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Impact of Smiles on Financial  
Choices  
Experimental Analysis

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# **Section 1**

# Introduction

*“I want to tell you a bit of straight psychology that I find very exciting, [...] There are two big things happening in psychology today. One, of course, is everything that's got to do with the brain, and that's dominating psychology. But there is something else that is happening, which started out from a methodological innovation as a way to study memory, and we've always known, that's the idea of the notion of association of ideas, which has been around for 350 years at least.”*

*Daniel Kahneman, Edge 262 - October 22, 2008*

When asked what we are thinking of we suppose to know what is going on in our brain. It usually is a conscious thought that linearly drive to another clear thought. However, this is not how the mind works. Most of thoughts, impressions and intuitions manifest to our conscious mind through a process we are not aware of. We do not realize how we capture a little shade of angry in the voice of our partner, or how we avoided an incumbent danger. Most of the work our brain does is in the background. Evolution shaped our cognitive abilities to work on two separate levels, the conscious and the unconscious. The latter is the intuitive, sometimes irrational, fast side of human mind. The first is logical, rational and slow. Given their characteristics, they perfectly complete each other, even if for most of the time they work separately. Throughout the thesis we refer to these two mechanisms of human mind as System 1 (unconscious) and System 2 (conscious), adopting Kahneman's definitions. This structure is very efficient: System 1 is constantly bombarded by stimuli coming both from the external and internal, while System 2 rests in a sort of stand-by mode. Paul Ekman<sup>1</sup> associates this automaticity

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<sup>1</sup> Ekman P., *“Emotions Revealed: Recognizing Faces and Feelings to Improve Communication and Emotional Life”*, Henry Holt and Company, 2007

of System 1 to emotions. Emotions can, and often do, manifest very quickly, so quickly that we do not even notice it. Sometime we do not even know what triggers an emotion but that speed can save our lives. In a masterpiece published in 1872 Charles Darwin described an experiment he himself performed that emphasizes the level of automaticity our System 1 is capable. Here is how he outlined the story:

*“I put my face close to the thick glass-plate in front of a puff-adder in the Zoological Gardens, with the firm determination of not starting back if the snake struck at me; but, as soon as the blow was struck, my resolution went for nothing, and I jumped a yard or two backwards with astonishing rapidity. My will and reason were powerless against the imagination of a danger which had never been experienced”<sup>2</sup>*

Emotions and automaticity are doubtless strongly interconnected, and we probably know very little about it. Since Darwin we have made several steps ahead, but yet there are parts of human mind we do not fully comprehend. Our logical and rational side, System 2, knows very little of what is going on in System 1, and as we can see from Darwin’s experiment, it does not even have control of it. System 2 is called to action when a task cannot be accomplished by System 1, and usually these are complex tasks. This is not always the case: sometimes System 1 simply notices something that does not match with its internal representation of the external world -which it always refer to- and therefore needs System 2 to intervene.

All of this constitute the fundamental basis upon which this thesis is structured. All concepts discussed, experiments conducted and interpretations proposed are inevitably rooted on a dual system of the mind, ruled by associative mechanisms, in which the conscious part do not play the main role. The paper will undertake an in depth analysis of the decisional process, covering the concepts of heuristics, perceived probabilities, priming and knowledge. We will first give an overview of present theories which have been conceived to deal with uncertainty, to then switch the attention to the mechanisms ruling our mind. We provide a description of how

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<sup>2</sup> Darwin C., *“The Expression of the Emotions in Man and Animals”*, 3rd edition, Oxford University Press, New York, page 43, 1998

these two arguments are correlated, showing how descriptive models based on perfect rationality cannot be trusted anymore. We used an empirical approach to investigate this relationship, which represent the connecting thread of the whole thesis.

In the first section, we analyzed concepts of heuristic and perceived probability. Considering possible events and associating probabilities is a difficult operation that it is possible to breakdown into three different phases: information acquisition, information assessment and judgment<sup>3</sup>. However, most of the time, it is hard to associate a probability distribution to each event to be evaluated. That is why the brain looks for shortcuts or rules of thumb to take decision in a faster fashion. These rules of thumb are called *heuristics*. People use to rely on a limited number of heuristic principles to reduce the complexity of the task of assessing probabilities and predicting values<sup>4</sup>. The subjective evaluation of probability can be seen as the subjective evaluation of distances or sizes: available data are of limited validity and processed through heuristic rules. Therefore, as guessing a distance leads to systematic errors, taking decision concerning the future based on heuristics may be inaccurate. The collecting information phase is highly influenced by what Tversky and Kahneman<sup>4</sup> in 1974 labelled *Availability* heuristic: when acquiring information, people are influenced by the ease with which they can actually bring to mind that information. It is easier and faster to recall events that happens with a certain frequency than rare ones even if frequency is not the unique factor affecting availability heuristic. Consequently, the reliance on availability leads to predictable *biases*. Information assessment is affected by *Representativeness*, and *Adjustment* and *Anchoring* heuristics. The first is described by the degree to which an event is representative of the stereotype of that event. The higher the representativeness the higher the probability that event has to happen. The second explains the process we sometimes undertook to yield an answer. In many situations, when asked to make estimations people tends to make initial and partial forecasts or estimations and

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<sup>3</sup> Rigoni U., "*Finanza comportamentale e gestione del risparmio*", in G. Giappichelli Editore, Torino

<sup>4</sup> Tversky A., Kahneman D., "*Judgment under Uncertainty: Heuristics and Bias*", *Science*, 1974

then to adjust yielding a final answer. Quite often, adjustments are insufficient since they depend on the anchoring point<sup>5</sup>. The decision making process is more complex. We treated here only two aspects that affect the process: *illusion of control* and *illusion of validity*. The concept of the illusion of control is based on the fact that people tend to underestimate the impact of randomness and to overestimate the ability factor in those situations generally considered subject to random factors<sup>6</sup>. Illusion of validity is based on the *Falsifiability Principle*<sup>7</sup>. A statement is called *falsifiable* if somehow it is possible to prove that it is false. The scientific method is based on the falsifiability principle. As already said, the brain uses cognitive filters to ease the decision taking process. Since the short term memory is limited, the information collected is filtered, and only those who can be said to be true are remembered. Looking for confirmation is what Tversky and Kahneman defined as *Confirmation bias*. The three phases just described -namely collecting information, the information assessment and the decision making- should all be taken into account in the design of a descriptive model of the decision making process under uncertainty. In the Perceived Probability chapter, we undertook an overview of present theories aiming at describing the decisional process. Expected Utility Theory and Prospect Theory are the main actors in such a play. The first is based on the fact that, given the expected value, people have an utility function that describes their preferences, associating a certain utility to the given expected value. However the descriptive power of the theory has been proven to be incomplete, and sometimes even wrong. Prospect Theory takes into account heuristics and bias, differentiates gains from losses, and highlights the importance of the initial reference point in the decision making process.

