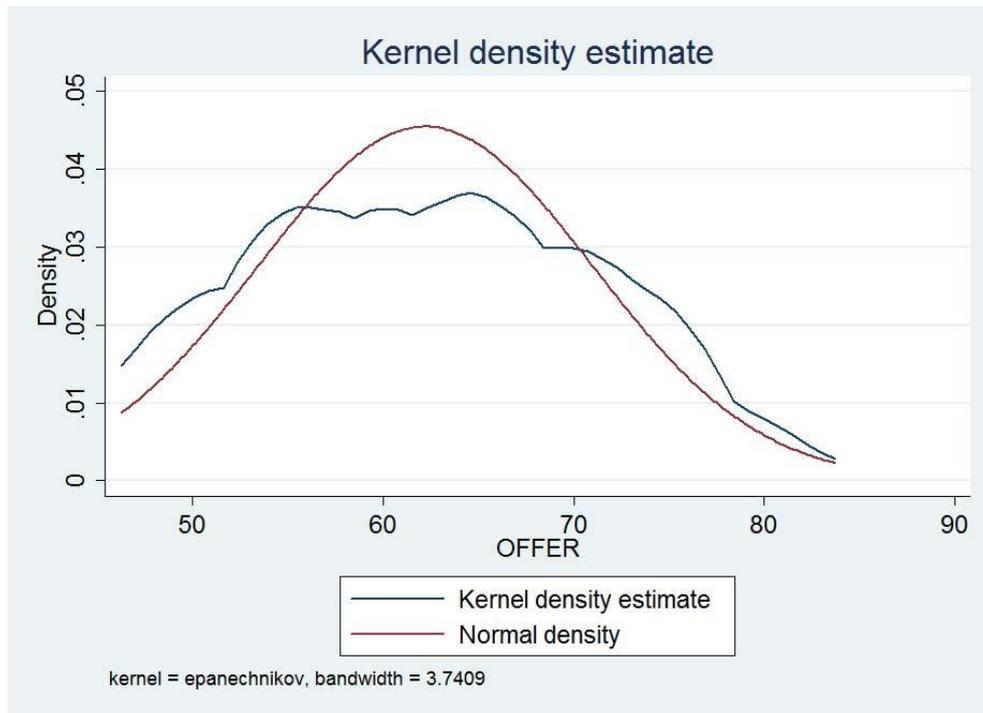
Graph 3.6: Kernel Density Estimate of Proposals.

The mean offer is 56.17 (SD=8.601). From the graph, we can see that the distribution is centered between 50 and 60, then it decreases toward 80, which represents the greatest offer. In order to investigate the differences between gender in ultimatum game proposals, we construct the same graph divided by gender.



Graph 3.7: Kernel Density Estimate of Female Proposals.

The distribution of the proposals made by women is very similar to the general distribution of the proposal. Females' mean offer is 51.7931 (SD=0.6779558). Considering the distribution of the male proposals, it is evident that the distribution is more similar to a normal distribution. Mean offer is 62.21429 (SD=1.354451). Therefore men are more likely to offer more and to risk more than women ($t(98) = -7.4441$; $p\text{-value} = 0.0000$). These results are in line with the findings of the previous experiment. Moving our attention to age differences, there is a significant difference in the behavior against risk between younger and older students. In particular, older students tended to propose lower offers than younger ($X^2_{1,4} = 10.287$, $p\text{-value} = 0.0359$). This is an evidence of the Steven and Albert's research (2012).



Graph 3.8: Kernel Density Estimate of Male Proposals.

As expected, our results show high levels of regret ($M= 7.29$, $SD= 2.21243$) when the individual's proposal is very close to the minimal acceptable offer (see theory in chapter two). Then, the second highest level of regret is recorded in the second scenario ($M= 4.66$, $SD= 1.628161$) where the proposal is accepted but it would have been accepted even if it was 10% higher. Lower levels of regret are registered for the situation where the proposal was refused for €10 ($M= 2.54$, $SD= 1.09563$), and even lower levels for the situation in which the offer is accepted but the Proposer could have asked and therefore have gained 2% more ($M= 1.57$, $SD= 0.6705192$). A further analysis allows us to evaluate the different levels of regret across gender. In the four scenarios, women reported more regret than men. This is an interesting finding suggesting that women make regret-minimizing proposal in the direction of proposing an amount close to the equal split.

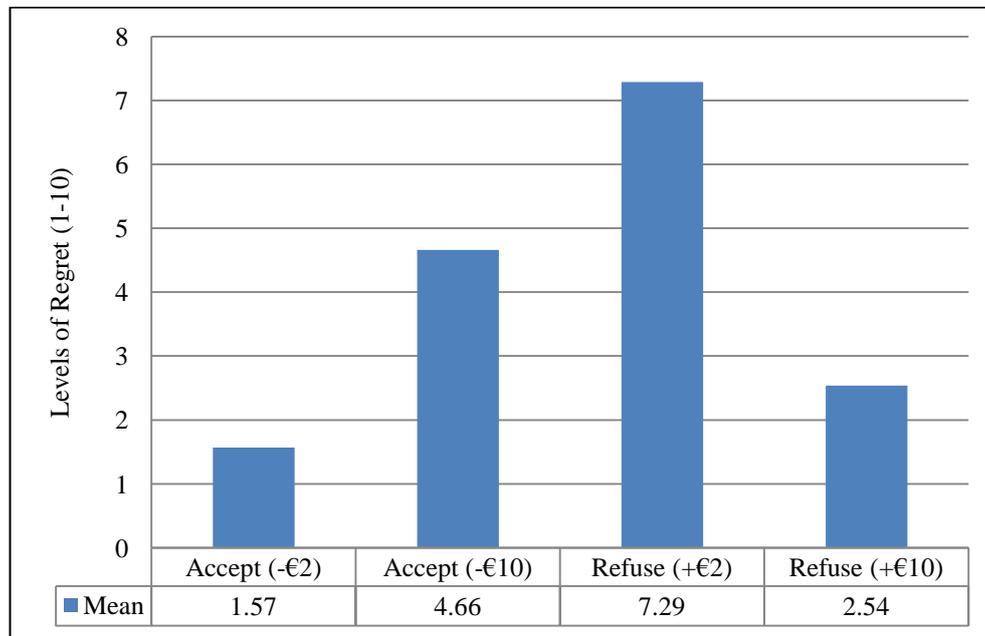
The regret-minimizing proposal for men turned out to be higher than for women and the reported levels of regret to be lower (Table 3.3).