In the second section we got into the core of the Associative Mechanism. We first outlined the two main characters of the story, System 1 and System 2. As

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<sup>5</sup> Lichtenstein S. and P. Slovic. "*Reversals of Preference Between Bids and Choices in Gambling Situations*", *Journal of Experimental Psychology*, 89, Jan. 1971

<sup>6</sup> Bonini N., Rumiati R., "*L'attribuzione causale nelle decisioni così dette a 'costi già sostenuti'*", 1991 in Rigoni U., "*Finanza comportamentale e gestione del risparmio*", in G. Giappichelli Editore, Torino

<sup>7</sup> K.R. Popper, "*Poscritto alla logica della scoperta scientifica vol 1: Il realismo e lo scopo della scienza*", il Saggiatore, 1984, p. 23. Nuova edizione economica 1994

already said, they respectively represent the intuitive, fast and sometime irrational thinking and, the logical, rational and meditated thinking. We then analyzed the concept of Automaticity, referring to it as the “[...] *control of one’s internal psychological processes by external stimuli and events in one’s immediate environment, often without knowledge or awareness of such control*”<sup>8</sup>. Most of the early studies on automaticity focused on social perception. The lens was on whether people’s impressions of others is driven by automatic biases. The perceptual apparatus is strongly linked with the behavioral one. *The “hardware” of the perception-behavior link has been found in the so called mirror neurons*<sup>9</sup>. These neurons are located in the premotor cortex of higher primates and have a very interesting function: they are activated both when a person watches a particular action being performed and when the action is actually performed. This shows not only the perception-behavior link, but also a deep connection to other people. The automatic side of mind has been linked with the theoretical analysis of intuition. This automaticity eventually affects decision making, most of the time doing a fairly good job<sup>10</sup>, but in a way most people are unaware. The fact that, e.g., emotions can have an influence in immediate behaviors is well-known, but these influences have been proved to persist over time<sup>11</sup>. It is through the concept of priming we started investigate this automaticity more accurately, and most importantly, measuring it. Around the 80s, psychologists started realizing that each word produces an instant reaction measurable with the ease with which linked words are recalled. For example, they observed that people who first saw the word *EAT* tend to complete the word *SO-P* with *SOUP* rather than with *SOAP*<sup>12</sup>. It is called *priming effect*. Not only people were more sensible to the word *SOUP*, but

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<sup>8</sup> Bargh J.A., Williams E.L., “*The Automaticity of Social Life*”, *Current Directions in Psychological Science*, vol 15, n.1, p. 1., 2006

<sup>9</sup> Rizzolatti G., Fogassi L., Gallese V., “*Neurophysiological mechanisms underlying the understanding and imitation of action*”, *Nature Reviews Neuroscience*, 2, 661–670, 2001

<sup>10</sup> Lieberman M.D., “*Intuition: A social cognitive neuroscience approach*”, *Psychological Bulletin*, 126, 109–137, 2000

<sup>11</sup> Lerner J.S., Small D.A., Loewenstein G., “*Heart strings and purse strings: Carry-over effects of emotions on economic transactions*”, *Psychological Science*, 15, 337–341, 2004

<sup>12</sup> Kahneman D., “*Pensieri Lenti e Veloci*”, Oscar Mondadori, 2013

also to all those words related to food. Later it has been understood that the *priming effect* is not limited to words, and that effects created in the mind in turn generate physical reactions<sup>13</sup>. Different types of priming have been presented and studied. We then turned our attention to the impact knowledge, experience and familiarity have in the decision making process. More specifically we investigated the hypothesis that financial literacy affects financially related decisions. The concept of financial literacy refers to the capability of understanding finance. It is related to the knowledge and skills requested to take financially related choices, in a informed and rational way. Also Debt literacy has been considered, given the structure of the experiments conducted. We exposed how financial and debt literacy is measured, proposing mainly Lusardi's scale. Finally we considered Bettman<sup>14</sup> approach to describe the effects of knowledge on the decision making process. The concept underlying the *constructive view of choice* proposed by Bettman is that consumers have elements of heuristics in memory, rather than complete rules. Such elements are combined during the decision process to create a heuristic. That implies the absence of a unique procedure, but rather a dynamic construction process that varies from one situation to the next. The presence of prior knowledge structure affects the type of information processed and the heuristic used in each stage of the construction process. Prior knowledge and experience may function as standards and therefore they can be used early in the decision process, while new consumers may need time to develop such standards.

The third section represents the real core of the thesis. Two experiments have been conducted through the Amazon Mechanical Turk platform. We decided to launch an on line survey to test our hypothesis about how the decisional process is affected. Participants have been divided into three treatment groups. The first, called *Control*, was supposed to choose between two loan offers: one with a fixed interest rate, the other with a variable one. We added two invented forecasts for the 12-

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<sup>13</sup> Niedenthal P.M., "*Embodying Emotion*", Science, 316, pp.1002-1005, 2007

<sup>14</sup> Bettman J.R., "*An Information Processing Theory of Consumer Choice*", Journal of Marketing, Vol. 43, No.3, pp 124 -126., 1979, Reviewed by Ross I., "*An Information Processing Theory of Consumer Choice by James R. Bettman*", American Marketing Association

month Euribor trend (on which the variable interest rate is calculated). The second group, called *Smiling Fixed*, was asked to take exactly the same choice. There was only one difference: to each offer (fixed and variable) was associated an image. Both images represent the same person with different facial expression: one neutral and the other smiling. The smiling faces is the treatment, therefore in the *Smiling Fixed* group the smiling face was associated to the fixed offer. The third group, called *Smiling Variable*, received the same survey as the *Smiling Fixed* group but with images switched, i.e., the smiling face was associated to the variable offer. The second experiment aims at better understanding the results obtained from experiment 1 and further investigate the effects of priming faces with different expressions on the decisional process. We kept three treatment groups. In this experiment Control group design include an image of a globe representing planet Earth. Smiling and Neutral groups were respectively primed with a smiling and neutral face. The choice is no more between a fixed offer (certain outcome) and a variable one (risky outcome), rather participants were asked whether they are interested in the variable offer or not. The choice between the fixed and the variable, however, is still present later on the experiment. Questions about confidence and trust were added.

We concluded the thesis discussing results obtained in the two experiments, proposing different interpretations for the effects observed, confirming existing results and confuting others. We also suggested a new type of rationality, namely biased-rationality, in which emotions and logic complete each other rather than compete.

# I. Heuristics

## I.1. Introduction

People take decisions every day. When these decisions deal with the future, the uncertainty factor becomes of critical importance. Considering possible events and associating probabilities is a difficult operation that it is possible to breakdown into three different phases: information acquisition, information assessment and judgment.<sup>1</sup> However, most of the time, it is hard to associate a probability distribution to each event to be evaluated. That is why the brain looks for shortcuts or rules of thumb to take decision in a faster fashion. These rules of thumb are called *heuristics*. People use to rely on a limited number of heuristic principles to reduce the complexity of the task of assessing probabilities and predicting values.<sup>2</sup>

The subjective evaluation of probability can be seen as the subjective evaluation of distances or sizes: available data are of limited validity and processed through heuristic rules. Therefore, as guessing a distance leads to systematic errors, taking decision concerning the future based on heuristics may be inaccurate.

Heuristics work through the correlation between the difficulty of the duty and the ability in collecting and evaluating information. Therefore, rather than looking for the best answer in absolute terms, heuristics lead to an answer which is “good enough” to take a decision.<sup>3</sup> This way of taking decision, allows our brain to perform difficult tasks which otherwise would be impossible. In fact, our mind needs some kind of cognitive filter to ease the collection and evaluation of information because of biological limits. All of this is due to evolution, therefore it should not be surprising that heuristics may lead to wrong decisions when it is time to take, e.g., financial choices. Humans being have been evolving for thousands of years, but we started dealing with financial choices less than a hundred years ago.

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<sup>1</sup> Rigoni U., “*Finanza comportamentale e gestione del risparmio*”, in G. Giappichelli Editore, Torino

<sup>2</sup> Tversky A., Kahneman D., “*Judgment under Uncertainty: Heuristics and Bias*”, *Science*, 1974

<sup>3</sup> Simon H., “*Models of Man*”, John Wiley, New York

Amos Tversky and Daniel Kahneman in “Judgment under Uncertainty: Heuristics and Bias” (1974), categorize three different types of heuristics: availability, representativeness and adjustment and anchoring.

## **1.2. Collecting Information**

### *1.2.1. Availability*

It has been shown (Tversky, Kahneman 1974) that when acquiring information, people are influenced by the ease with which they can actually bring to mind that information. It is easier and faster to recall events that happens with a certain frequency than rare ones. Frequency is not the unique factor affecting availability heuristic. Consequently, the reliance on availability leads to predictable *biases*.

It is possible to distinguish two different mechanisms according to which availability heuristics operates<sup>4</sup>: availability by construction and availability by recall.

#### *- Availability by Construction*

It consists in the way people use information to build examples in their mind. The easier the reconstruction the more comfortable with the option, i.e., higher associated probability. A classic example is the following: a group of people have been asked to estimate if there exists more words beginning with “r” or words containing “r” as third letter. Since it is easier to imagine words starting with some given letter rather than thinking about words with some given letter in any other position, most people would answer wrong. In fact there exists more words which have an “r” as third letter.

#### *- Availability by Recall*

The easier to bring to mind the more positive the judgment. Since it is easier to recall familiar and relevant situation, the judgment will be biased towards more

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<sup>4</sup> Rumati R., “*Giudizio e decisione*”, Il Mulino, Bologna, 1990

familiar scenarios. In fact, recent events are considered more relevant while acquiring information, even if they may be less likely.

### **1.3. Information assessment**

#### *1.3.1 Representativeness*

“What is the probability that event A originates from process B?”

It is answering this kind of question that people use representativeness heuristic, in which probabilities are evaluated by the degree to which A resembles B. For instance, consider the following description: “Steve is very shy and withdrawn, invariably helpful, but with little interest in people, or in the world of reality. A meek and tidy soul, he has a need for order and structure, and a passion for detail.” (Tversky, Kahneman 1974)

When asked to guess if Steve is either a librarian or a salesman, people would choose the first because the degree to which Steve is representative of the stereotype of librarian is higher than the stereotype of a salesman.

One of the factors that do not affect representativeness but should is the *insensitivity to prior probability of outcomes* (Tversky, Kahneman, 1974). Keeping with the Steve example, to actually give an answer to the question different information are needed, e.g., the percentage of librarian and salesman in the world. Therefore the fact that there are more salesman than librarian should enter in the assessment of probability. Following the same line, and taking into account a classic *Heads and Tails* game, people believe that a sequence of six heads in a row out of twelve tosses is less likely than a more random distribution of six heads and tails, even if the probability associated to both sequences is 50%. This is what Tversky and Kahneman called *Misconception of chance*.

### 1.3.1. Adjustment and Anchoring

In many situations, when asked to make estimations people tends to make initial and partial forecasts or estimations and then to adjust yielding a final answer. Quite often, adjustments are insufficient since they depends on the anchoring point<sup>5</sup>.

In a famous experiment, Tversy and Kahneman asked people to estimate the percentage of African countries among the United Nations. They set an anchoring point spinning a wheel to generate a random number between 0 and 100. People where aware that the number generated by the wheel has absolutely no relation with the question asked, but still there is a significance correlation between the two. Groups with anchoring point close to 65 estimated that about 45% of United Nations countries are African, while groups with anchoring point of 10 estimated 25%. Bar-Hillel<sup>6</sup> (1973) asked people to bet on one of two events. Three types of events were used:

- simple events: extracting a white ball from a box containing 50% white balls and 50% red balls;
- conjunctive events: extracting seven white balls in a row, with replacement, out of a box containing 90% white balls and 10% red ones.
- disjunctive events: extracting a white ball at least once in seven tries, with replacement, in a box containing 10% white balls and 90% red.

Even if “a” has associated probability of 0.50, “b” 0.48 and “c” 0.52, a significant majority of people chose “b” when compared to “a”, and chose “a” when compared to “c”. J. Cohen et al. (1972) in a study on choices among gambles indicate that people tend to overestimate the probability of conjunctive events and to underestimate the probability of disjunctive events.<sup>7</sup>

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<sup>5</sup> Lichtenstein S. and P. Slovic. “*Reversals of Preference Between Bids and Choices in Gambling Situations*”, Journal of Experimental Psychology, 89, Jan. 1971

<sup>6</sup> Bar-Hillel M., “*On the subjective probability of compound events*”, Organizational behavior and human performance, 9 1973

<sup>7</sup> Cohen J., Chesnick E.I., D'Haran, “*A confirmation of the inertial - $\psi$  effect in sequential choice and decision*”, British Journal of Psychology, 1972, in Tversky A., Kahneman D., *Judgment under Uncertainty: Heuristics and Bias*, Science, 1974

## **I.4. Decision Taking**

### *I.4.1 Illusion of control*

Suppose we have a box containing 50 pieces of paper numerated from 1 to 50. If we are asked to pick a piece of paper out of the box, the probability of extracting, e.g., the number 12 is 1/50. This because we assume that there is no other information we can use. Suppose now we know that the pieces of paper were introduced in the box progressively, from 1 to 50. If we are still asked to extract the number 12, probably we would try to pick a piece of paper closer to the bottom of the box rather than to the top, to increase chances of success. Therefore, even in a casual event, there may be some element of ability or knowledge. On the same line, if a fund is expected to perform a +2% over the next year, and at the end of the year, the actual performance is just +1%, people may think that the fund manager is no longer as good as he was.

The concept of the illusion of control is based on the fact that people tend to underestimate the impact of randomness and to overestimate the ability factor in those situations generally considered subject to random factors<sup>8</sup>.