	General	Females	Males	t and p-value
Accept (-€2)	1,57	1,83	1,21	t(98) = 5.0402 p-value = 0.0000
Accept (-€10)	4,66	4,91	4,31	t(98) = 1.8542 p-value = 0.0334
Refuse (+€2)	7,29	7,55	6,93	t(98) = 6.8713 p-value = 0.0000
Refuse (+€10)	2,54	3,07	1,81	t(98) = 1.3968 p-value = 0.0828

Table 3.3: Levels of regret (mean values) for the four different scenarios, divided by gender. T-test on gender differences.

In general, the expectation of feedback on responder minimal acceptable offer leads participants to make higher proposals (Zeelenberg and Beattie, 1997). This behavior is the result of regret aversion, because high proposals would generate less regret if accepted. Therefore we can conclude that men are more regret averse because they made higher proposals in average than women. The proposals, in general were not so high to be rejected, which suggests that participants minimized both the regret that could arise from proposing too little and the regret that could arise from proposing too much.

To conclude, regret aversion works in two directions and the proposal should be accurate in order to minimize future regret.



Graph 3.9: Levels (mean values) of regret corresponding to four different scenarios.

Further researches have measured the intensity of experienced retrospective regret. After participants received feedback and indicated their regret, they were asked to make a second choice. Decision makers who have just experienced regret will probably behave differently than decision makers who did not experience regret. Participants who could have proposed for themselves €10 more, experienced more regret than participants who could have proposed only €2 more. When they were asked to play a second round of the ultimatum game their proposals were influenced by the amount of regret experienced, and they asked to keep more money for themselves (Zeelenberg and Beattie, 1997). They behaved in such a way that their regret will disappear, or future regret will be minimized.

To conclude, this experiment described the regret-minimizing behavior of people making decisions in an interpersonal context, namely in an ultimatum bargaining situation. Expectation of feedback leads to higher proposals than general ultimatum game. Proposals significantly differ across gender, in particular, men proposed to keep more money when deciding the splitting, whereas women's proposals were lower. There is an interesting trend for the proposals, in fact they turned out to be higher for younger students. Regret can arise from two different directions, and people have to be able to average them in order to take the regret-minimizing decisions. Proposers can regret of having proposed too little, or of having proposed too much because the proposal, in this case, has higher chances to be rejected. Very high levels of regret are registered when the proposals were rejected and the minimal acceptance offers were very close to the actual proposals. Lower levels of regret were registered when the proposals were accepted and the Responder would have accepted offers a little bit higher. Women registered higher levels of regret than men. Correlated studies have shown that the experience of retrospective regret influences future decision making, as chapter four will describe.

CHAPTER 4

Effects of Experienced Regret on Future Choices

It is frustrating but true that even one's best decisions sometimes result in unwanted outcomes (Ratner and Herbst, 2005). It is inevitable, sometimes it happens that things do not turn out to be as we wish, and we think that we could have done something different to avoid the feeling of that painful emotion called regret. In this chapter we will analyze the effect of regret on future choices. Regret can be considered as an adaptive emotion that helps individuals to learn from the best options (Zeelenberg, 1999; Zeelenberg et al., 2001). The research suggests that, as in the case of the anticipation of regret, also the experience of regret is a determinant of the decisional activity. According to Zeelenberg and Beattie (1997), the experience of regret pushes people to soften the intensity of regret and to minimize the possibility to experience it again in the future. Zeelenberg and Beattie induced regret in ultimatum game (as explained in chapter three) where participants were divided into two groups: the control group and the experimental group. People were playing the role of proposers and their proposals have been always accepted. Participants of the experimental group were told to be too generous and that the proposal would have been accepted even if it was a lot lower. In the second round, the experimental group's proposals were higher than in the first one whereas the control group's remained unchanged. The authors stated that the experience of regret lead participants to change their strategy.

As anticipated in chapter two, a study on consumers was performed to gain information on the different effects of the experience of regret and disappointment on future behavior (Zeelenberg and Pieters, 1999). Participants were asked to think about an unsatisfactory event occurred with a service provider. The authors have demonstrated that when the dissatisfaction was associated to disappointment, the response consists on the willingness to complain with the service provider and to tell other people the bad experience. When instead dissatisfaction is associated to regret, consumers tend to switch provider, abandoning the previous provider to a new one. Going back to the old provider would mean risking to feel regret one more time. Therefore switching to a new provider is the regret-minimizing choice. The experienced regret seems to favor the *switching behavior*, the tendency to behave differently than in the past. This effect is a functional consequence of regret, because it avoids repeating the mistakes in the future, increasing the possibility of obtaining better outcomes.

4.1. RATNER AND HERBST'S STUDIES

Ratner and Herbst (2005) performed four experiments and demonstrated that the experience of regret can lead to dysfunctional effects and non-adaptive behaviors. Most of the times the dominant alternative is abandoned and an alternative one, which is suboptimal, is preferred. In their first experiment, participants have been asked to decide to choose between two brokers to invest \$5000. The two brokers have different probabilities of success: broker A has a probability of success equal to 43% whereas broker B has 54%. As expected, nearly all the participants chose to invest money with broker B, that is the dominant alternative. Later, people were informed of the outcome of the investment. In particular half of them received a positive outcome, that means that chosen broker was successful and now the

investment is equal to \$5750. The other half of the participant was informed that the broker was not successful and the investment is equal to \$4250. People are now asked to answer to a series of items regarding their decision and their feelings. Participants who have obtained a negative feedback, not only experienced more regret than those who have obtained a positive feedback, but they also feel to had taken a bad decision and they wish to go back in time and change their actions. Moreover all participants are asked what they would do if they have to choose again to entrust their money to one of the two previous brokers. Nearly all the people who received positive feedback chose broker B again, whereas just 77% of the people who received negative feedback entrusted their money to broker B for the second time. Analysis demonstrated that the intention to switch broker depends on the kind of feedback obtained and on the experienced regret. The willingness to change broker does not depend on the revision of knowledge, the *hindsight bias*, because both the participants that would maintain the same broker, and those who would like to switch to the other, agreed that the probability of future success of broker B was greater than broker A. The experience of regret has lead to the intention of make a suboptimal choice in the future, abandoning the dominant choice to prefer an alternative with lower probability of success. Subsequent experiments have shown that the intention of switching broker was exclusively due to the emotional reaction after the outcome.