### *I.4.2. Illusion of validity*

All empiric disciplines are essentially based on a retrospective analysis: once a theory is established it is necessary to test it. The German philosopher Karl Popper called this process *Falsifiability Principle*<sup>9</sup>. A statement is called *falsifiable* if somehow it is possible to prove that it is false. The scientific method is based on the falsifiability principle. In 2002, Legrenzi did an experiment that can be used to explain this principle<sup>10</sup>. People were shown the following sequence 2-4-6 and then asked which

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<sup>8</sup> Bonini N., Rumiati R., "L'attribuzione causale nelle decisioni così dette a 'costi già sostenuti'", 1991 in Rigoni U., "Finanza comportamentale e gestione del risparmio", in G. Giappichelli Editore, Torino

<sup>9</sup> K.R. Popper, "Poscritto alla logica della scoperta scientifica vol 1: Il realismo e lo scopo della scienza", il Saggiatore, 1984, p. 23. Nuova edizione economica 1994

<sup>10</sup> Legrenzi P., "Prima lezione di scienze cognitive", Laterza, Roma-Bari, 2002

“rule” generated that sequence. Since multiple answer can be given, they could generate a new sequence, and then they would have been told whether the new sequence follows the original “rule”. When people proposed something like 8-10-12 and 20-22-24 they received a “yes” for answer. Therefore, they conclude that “even numbers that increase of 2” was suggested as a rule, which seems reasonable. What about if we want to use the falsifiability principle? We should propose the sequence 3-5-7 expecting a “no” for an answer. However this is not the case, so also 3-5-7 is a sequence generated from the original rule, i.e., “even numbers that increase of 2” is not the correct rule.

As already said, the brain use cognitive filter to ease the decision taking process. Since the short term memory is limited, the information collected are filtered, and only those who can be said to be true are remembered. Looking for confirmation is what Tversky and Kahneman defined as *Confirmation bias*.

## **2. Perceived Probability**

### **2.1. Introduction**

For decades economists have been studying the best way to take decision under uncertain circumstances. That is why gambling and risk options are so interesting. They allows to study a very simple situation which may explain more complex scenarios. It is possible to classify those theories in two categories<sup>11</sup>: normative and descriptive. Normative theories describe what is the absolute best choice to take when facing a risky decision. Descriptive theories, on the other hand, try to explain how people actually take choices in condition of uncertainty.

In this section, for the sake of completeness, we will briefly present expected utility theory and its violations under the descriptive point of view. Then Prospect Theory and its implications will be highlighted.

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<sup>11</sup> Rigoni U., “*Finanza comportamentale e gestione del risparmio*”, in G. Giappichelli Editore, Torino

## 2.2. Expected Utility Theory

“We wish to find the mathematically complete principles which define “rational behavior” for the participants in a social economy, and derive from them the general characteristics of that behavior.”<sup>12</sup> More than two centuries later, that is what Von Neumann and Morgenstern claimed in the book which ended up formally developing the Bernoulli’s intuition into the Expected Utility Theory. It is based on four axioms:

- *Completeness*: an individual can always compare uncertain results establishing a preference or indifference ranking
- *Transitivity*: individuals act consistently: if they prefer A to B, and B to C, they will prefer A to C.
- *Independence*: when comparing two games<sup>13</sup>, the focus is on elements which are not in common. Let  $A > B$  and  $t \in (0, 1]$  then  $[tA + (1-t)C] > [tB + (1-t)C]$
- *Continuity*: assume that  $A > B > C$  then there exists a probability  $\beta$  such that  $B = \beta A + (1-\beta)C$

### 2.2.1. The Utility Function

A fundamental hypothesis of the Expected Utility theory is the *non-satiation*: the marginal utility of wealth is always positive. Even if each individual has a different Utility Curve, the axioms are respected. This means that, e.g., if  $A > B$  then  $U(A) > U(B)$ . Moreover, the *Transitivity* axiom implies that the utility function can be applied to whatever game as follows:

$$Utility = \sum_{i=1}^N p_i U(w_i)$$

with  $p_i$  representing the  $i$ -event associated probability and  $w_i$  the outcome.

This means that the expected utility is a linear function and can be expressed as an average of all possible outcomes weighted the associated probability. The shape of

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<sup>12</sup> Von Neumann J., Morgenstern O., “*Theory of Games and Economic Behaviour*”, Princeton University Press, Princeton, 1947, p.31

<sup>13</sup> In Game Theory, the study of strategic decision making, a game is a situation in which different events have different associated probabilities and outcomes

the function can be concave, linear or convex and they respectively represents an individual risk averse, neutral or seeking.

### 2.3. Violations of Expected Utility Theory

Bernoulli's intuition held for more than two hundreds years, and still today is largely used and taught in Economics courses. However, there are certain situations in which the theory is systematically violated. In 1953, the Nobel prize Maurice Allais<sup>14</sup>, showed how the Von Neumann-Morgensten theory do not hold using what it will be called the Allais Paradox. In his paper, Allais discussed the results of a survey he conducted the former year. His example has been discussed widely under both normative and descriptive perspective. The Allais' example has been discussed under different point of view.<sup>15</sup> Here we present a variation elaborated by Kahneman and Tversky<sup>16</sup>.

Consider the following games:

Game 1			
Option 1		Option 2	
Probabilities	Gains	Probabilities	Gains
0.33	2,500	1	2,500
0.66	2,400		
0.01	0		

The expected value of Option 1 is 2.409

The expected value of Option 2 is 2.400

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<sup>14</sup> Allais M., (1953), "Le Comportement de l'Homme Rationnel devant le Risque: Critique des Postulats et Axiomes de l'Ecole Americaine", *Econometrica*

<sup>15</sup> Slovic P., Tversky A., "Who Accepts Savage's Axiom?", *Behavioral Science*, 19, 1974, pp 368-373

<sup>16</sup> Tversky A., Kahneman D., "Prospect Theory: An Analysis of Decision Under Risk", *Econometrica*, Vol. 47, No.2, pp 263-292

Game 2			
Option 3		Option 4	
Probabilities	Gains	Probabilities	Gains
0.33	2,500	0.34	2,400
0.67	0	0.66	0

The expected value of Option 3 is 825.

The expected value of Option 4 is 816.

Obviously the final choice depends on the Utility function. In the sample analyzed 82% of people chose Option 2 in Game 1 and 83% of people chose Option 3 in Game 2. Since  $U(0)=0$  it turns out that the utility of winning €2.400 is greater than the 33% of chances of winning €2.500 and the 66% of winning €2400. Moreover, given the Independence assumption, people ignore common results (namely €2400). That means that the utility of getting €2.400 with 34% of probability is better than getting €2.500 with 33% of probability. However, from Game 2 it turns out exactly the opposite, violating the independence assumption. This happens also when monetary outcome are substituted with something different like winning a three-week tour across Europe<sup>17</sup>. This effect has been labelled *Certainty Effect*<sup>18</sup>. The independence assumption is violated also when an individual decides between two offers with very low associated probability. In this case, individuals tend to ignore probabilities focusing more on the greater payoff, as reported by MacCrimmon and Larsson<sup>19</sup>.