In the second experiment, even though participants were asked to produce the expected probabilities of success of the two brokers before taking the decision, the effect of switching behavior was not reduced. The third experiment has produced another evidence of how much regret biases decision making. In fact, after the feedback, participants were invited to focus on their emotions by answering to a series of items about their

feelings, or to think about the cognitive processes by answering to a series of items about the probabilities of the trends in the market. The switching effect turned out to be greater for participants who focused their attention on emotions (53% wanted to change broker), whereas switching behavior was lower for people who focused on their cognitive processes (17% wanted to change broker).

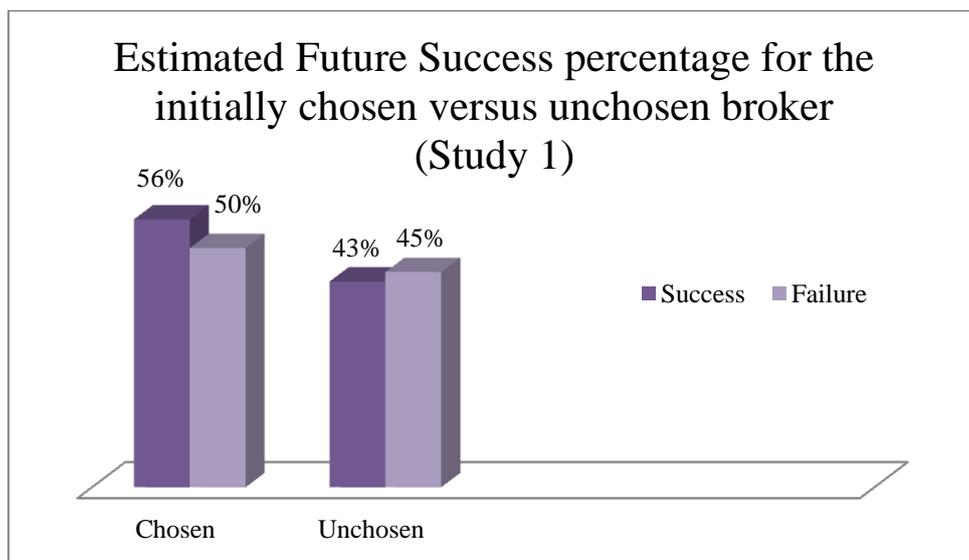


Table 4.1: Estimated Future Success percentage for the initially chosen versus unchosen broker (Study 1). Source: Ratner and Herbst, 2005.

In the forth experiment the authors have investigated on the relation between the intention to change choice and the *need for cognition*, a personality variable that reflects the tendency to spontaneously engage in cognitive activities (Cacioppo and Petty, 1982). The results have demonstrated that participants with high levels of need of cognition were more likely to choose the broker with more probability of success than the participants with low need for cognition.

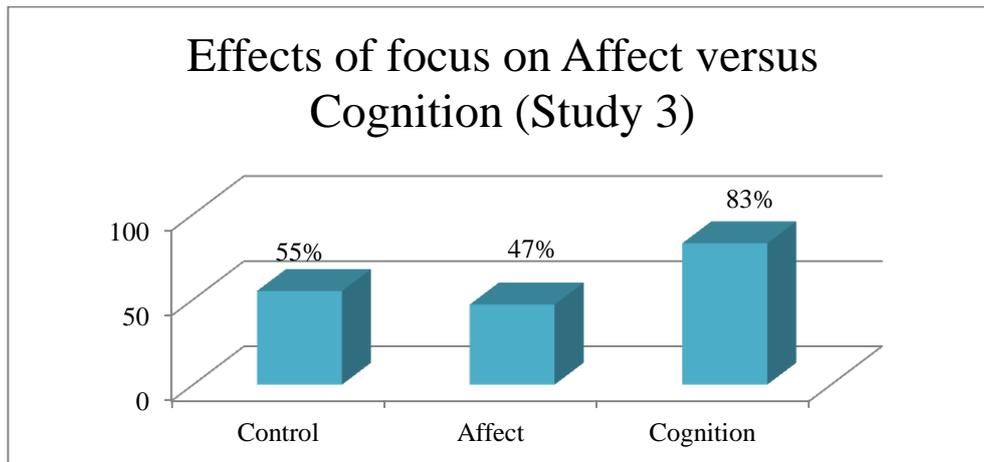


Table 4.2: Effects of focus on affect versus cognition on the percentage choosing to return to the original broker following a negative outcome (Study 3). Source: Ratner and Herbst, 2005.

In this way Ratner and Herbst (2005) generalized the results of the third experiment: people who tend spontaneously to give more importance to cognitive components of a decision, such as the probabilities of success of the alternatives, are less likely to base their decision on the emotions and in this case on regret.

To sum up, the results of Ratner and Herbst's studies have demonstrated that people tend to feel regret as a consequence of what, in retrospective, turned out to be the best choice, and the experience of regret reduces the intention of taking again the same choice if the same situation will arise in the future. However, this study has some limitations. It does not permit to distinguish whether the effect of switching behavior is due to regret or to the outcome bias (Baron and Hershey, 1988). In fact the authors just compare two situations, one with positive outcome and the other with negative one. Therefore it is not possible to understand whether the switching behavior was driven by regret or by the negative outcome. Another limitation is that

the observed effect of switching behavior is not only linked to an actual action, but also to the intention of behaving in a certain way in a situation. The authors states that the different outcomes of experiment one can change the estimation of the probability of success of broker B: from 54% to 50% following the failure of the first experiment, and 54% to 56% in case of success. The experimental situation does not exclude that participants have perceived the two events, the first and the second choice between the brokers, as dependent. More specifically, the outcome of the first experiment could have been considered as informative of the skills of the chosen broker and be used to modify the expectation of future success.

4.2. EXPERIENCED REGRET ON CONSUMER BEHAVIOR

Bui, Krishen and Bates (2011) built a study regarding the impact of regret on cognitive processes by developing and testing a model of the effect of regret on brand switching intention, satisfaction levels, negative emotions, and ruminative thoughts. Regret is an important construct of study when explaining consumer decision making. In particular, regret has a positive effect on brand switching intention and a negative impact on satisfaction levels (Bui et al., 2011). Therefore, the role of regret has crucial implications for marketers who are interested in creating brand loyalty, as well as for those managers looking to reconstruct relationships among consumers that have had negative experience with that brand. These findings indicate that it is important for managers to focus on the causes of regret and to mitigate its consequences. Consumers always compare their experienced purchase choices with foregone alternatives. Thus it is important to maximize consumers' positive brand evaluations over time. Even when alternative brands are not available, consumers may engage in counterfactual thinking and mentally simulate what might have occurred.