This is just an example of the violations of the Expected Utility theory. Another relevant problem of the theory may be explained with the following simple example.

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<sup>18</sup> Tversky A., Kahneman D., "Prospect Theory: An Analysis of Decision Under Risk", *Econometrica*, Vol. 47, No.2, pp 263-292

<sup>19</sup> McCrimmon K.R, Larsson S., "Utility Theory:Axioms versus Paradoxes",in, Allais M. Hagen O. "Expected Utility Hypothesis and the Allais Paradox", *Theory and Decision Library*, Vol.21, 1979, pp 333-409

Steve has €1.000 in his bank account, while Britney has €11.000.

The day after both have €6.000.

The Expected Utility theory claims the Utility of wealth is associated to happiness. However, even if Steve and Britney have the same amount of money in their bank account, Steve would likely be happy, while Britney would probably be sad. Let us reconsider the last example and modify it a little bit.

Steve has €1.000 in his bank account, while Britney has €11.000.

They are offered the following gambles:

- 50% of probability of ending up with either €1.000 or €11.000
- 100% of probability of getting €5.000

The first option has an expected value of €6.000 which obviously is greater than €5.000. According to the Expected Utility theory Steve and Britney are facing the same gamble. However, it looks obvious that the situations are pretty different. Steve is essentially choosing how much he wants to win, while Britney how much is about to lose. Both examples shows an important point: losses and gains are processed differently. Consider these two gambles.

- Winning €9.000 or the 90% of probability of winning €10.000 and 10% of getting nothing
- Losing €9.000 or the 90% of probability of losing €10.000 and 10% of losing nothing

It is easy to notice that the two scenarios are symmetrical, but the choice most people would take is the opposite: getting the sure winning in the first case, and gambling in the second one, hoping to do not lose. This is the so called *Reflection Effect*.

Since it is unlikely and irrational that an individual is both risk averse and risk seeking, there must be some problem with the theory.

## 2.4. Prospect Theory

In 1979, Daniel Kahneman and Amos Tversky in *Prospect Theory: An Analysis of Decision under Risk*<sup>20</sup> elaborated a purely descriptive theory, with the aim of documenting and explaining the systematic violations of rationality axioms in the Expected Utility Theory.

They understood that rather than assessing the utility comparing two different wealth states, it would be more efficient assessing them as variations of wealth, and that gains and losses are perceived differently. The intuition behind the Prospect Theory is as simple as smart, and can be easily explained with the following example.

- You receive a gift of €1.000. Now choose between the following options:
  - 50% of probability of winning €1.000 or 100% of getting €500
- You receive a gift of €2.000. Now choose between the following options:
  - 50% of probability of losing €1.000 or 100% of losing €500

If we use Expected Utility theory, the only thing that count is the final wealth state. In both cases you can get for sure €1.500 more than before starting the game, but you have a more risky option in which you may end up with €1.000 or €2.000. That means, that you should take the same decision in both scenarios. However, for most people this is not the case. It is easy to understand why: ending up with €1.500 represents a gain in the first case and a loss in the second one. That shows the importance of a reference point as illustrated in the example of Steve and Britney. Anyhow, this example differs in the gift received at the beginning of the game. Most people did not care a lot of the initial gift received: it is included in the reference point. This happens because for most people, €1.000 or €2.000 will not change their life. It is not about the difference in the wealth state that guide choices in gambling situations: simply people love gains and hate losses, even more than how much they love gaining.

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<sup>20</sup> Tversky A., Kahneman D., "Prospect Theory: An Analysis of Decision Under Risk", *Econometrica*, Vol. 47, No.2, pp 263-292

In Prospect Theory the decisional process is divided into two distinguished phases: editing and evaluation<sup>21</sup>.

As said in the Heuristics paragraph human brain needs to reformulate and simplify information which otherwise would be biologically impossible to assess. In the Editing Phase a preliminary analysis is performed which often leads to a simplification of the initial problem. The simplification itself may be one of the causes of the inconsistency of choices examined. Tversky and Kahneman identify four main operations which are performed during the *editing phase*. They are not accomplished every single time, since it may be not required.

- *Coding*: as shown with former examples, Prospect Theory emphasizes the importance of a reference point. Rather than thinking about the final state of a gamble, individuals code it in terms of gains and losses. The operation of *coding* is extremely important and the way it is performed may be influenced by several factors, e.g., the way the problem is formulated<sup>22</sup> rather than the pre-existing expectations of the decision maker.
- *Combination*: in order to simplify events, e.g., with different variances but the same outcome, a combination of the two problems into a single one is performed by simply adding the variances: for example, the events “winning 100 with 25% probability” and “winning 100 with 30% probability” are grouped into “winning 100 with 55% probability)
- *Segregation*: some problem may be reformulated in terms of sure gains or losses. For example, when facing the following gamble “winning 1000 with 50% of probability or 100” individuals segregates the “sure gain of 100” from “winning 1000 with 50% probability”.
- *Cancellation*: when assessing events with a shared component, this is ignored by individuals, often altering the “game” itself. Consider the following example, which has been presented by Kahneman and Tversky. It is a two-stage game, in which you have 25% of probability to access the second stage. In the second

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<sup>21</sup> Tversky A., Kahneman D., “*Prospect Theory: An Analysis of Decision Under Risk*”, *Econometrica*, Vol. 47, No.2, pp 263-292

<sup>22</sup> see *framing effect*

stage the choice is between a sure gain of €300, or a possible gain of €400 with 80% of probability. The original experiment divided people in two groups: one would have played the entire game, the second only the second stage. In both cases 78% of people made the same choice, namely the sure gain of €300, even if the two events are very similar in terms of outcomes and standard deviation.

Two additional operations should be mentioned: *simplification* and *detection of dominance*. The first one refers to the fact that individuals tend to round outcomes and probability: a potential gain of €390 with 49% of probability is seen as a potential gain of €400 with 50%. Also, it operates discarding very unlikely events. The detection of dominance consists in the scanning of all possible option in the attempt of find and discard dominated options<sup>23</sup>.

Once the *editing phase* is completed, individuals choose the option with greater value. The value of the game depends on the value associated with outcomes and the weight given to probabilities:

$$\text{Value of the Game: } \sum_{i=1}^N \pi(p_i)v(x_i)$$

with  $p_i$  representing the probability of the  $i$ -game,  $x$  the outcome,  $\pi(\bullet)$  the weighting function and  $v(\bullet)$  the value function. Even if it may look similar to the Expected Utility one, there are some important factors which make it very different. First of all, the *editing phase* alters the original problem, changing outcomes and probabilities. Second, outcomes are seen as gains or losses with respect to a reference point, rather than as final states of wealth. This is extremely important since our perceptual apparatus respond to changes and differences<sup>24</sup>. When considering for example the loudness of a car, we refer to past and present experiences, using a reference point. The value function, strictly speaking, depends on two arguments: the initial or reference position, and the magnitude of the change. A change of €100 is obviously

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<sup>23</sup> Tversky A., "Intransitivity of preferences", Psychological Review, 76, 1969, pp 31-48

<sup>24</sup> Helson, H. "Adaptation-Level Theory", New York: Harper, 1964 in Tversky A., Kahneman D., "Prospect Theory: An Analysis of Decision Under Risk", Econometrica, Vol. 47, No.2, pp 263-292

perceived different if the initial point is €200 or €1200. Third, probabilities are not taken as given, by they are linearly weighted through the weighting function. Since positive and negative outcomes are perceived differently, they are also described differently. In Prospect Theory the curve is concave for positive outcomes and convex for negative ones. As already said, whenever the outcomes to choose are either all positive or all negative, the *editing phase* will likely segregate the sure gain/loss from the rest of the problem. Therefore the Value Function becomes:

$$\text{Value of the Game: } v(x_j) + \sum_{i=1}^N \pi(p_i)(v(x_i) - v(x_j))$$

As described before, the value of this kind of game is given by the sum between the sure gain/loss and the (weighted) difference between risky outcomes and the sure gain/loss.

#### 2.4.1. The Value Function

The Value Function is based on three main assumptions:

- it is defined as variation of wealth states with respect to a reference point;
- it is concave in gains and convex in losses;
- it is steeper in losses than in gains. The slope reach its maximum value around the reference point.

Table 1 provides a graphical representation of the value function<sup>25</sup>.

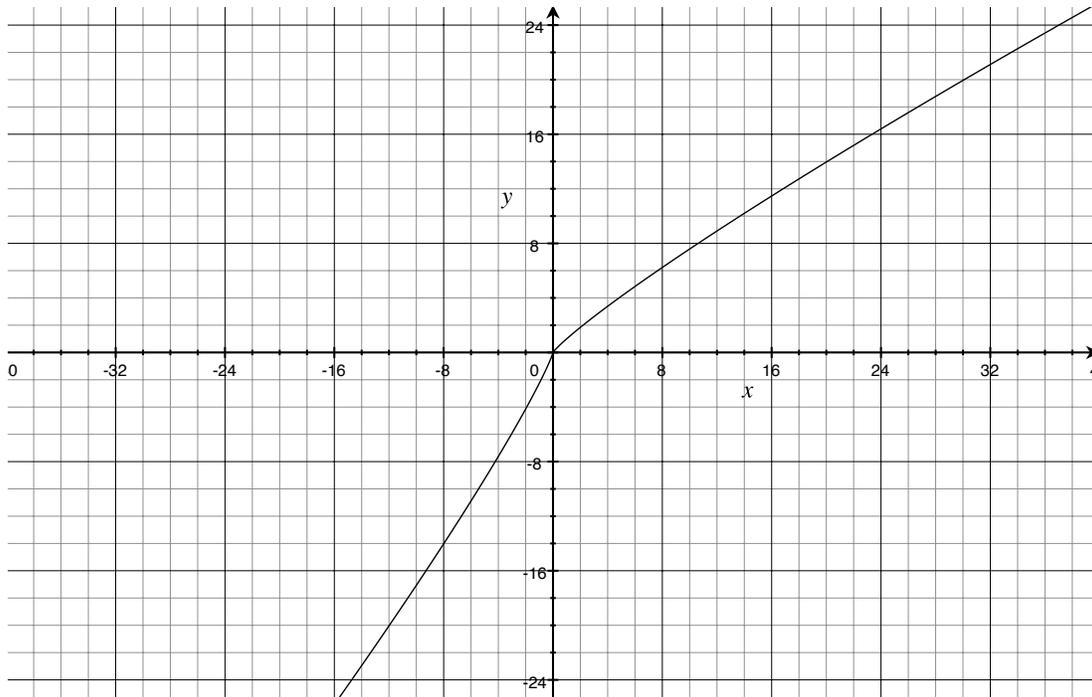
However, since the value function is a function with two variables (reference point and gain/loss) this is just an approximation empirically acceptable. It is likely that the magnitude of the variations influences more the whole choice than the initial status. The shape of the function has two important features: since it is concave in the gain domain and convex in the loss one, when taking decisions in the positive side, risk aversion choices are more frequent. On the other side, in the negative domain, an increase of risk seeking choices are registered. However, the initial state may alter

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<sup>25</sup> Tversky A., Kahneman D., "Advances in Prospect Theory: Cumulative Representation of Uncertainty, in Journal of Risk and Uncertainty, 5, pp.297-323

Table 1

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



the normal behavior, e.g., when it is present an extremely/excessively risky choice: in this case, individual behave in a risk averse fashion even in the negative domain. Finally, the fact that the function is steeper in the negative domain explains the loss aversion: individuals tend to avoid symmetric gambles, like winning or losing €100 after the toss of a coin. Moreover, it is even steeper in proximity of the reference point. This is in complete contrast with the Utility Function of Markowitz<sup>26</sup> which is more shallow.

#### 2.4.2. The Weighting Function

The scaling of individuals' preferences in Prospect Theory is complicated by the weighting function. In fact, the value of each outcome is multiplied by a decision weight. A defining characteristic of the decision weights is that they violates probability axioms: for example the summation of probabilities may not sum up to one. That means that the value of a game is not linear, as in Expected Utility theory.

<sup>26</sup> Markowitz H., "The Utility of Wealth", The Journal of Political Economy, 60, 1952

“Decision weights measure the impact of events on desirability of prospects, and not merely the perceived likelihood of these events”<sup>27</sup>. In order to derive those decision weights a significant number of experiments has been conducted<sup>28</sup> using gambles with clear probabilities.

The essential properties of the weighting function are the following:

- it is an increasing function with  $\pi(0)=0$ ,  $\pi(1)=1$ . That means that impossible events are ignored.<sup>29</sup>
- *overweighting*: low probabilities are overweighted:  $\pi(p)>p$
- *subproportionality*: high probabilities are underweighted:  $\pi(p)<p$
- *subadditivity*: with very small probabilities,  $\pi$  is a subadditive function of  $p$ , i.e.,  $\pi(rp)>r\pi(p)$  with  $0 < r < 1$ .
- *subcertainty*: when two events are complementary, individuals behave as if the sum of weights associated to probabilities is smaller than one, i.e.,  $\pi(p)+\pi(1-p)<1$ .

All these properties imply the nonlinearity of the weighting function. When close to extremes, i.e., probabilities very close to either 1 or 0, individuals show very low comprehension of laws of probabilities, for example either neglecting or exaggerating the distance between a very likely event and a certain one. The following example may clear the concept. Richard Zeckhauser, proposed the following situation: you are playing the Russian Roulette, and you are given the opportunity of removing one bullet. How much would you pay if there currently are four bullets? What about if there were only one bullet? Rationally people should pay

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<sup>27</sup> Tversky A., Kahneman D., “*Prospect Theory: An Analysis of Decision Under Risk*”, *Econometrica*, Vol. 47, No.2, p 280

<sup>28</sup> Barnes, J. D., Reinmuth J.E., “*Comparing Imputed and Actual Utility Functions in a Competitive Bidding Setting*”, *Decision Sciences*, 7, 801-812, 1976

Grayson C. J., “*Decisions under Uncertainty: Drilling Decisions by Oil and Gas Operators*”, Cambridge, Massachusetts: Graduate School of Business, Harvard University, 1960.