Consequently, it is important for marketers to engage in post-purchase communication efforts to minimize regret, even when alternative brand is not present. The findings also validate existing research regarding the influence of regret on consumer behavior and decision making (Inman and Zeelenberg, 1997). Consumers, should pay close attention to the extent of which negative emotions are felt. The amount of negative emotions felt, impacts both on the extent of satisfaction level and on the extent of rumination experienced. To conclude, both consumers and marketing managers should be prepared to deal with the consequences of consumer regret. Likewise, it will benefit marketing managers to try to minimize consumer post-purchase regret. By furthering their understanding of the consequences experienced due to regret and the extent of negative emotion, both firms and individuals will be able to enhance their overall welfare.

Inman and Zeelenberg (1997), through a series of experiments, tested the role of regret in situations of repeated purchases versus switching decisions. As we have seen in chapter two, the decision making literature has consistently reported that decisions to maintain the status quo tend to be regretted less than decisions to change it. For example, Simonson (1992) assesses the regret in search pattern for a journal article. Participants of his experiment showed more regret if they started searching from the last issue and found the article in the first issue than if they had started searching from the first issue and found it in the last issue. In fact, starting to search from the beginning is the default option (the status quo option). Kahneman and Miller (1986) stated that people feel greater regret after a decision where they can easily imagine the alternative better outcome than when it is hard to imagine a better result.

As consumers, we always ask ourselves whether to continue doing things as we have been doing (repeating) or to change to a different option (switching). The status quo is the tendency to maintain one's current or previous decision (Samuelson and Zeckhauser, 1988). Previous information and previous decisions play a crucial role for future decisions. If there is sufficient motivation to warrant a switch, then consumers will feel less regret in the face of a subsequent negative performance by the chosen alternative (Inman et al, 1997). Therefore, having good reasons to switch may protect the consumer to regret when she opts to switch. In a series of four studies, the authors stated that if there is sufficient motivation justifying a switch, consumer will experience less regret following a subsequent negative outcome realized through a switch than in one realized through a repeated purchase. To conclude, the negative emotion of regret can be mitigated when the decision are justified and appropriated under the circumstances.

4.3. REGRET: A FUNCTIONAL AND DYSFUNCTIONAL MECHANISM

The effects of regret anticipation in decision making process have been largely covered in the literature as we have seen in chapter three. Regret aversion drives people to prefer options that minimize the possibility of feeling this painful emotion. Nevertheless, the regret is a common experience because of the numerous states of the world and the numerous possible outcomes. What are the consequences of the experience of regret? What happens when regret is the consequence of a good decision, that turns out to do not have the desirable outcome? What can we do in order to manage the experience of regret? It is not always possible to go back in time and delete or change the results of the choice already taken. Therefore, the

only thing we can do is to behave differently in the future in the case a similar situation will occur (Ratner and Herbst, 2005). It is a functional mechanism that helps us to learn from mistakes and to reduce the probabilities of future negative outcomes. But sometimes, as stated in this chapter, this mechanism is not functional and it leads to suboptimal choices with lower probabilities of success. The experience of regret can be so strong that it causes switching behavior, and so to abandon the alternative that has led to regret in the past and to take a different course of action even if the probability of success is still greater in the abandoned alternative. Following the analysis, it is clear of how the experience of regret is crucial on future decision making and how switching behavior is qualified as bias of decision. Having analyzed two situations with the same negative outcome, but where regret was introduced only in one situation, leads us to compare the effect of regret with the effect of negative outcome (outcome bias). Negative outcomes had a reduced impact on future decisions, but situations of regret led to switching behavior. An aspect that deserves particular attention and further analysis is the temporal duration of the regret experience. For how long does the experienced regret keep influencing and bias our decisions? Is it a short effect that vanishes after the intervention of “psychological repair work” (Gilovich and Medvec, 1995), or on the contrary, it is so hard to have effects on medium long-run? Future researches will answer these questions.

CHAPTER 5

A Neuroeconomic Perspective

In recent years, decision making has become a subject of neuroscience research. The nascent field of neuroeconomics has been capturing a lot of attention by researchers who seek to investigate on the brain areas that play a crucial role on decision making and on the associated emotions. This discipline was born with the aim of contrasting standard economic models of human decision making (such as utility theory) which have typically minimized or ignored the influence of emotions on people's decision making behavior, (wrongly) idealizing the decision maker as a perfectly rational cognitive machine (Sanfre, Rilling, Aronson, Nystrom and Cohen, 2003). However, this assumption has been challenged by behavioral economists, who have identified additional psychological and emotional factors that influence decision making (Camerer and Lowenstein, 2003; Loewenstein and Lerner, 2003) and recently researchers have begun using neuroimaging to examine behavior in economic games (McCabe, Houser, Ryan, Smith and Trouard, 2001).

Studying animals is informative about humans because many brain structures and functions of non-human mammals are similar to those of humans (in particular we are more similar to monkeys than those species are similar to other species). Human brain differs from animals' one because the brain cortex is folded many times over itself in order to provide the widest possible surface to the neuronal substrate. The cortex is the most developed brain area in humans, it is equal four times the brain cortex of a gorilla. Humans are different from other animals in that we worry about or derive

immediate pleasure from thinking about delayed consequences, so our affective system can also motivate behaviors that have long-term beneficial consequences. Indeed, a number of human pathologies, such as anxiety disorders, workaholism, and self-destructive miserliness, seems to be driven by an excess of future-mindedness (Camerer, Loewenstein and Prelec, 2005).

5.1. NEUROSCIENTIFIC TOOLS

Nowadays, neuroeconomics uses neuroscience methods in order to explore the areas of the brain that fire up when individuals are asked to make a choice between alternatives. Brain imaging is currently the most popular neuroscientific tool. Most brain imaging involves a comparison of people performing different tasks, an “experimental” and a “control” task. The difference between images taken while subject is performing the two tasks provides an image of the regions of the brain that are differentially activated by the experimental task. Below, we are going to describe three basic imaging methods. Electro-encephalogram (or EEG) is the oldest technique that is composed by electrodes attached to the scalp to measure electrical activity synchronized to stimulus events or behavioral responses. EEG has an excellent temporal resolution (on the order of 1 millisecond) and it is the only method used with humans that directly monitors neural activity, as opposed to blood-flow, as we will see for the other two neuroscientific tools. EEG has a poor spatial resolution which means that it can only measure activity in the outer part of the brain. However, its resolution is been improving through the use of an ever-increasing number of electrodes. The greater advantage for economists regarding EEG is that it is relatively unobtrusive and portable, which eventually may reach the point where it will be possible to take unobtrusive measurements from people as they go