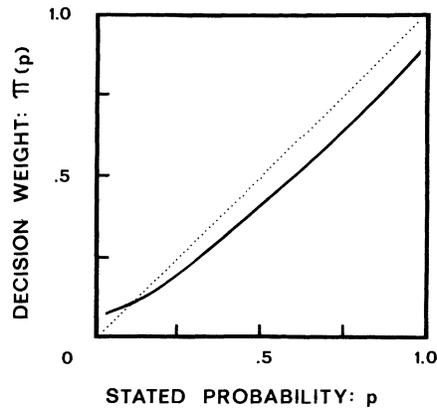
Green P. E., “*Risk Attitudes and Chemical Investment Decisions*”, *Chemical Engineering Progress*, 59, 35-40, 1973

Halter A.N., Dean J.W., “*Decisions under Uncertainty*”, Cincinnati: South Western Publishing Co., 1971

Swalm R.O., “*Utility Theory-Insights into Risk Taking*”, *Harvard Business Review*, 44, 123-136. 1966

<sup>29</sup> This is one of the weak points of Prospect Theory and it will be explained later on this chapter.

in both cases the same amount to have the bullet removed, but this is not the case. Most people would be willing to pay more to remove the last bullet, even if in both cases the probability of dying is 1/6. This trend may be described by the following hypothetical weighting function.



The figure above has been taken from Tversky A., Kahneman D., "Prospect Theory: An Analysis of Decision Under Risk", *Econometrica*, Vol. 47, No.2, p 280

## 2.5. Cumulative Prospect Theory (CPT)

In 1992, Tversky and Kahneman proposed an evolution of the original theory<sup>30</sup>. It somehow resemble the Rank-Dependent Expected Utility theory, which is a version of the Expected Utility theory based on the fact that the value of a game is not linear with respect to probabilities and depends on all possible outcomes of the game<sup>31</sup>. The main innovation of the CPT is a different way to derive the decision weights. Namely, they depends on the cumulative distribution and are obtained applying different weighting functions to gains and losses. Suppose that the outcome  $x_i$  is considered better than  $x_j$

when  $i < j$ , then the weight of the gain will be obtained in this way:

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

<sup>30</sup> Tversky A., Kahneman D., "Advances in Prospect Theory: Cumulative Representation of Uncertainty, in *Journal of Risk and Uncertainty*, 5, pp.297-323

<sup>31</sup> Diecidue E., Wakker P.P., "On the Intuition of Rank-Dependent Utility", *Journal of Risk and Uncertainty*, 23, pp 281-298

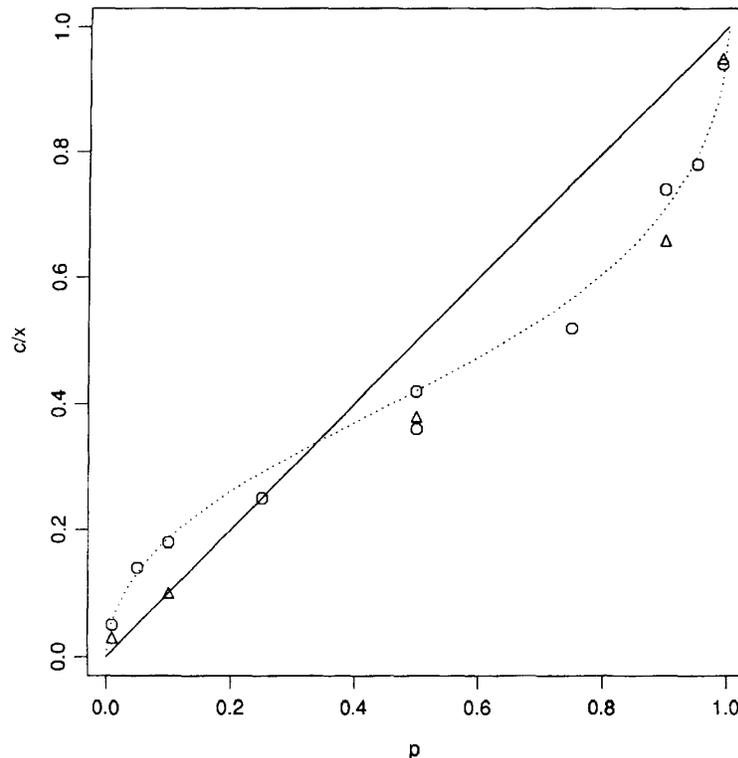
with  $w^+$  representing the weighting function and  $F(\bullet)$  the cumulative probability function. In this formulation, the CPT is quite similar to the Rank-Dependent theory: the decisional weight is the difference between the weighting function applied to the probability of either a gain (loss) or a tie, and the weighting function applied to the probability of a gain (loss). In this way, the value of an aleatory prospect would be:

$$V = \sum_{i=1}^n \pi_i v(x_i)$$

with  $\pi_i$  representing the decisional weights and  $v(0)=0$

Tversky and Kahneman proposed the following functional form to evaluate gains and losses:

$$w^+(p) = \frac{p^\gamma}{(p^\gamma + (1-p)^\gamma)^{\frac{1}{\gamma}}} \quad w^-(p) = \frac{p^\delta}{(p^\delta + (1-p)^\delta)^{\frac{1}{\delta}}}$$



The figure above has been taken from Tversky A., Kahneman D., "Advances in Prospect Theory: Cumulative Representation of Uncertainty, in Journal of Risk and Uncertainty, 5, pp.297-323

According to the original Prospect Theory, individuals are risk averse in the positive domain and risk seeking in the negative. In the CPT behavior of individuals is even more variegated. First of all, individuals are risk averse when there are good chances and outcomes are not too high. When gains are very unlikely and outcomes very high, like in lotteries, then individuals become risk seeking. The opposite happens in the negative domain.

## **2.6. Implications**

The aim of this paragraph is to highlight some of the implications of Prospect Theory which are material to the thesis. Hereafter will be presented four aspects of Prospect Theory which shows how individuals' behavior in risky choices is extremely vulnerable under several point of views.