about their affairs. Like EEG, positron emission topography (PET) scanning is an old technique in the rapidly changing time-frame of neuroscience, but it is still a useful technique. PET measures blood-flow in the brain, which is reasonable proxy for neural activity, since neural activity in a region leads to increased blood-flow in that region. PET provides better spatial resolution than EEG, but poorer temporal resolution because blood-flow to neutrally active areas occurs with a stochastic lag in the range of 2-4 seconds. The newest, widely used tool is functional magnetic resonance imaging (fMRI), that measures brain activity by detecting associated changes in blood-flow. This technique relies on the fact that cerebral blood-flow and neuronal activation are coupled. When an area of the brain is in use, blood-flow to that region also increases. Different from the magnetic resonance imaging (MRI), that provides images on brain structures as a whole, fMRI is able to map the brain areas that are active during the execution of a particular task. This technique uses the magnetic properties of the nucleus of atoms constituting our body. Signals of resonance are measured with the help of magnetic fields and radio waves. When we compute an action, like moving a foot or reading something, some particular brain area fires up. In these areas more oxygen is consumed. FMRI is able to detect these variations of oxygen levels and to translate them into images. FMRI is therefore very accurate but is very expensive and not portable. We can only find it in some laboratories of hospitals and universities. It provides a good spatial resolution, but a poor temporal one due to the blood-flow which takes time to flow to the interested brain area. Brain imaging still provides only a crude snapshot of the brain activity. Neural processes are thought to occur on a 0.1 millimeter scale in 100 milliseconds, but the spatial and temporal resolution of a typical scanner is only 3 millimeters and about 2 seconds. However, the technology has been improving rapidly and will continue to improve. Therefore we will be able to discover and set up deeper researches very soon.

Hybrid techniques that combine the strengths of different methods are particularly promising.

5.2. A TWO-DIMENSIONAL CHARACTERIZATION OF NEURAL FUNCTIONING

	COGNITIVE	AFFECTIVE
CONTROLLED PROCESSES <ul style="list-style-type: none"> • Serial • Effortful • Evoked deliberately • Good introspective access 	I	II
AUTOMATIC PROCESSES <ul style="list-style-type: none"> • Parallel • Effortless • Reflexive • No introspective access 	III	IV

Table 5.1: A two-dimensional characterization of neural functioning. Source: Camerer et al., 2005.

This section will highlight some of the most relevant neuroscientific findings for economic decision making. As table 5.1 shows, neural functioning is characterized by *controlled* and *automatic* processes (Schneider and Shiffrin, 1977), *cognition* and *affect*. *Controlled* processes are serial which means that they tend to be step-by-step computations, are often linked to subjective feelings of effort and typically occur consciously when the agent encounter a challenge or a surprise (Hastie, 1984). Since

controlled processing is conscious, people often have reasonably good introspective access to it. Conversely, *automatic* processes are the opposite of controlled processes. They operate in parallel and do not require any effort from the agent since they operate outside of conscious awareness. Thus, people have little introspective access to why automatic judgments or choices are made. Automatic and controlled processes can be very roughly distinguished by where they occur in the brain as showed in Figure 5.1 (Lieberman, Gaunt, Gilbert and Trope, 2002). The second distinction represented by the two columns of Table 5.1, is between cognitive and affective processes. Zajonc (1998) defines cognitive processes as those that answer true/false questions and affective processes as those that motivates approach/avoidance behavior. Affective processes include emotions such as anger, sadness, and shame, as well as “biological affects” (Buck, 1999) such as hunger, pain and sex drive.

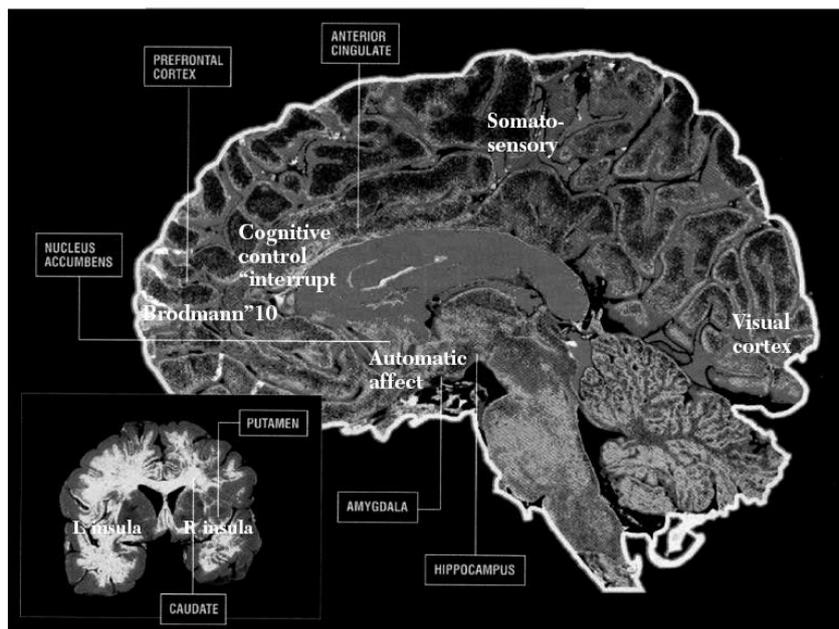


Figure 5.1: The human brain with some economic relevant areas marked. Source: Camerer et al., 2005.

5.3. ORBITAL FRONTAL CORTEX AND REGRET

Several experimental evidences assigned to the orbital frontal cortex (OFC) the critical role for decision making processes. OFC is in fact active in the assessment and comparison between the outcomes (Elliott, Newman, Longe and Deaking, 2003; Breiter, Aharon, Kahneman, Dale and Shizgal, 2000) and it is connected with prefrontal and dorsolateral regions that are active during the reasoning and planning processes and with the limbic areas which are fundamental for emotions, such as the amygdala, that we will cover below. Controlled processes occur mainly in the front parts of the brain. OFC is sometimes called the “executive” region because it draws inputs from almost all the regions, and integrates them to form short-term and long-term goals, and plans actions that takes these goals into account (Burgess and Shallice, 1996). The prefrontal area is the region that has grown the most in the course of human evolution and which, therefore, most sharply differentiates us from our closest primate relatives (Manuck, Flory, Muldoon and Farrel, 2003). OFC seems to play an important role in the feeling of regret. One of the study of Camille, Coricelli, Sallet, Pradat-Diehl, Duhamel e Sirigu (2004) has compared the performances of patients with OFC lesions with a control group composed by normal subjects. The task consists on a series of choices between bets very similar to the scenario used by Meller, Swartz and Ritrov (1999) to test *subjective expected pleasure theory*. Participants were presented a choice between two risky gambles with a monetary reward. After each choice, they obtained a feedback only on the outcome of the chosen bet (partial feedback condition), or also on the outcome of the not chosen option (total feedback condition). In this way regret was introduced and participants were asked to report their levels of regret on a scale. As Figure 5.2 shows, participants were presented with two wheels that appeared on a computer screen

(gamble 1 and gamble 2). Each wheel had two sectors: a grey and a black one representing the different value pairs. The size of each sector indicated the outcome probability. The possible outcomes are any pair between the values: +50, -50, +200, -200 associated with the probabilities (0.8, 0.2, 0.5). The subjects selected one of the two wheels and a rectangular box appeared around the selected wheel. In partial feedback blocks, a spinning arrow appeared only in the selected wheel and only the outcome of the selected wheel could be seen. In complete feedback blocks, a spinning arrow appeared in both the selected and the nonselected wheels. Therefore subjects could see both outcomes. At the end of each trial, subjects rated their affective state using a stating scale from -50 indicating an extremely sad emotion following their choice, to +50 indicating an extremely happy feeling. The evaluations reported by the control group, as predicted from Mellers et al. (1999), were not only based on the absolute value of the winning or losing, but they were also based on a comparison between the obtained outcome and the outcome they could have obtained if they had chosen differently. Participants during their choices were analysed through the skin conductance response (SCR), a method that allows to measure the electrical conductance of the skin, which varies with its moisture level. This is of interest because the sweat glands are controlled by the sympathetic nervous system, so skin conductance is used as an indication of psychological or physiological arousal. In the present experiment SCR increases when learning the outcome of the gamble, revealing the emotional nature of this information. The distinction between regret and disappointment expressed by subjective affective ratings is confirmed by the psychological index of emotional reactivity, because viewing the outcome of the rejected alternative enhances SCR as compared with viewing only the outcome of the chosen gamble (Figure 5.3.E).

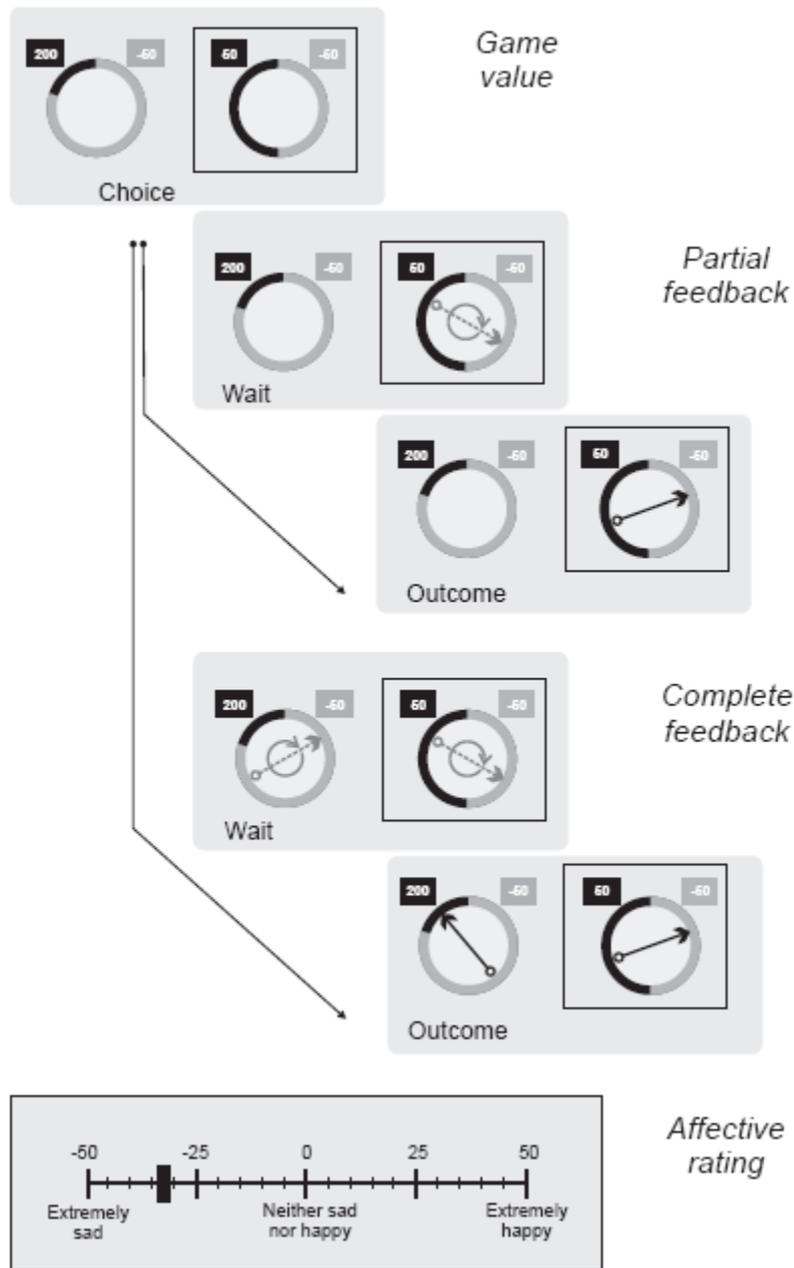


Figure 5.2: Time course of a gambling trial. Source: Camille et al., 2004.

The subjective emotion experienced in the gambling task depends on the values of the obtained and the not obtained outcome. Subjects express more pleasant emotions when the obtained value is positive than when it is

negative. In the partial feedback condition, disappointment is expressed in the perception of losses as more unpleasant and gains as less pleasant if the not obtained outcome from the same gamble wins 200 instead of losing 200. Direct comparisons between the two conditions show different levels of emotional involvement under complete and partial feedback. The emotional reaction is modulated more strongly in the complete feedback condition, in fact only in this condition, regret is possible. Figure 5.3 shows the effect of the not obtained outcome of the gamble in partial and complete feedback. A and C represent mean emotional ratings made by 18 normal control subjects for two obtained outcome (on the x axis) -50 and 50 as a function of the not obtained outcome (blue line and symbols, -200, red line and symbols, 200) in the partial and complete feedback conditions, respectively. B and D represent the same situation as A and C but the results are related to orbital frontal patients. E and F represent the mean skin conductance response of normal subjects and orbital frontal patients, respectively. Grey bars represent partial feedback condition (therefore it measures the level of disappointment) whereas black bars represents complete feedback (therefore it measures the level of regret). There is a clear signature of regret: an unpleasant emotion triggered by knowledge of the rejected alternative outcomes. Comparing normal subjects with ones with orbital frontal lesions, a very different pattern of results arises. Like normal subjects, they are generally happier when winning than when loosing and their SCR demonstrated clear emotional arousal when learning the outcome of the gamble. The disappointment effect, that is the effect of the not obtained outcome of the chosen option, is present but without showing as much contrast as that seen in normal subjects. To sum up, control group evaluates a winning of 50 more negatively when the alternative turned out to be winning 200, than in the case in which the alternative was to lose 200.

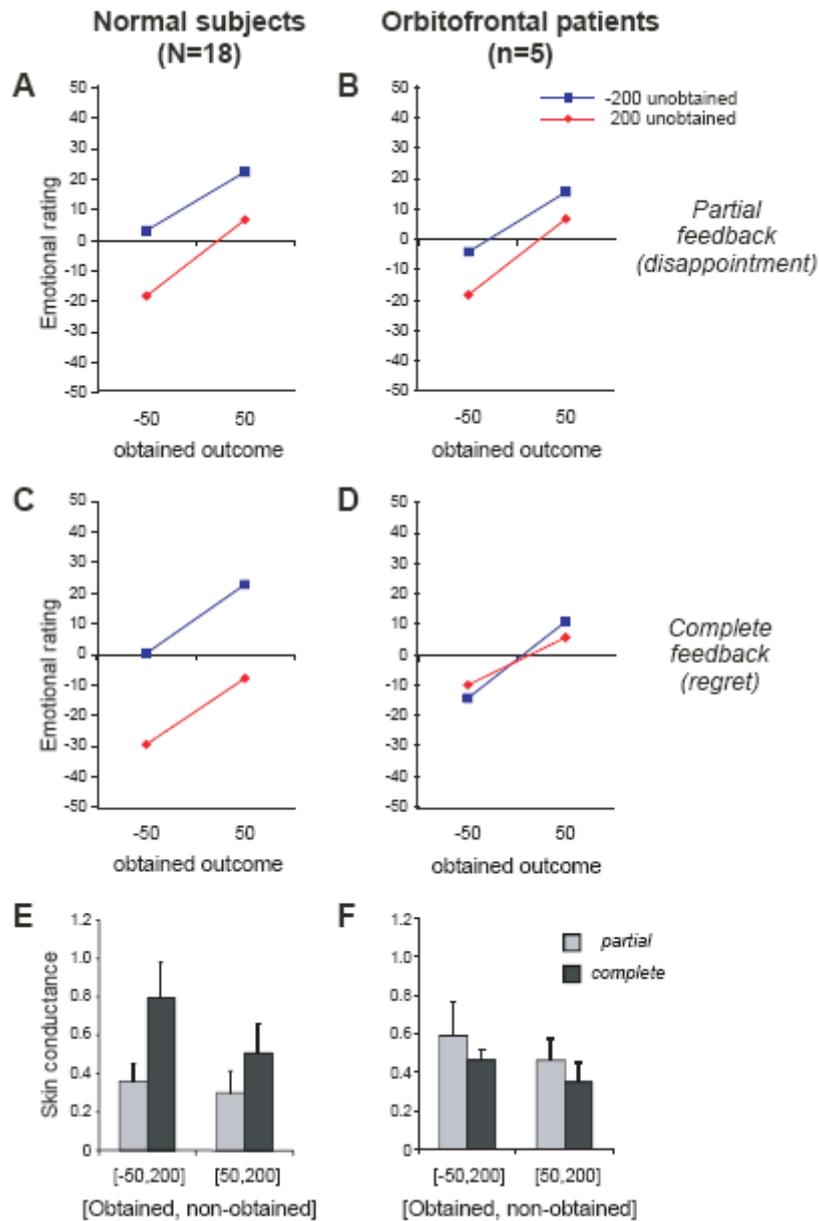


Figure 5.3: Effect of the non-obtained outcome of the gamble in partial and complete feedback. Source: Camille et al., 2004.

Moreover, participants of control group anticipated regret and made choices that minimize the possibility of feeling again this negative emotion. In contrast, patients with OFC lesions did not demonstrate effects linked to

regret, neither on the evaluation of their emotional states nor in their choices. They reported being happy when winning and disappointed when losing. Their assessment depended only on expected value of the outcome and they were independent from the values of alternative choices. Their choices were not driven by regret aversion but just by the maximization of the expected utility. Paradoxically, patients with OFC lesions demonstrated a behavior in line with the theory of rational decision. They were not able to create assessments based on the comparison between real and counterfactual outcomes, they do not feel regret and therefore they cannot anticipate it and learn from past experiences. To conclude we can say that OFC integrates cognitive and emotional components of the entire process of decision making, its incorrect functioning determines the inability to generate specific emotions such as regret, which has a fundamental role in regulating individual and social behavior (Camille et al, 2004).

The involvement of the OFC in the anticipation and experience of regret has been confirmed by a study with fMRI performed by Coricelli, Critchley, Joffily, O'Doherty, Sirigu and Dolan (2005), who have used the same experimental scenario described above to test participants without lesions. They observed an increase of brain activity in the OFC in the anticipation of regret, in the experience of it and in the comparison with the counterfactual outcomes. Results demonstrated that the experience of regret activates a mechanism of cognitive control in the successive choices. Coricelli, Dolan and Sirigu (2007) have proposed a different model of interaction between emotions and decision making. According to these authors, it would be more correct to talk about a *top-down* process from the cognitive processes to the emotions, where the OFC modulates the production of emotions through the counterfactual thinking. The inability of people with OFC lesions to put in place counterfactual mechanisms, does not permit them to

generate emotions associated to the decision making process such as regret. There are two key points within regret theory: first the fact that regret is commonly experienced, and second, that people try to anticipate and avoid the experience of future regret. Anticipated regret, as we have seen in chapter three, is based on considering to choose an alternative and simultaneously rejecting other alternatives. In this setting, regret is not fully rational. Formally, the regret function φ represents the comparison between the value (v) of the choice (x) and the value of a rejected alternative (y):

$$\varphi[v(x) - v(y)] \quad (5)$$

In regret theory, the function φ enters into the utility function (U):

$$U(x,y) = v(x) + \varphi[v(x) - v(y)] \quad (6)$$

The utility of an action, for example choosing action x and automatically rejecting action y , can be computed as the sum of expected utility of the chosen action x and of the anticipated regret term $\varphi(\cdot)$. $\varphi(\cdot)$ is decreasingly concave in the case of regret aversion ($\varphi''(\cdot) < 0$), which accords with the commonly observed pattern of choice behavior (Bleichrodt et al, unpublished). People with lesions to the OFC are unable to generate outcome evaluations and outcome expectancies, based upon a counterfactual comparison between the value of a chosen and a rejected alternative. Formally, they are unable to generate the regret function φ (Bell, 1982).

5.4. AMYGDALA AND REGRET

Sometimes we are asked to make risky or uncertain decisions as in the case of intertemporal choices. A lot is known about the neural processes underlying affective responses to risks. Much risk-averse behavior is driven by immediate fear responses to risk, and fear, seems to be largely traceable to a single small area of the brain called the *amygdala*. The amygdala constantly scans incoming stimuli for indications of potential threats, and it responds to inputs from both the automatic and controlled processes in the brain. But the amygdala also receives cortical inputs, which can moderate or even override its automatic quadrant IV response. This area is crucial for regret. In neuropsychological studies of gambling (Bechara, Damasio, Damasio and Lee, 1999), patients with bilateral amygdala damages fail to observe the normal emotional responses to monetary reward, clearly suggesting a role for this region in financial reward processing. In the Iowa Gambling Task, normal individuals initially sampled the advantageous and disadvantageous decks equally, but after experiencing the high punishment from the disadvantageous deck, they shifted their choice to the advantageous one. In contrast, patients with amygdala damages tended to choose more often from the disadvantageous deck because they are unable to distinguish between risky and not risky situations. The patients did not have anticipatory SCRs before choosing the disadvantageous desk which means they did not realize the risk they were taking. This suggests that subjects with amygdala damages had an impairment in registering the emotional impact of reward and punishment caused by specific behaviors, a fundamental function necessary for being able to anticipate the rewarding and punishing consequences of these behaviors in the future (Naqvi, Shiv and Bechara, 2006).

The obtained results not only provide direct empirical support for economic models that acknowledge the influence of emotional factors on decision making behavior, but they also provide the first step toward the development of quantitative measures that may be useful in constraining the social utility function in economic models (Fehr and Schmidt, 1999). Models of decisions making cannot afford to ignore emotions as vital and dynamic component of our decisions and choices in the real world. In conclusion, we have seen how much value added can neuroscience give to economics. Neuroeconomics is a new field that is attracting a lot of attention. Man is not rational and emotions play a crucial role on our decisions. Therefore it is necessary to study and understand what is going on in our brain when we face a decision, especially in risky and uncertain situations. Thanks to the always improving technology, neuroeconomics is answering several questions and researchers will be able to gain more and more information about the complex, mysterious and perfect human brain.

CONCLUSIONS

Emotions are important determinants of decision making. Our decision often leads to regret, a negative emotion based on the cognitive processes of counterfactual thinking and responsibility attribution. Human preferences are not stable and they are often determined by changes in outcomes relative to reference levels, not merely by absolute levels of outcomes (Rabin, 1998). Self blame is the critical element that distinguishes regret from closely related emotions, such as disappointment. The overall feeling of regret is a combination of two components: counterfactual thought and self-blame. Counterfactual thinking is the mechanism by which we compare “what is” with “what might have been”. Contrary to mere disappointment, which is experienced when a negative outcome happens regardless of our decision, regret is an emotion strongly associated with a feeling of responsibility. Regret and disappointment have distinct behavioral consequences associated with their experience. The emotional and behavioral responses of consumers who experienced unsatisfactory service delivery have been analyzed. Consumers who experienced regret tended to switch to a new service provider whereas consumers who experienced disappointment had the tendency to complain. Regret aversion is an important factor of the decision making process. The anticipation of regret is the assumption that people can foresee regret that they would feel as a consequence of their choices. It induces us to make more rational choices, thinking more elaborately before making a decision. Consumers’ choices between alternatives can be systematically influenced by asking them to anticipate regret and responsibility they would feel if they made the wrong decision. Experiment 1 studied the role of anticipated regret on risky

decision making introduced by the expectation of partial or total feedback. It demonstrated that the anticipation of regret can promote risk-averse and risk-seeking choices depending on which of the two is the regret-minimizing option (Zeelenberg, 1999). In particular, people showed risk-aversion in the domain of gains and a risk-seeking behavior in the domain of losses, regardless of the partial or total feedback condition. Total feedback leads to more risky behaviors in the domain of the gains whereas it does not have important implications on the domain of losses, compared to partial feedback results. Important differences across gender are outlined. Men showed more risk-seeking attitudes than women. Men are more affected by the expectation of feedback in the domain of gains, whereas women are more affected by the expectation of feedback in the domains of losses. The second experiment measured the different levels of regret, introduced by manipulation of feedback, in the context of ultimatum game. Expectation of feedback leads to higher proposals than general ultimatum game (Zeelenberg and Beattie, 1997). Proposals significantly differed across gender, in particular men proposed to keep more money when deciding the splitting. In addition, females reported higher levels of regret than males. Moreover, proposals were registered to be higher for younger participants. Proposers can regret having proposed to keep too little, or having proposed to keep too much. In this last scenario, the probabilities that the proposal is rejected are big. Very high levels of regret were registered when the proposals were rejected and the minimal acceptance offers were very close to the actual proposals. The proximity between the real outcome and an alternative, but more desirable one, facilitates the production of counterfactual thoughts and thus it increases regret. The experience of regret can have positive and negative consequences, in fact regret is both a functional and a dysfunctional mechanism. Regret can be considered as an adaptive emotion that helps individuals to learn from the best options and adapt their future behavior (Zeelenberg et al., 2001). It can also favor a

switching behavior and suboptimal choices. The role of regret has crucial implications for marketers who are interested in creating brand loyalty. Thus it is important to maximize consumers' positive brand evaluations over time, engaging in post-purchase communication efforts. Orbital frontal cortex (OFC) plays an important role in the feeling of regret since it creates counterfactual mechanisms. OFC integrates cognitive and emotional components of the entire process of decision making, its incorrect functioning determines the inability to generate specific emotions such as regret, which has a fundamental role in regulating individual and social behavior. In particular, patients reported to be happy when winning and disappointed when losing, and their assessment depended only on the maximization of expected utility of the outcome and it was independent from the alternative choices. Amygdala plays an important role in the decision making, helping people to distinguish between risky and not risky situations. Subjects with amygdala damages have an impairment in registering the emotional impact of reward and punishment caused by specific behaviors and therefore they are not able to anticipate the consequences of their future behavior.

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