### **2.6.1 *The Endowment Effect***

The Endowment Effect can be easily understood with the following example: suppose you have bought the tickets for the Super Bowl, and the team you supported is playing the game. Also, suppose you paid the ticket at the regular price of \$200 and now tickets are all sold out, and very rich fans are offering \$3000 for the ticket. Would you sell it? Most of the people would not<sup>32</sup>. This is a simple example of Endowment Effect. Kahneman, Knetsch and Thaler<sup>33</sup> elaborated an experiment to prove and understand it. Using a variation of an experiment conducted by Vernon Smith, they first gave “*induced value tokens*” to half participants to create supply and demand, set a price, and started several markets. Market rules accurately described the final distribution of tokens, the market clearing price, and volume of the trades.<sup>34</sup> The same experiment was repeated replacing tokens with a

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<sup>32</sup> Krueger A.B., “*Supply and Demand: An Economist Goes to the Super Bowl*”, in Milken Institute Review, A Journal of Economic Policy”, 3, pp. 22-29, 2001

<sup>33</sup> Kahneman D., Knetsch J.L., Thaler R., Anomalies: The Endowment Effect, “*Loss Aversion and Status Quo Bias*”, The Journal of Economic Perspectives, Vol. 5, no.1, pp 193-206, 1991

<sup>34</sup> Also, results showed that the task of the game was understood, and that market mechanisms was such that transactions costs were low.

mug from the University where participants were studying. The real price of the mug was known. Mugs were distributed randomly to participants. In this case Supply and Demand mechanisms did not predict the final outcome: the volume of trades was half of the predicted one and buying price was half of selling price. A third experiment was repeated adding to *buyers* and *sellers* a third category: *choosers*. Their task was to choose between the mug and the money, and to signal how much money they would ask in exchange for the mug. Even if *buyers* and *chooser* are facing the same problem, either selling the mug or keeping it, buyers valued the mug the double than choosers did. What is even more interesting is that while there was a significant distance between the price asked by *sellers* and the one *buyers* would have paid, there was not between *choosers* and *buyers*. The only difference between *sellers* and *choosers* was that the first received the mug and then had to decide whether to renounce the mug or not. This means that there is an emotional side that affect choices, and it may be described by the loss aversion. Indeed, it has been shown<sup>35</sup> that the Endowment Effect is present only if participants physically hold the object for a certain amount of time before getting to know about the possibility of trading. Several experiment has been conducted, and the Endowment Effect seems to be absent in expert traders and very poor people<sup>36</sup>. The difference between them is that while traders are indifferent to the difference between renouncing and gaining, all very poor people choices concerns losses, since their reference point is below the status quo.

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<sup>35</sup> Knetsch J.L., *"The Endowment Effect and Evidence of Nonreversible Indifference Curves"*, The American Economic Review, 79, pp. 1277-1284, 1989

<sup>36</sup> Cohen D., Knetsch J.L., *"Judicial Choice and Disparities Between Measures of Economic Value"*, in Osgoode Hall Law Review, 30, pp. 737-770, 1992.  
Korobkin R., *"The Endowment Effect and Legal Analysis"*, Northwestern University Law Review, 97, pp. 1227-1293, 2003

### 2.6.2. *Mental Accounting*

It is the mental process of organizing, assessing and keeping track of economical and financial operations<sup>37</sup>. An example will clarify the concept. Two groups of people are asked to face the following situation<sup>38</sup>:

- Suppose you want to go to the theater and you have already bought the ticket for \$10. Once you arrived at the theater you realize you lost the ticket. Would you still go to the theater?
- Suppose you want to go to the theater. Once you arrived at the theater you realize you lost a 10 dollar bill. Would you still go to the theater?

In the first case only 44% of people responded affirmatively, while in the second one 88% of people would go to the theater anyway.

It is possible to analyze these results in *mental accounting* terms. Once an individual decides to do something, he/she creates a mental account and define a budget for that account. People who faced the first scenario had already spent the money in the “theater” mental account and do not want to use, while in the second case they spent (actually lost) the money coming from a different account, say “daily expenses”. Therefore, they reduced their daily expenses account but still have the money in the “theater” account to go seeing the show.

The implications of the *mental accounting* are profound. In financial choices, e.g., may lead investors to take irrational decisions. Suppose you have two stock options in your portfolio, say A and B. A can be said to be a good investment so far (the current price is higher than price paid) while B is not (the current price is lower than price paid). Both A and B, if sold today worth €1000. Suppose you actually need €1000 cash today, would you sell A or B to get the cash you need? Most people would sell A<sup>39</sup>, even if a more rational thinking would have led to the opposite conclusion. Selling A, on one hand you register a profit, but on the other one you still have the losing stock option in your portfolio. A full description of the mental accounting

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<sup>37</sup> Thaler R., “*Mental Accounting and Consumer Choice*”, *Marketing Science*, 4, pp.199-214, 1985

<sup>38</sup> Tversky A., Kahneman D., “*Choices, Values, and Frames*”, *American Psychologist*, 1984

<sup>39</sup> Shefrin H., Statman M., “*The Disposition to Sell Winners Too Early and Ride Losers Too Long: Theory and Evidence*”, *Journal of Finance*, 40, pp 777-790, 1985

theory is not material to the purpose of the thesis, therefore we just report a definition of *mental accounting* given by Thaler<sup>40</sup> which embodies three different aspects of individuals' mental process. First *mental accounting* can be defined as the way outcomes and actions are perceived by individuals. In this sense, Prospect Theory is a good way to describe *mental accounting*. Second, the attribution of savings to mental accounts: Thaler describes three different categories: *Consumption Accounts*, *Wealth Accounts* and *Income Accounting*. The third aspect is about the frequency and the modalities with which people check their accounts.

### 2.6.3. Framing Effect

Individuals' preferences should depend on their utility function, according to standard theories. However, Tversky and Kahneman<sup>41</sup> shown that by simply altering the way a problem is framed, people may take irrational choices. The following example is emphasizes this aspect. A group of people is asked told that a tropical disease could kill 600 people. To save them, two different programs are available:

- Save 200 people with 100% of probability;
- Save 600 people with 33% of probability.

72% of people chose the first option: save 200 people with 100% of probability.

Later the two programs were presented in this way:

- 400 people will die with 100% of probability;
- Nobody will die with 33% of probability.

78% of people chose the second program.

The two pairs of programs presented are the same: in the first case, in both presentation 200 people survive and 400 die. The only difference consists in the language used: in the first scenario, they talked about people saved, in the second

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<sup>40</sup> Thaler R., "*Mental Accounting Matters*", Journal of Behavioral Decision Making, 12, pp.139-206, 1999

<sup>41</sup> Tversky A., Kahneman D., "*Prospect Theory: An Analysis of Decision Under Risk*", Econometrica, Vol. 47, No.2, p 280

one about people that dies. The “survival” point of view is clearly associated with a gain, while the “death” point of view with a loss<sup>42</sup>.

The Framing Effect allows us to introduced how individuals’ mind work. In the next chapter the Associative Mechanism will be introduced.

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<sup>42</sup> Tversky A., Kahneman D., “*The Framing of Decisions and the Rationality of Choice*”, Science, 211, pp. 453-458., 1981

# **Section 2**

## 3. Associative Mechanism

### 3.1. Setting the basis

Before getting into the core of the associative mechanism, a brief explanation of the assumptions we adopted is needed.

Two fundamental mechanisms rule human mind: on one side the intuitive, fast and sometime irrational thinking; on the other the logical, rational and meditated thinking<sup>1</sup>.

Keith Stanovich and Richard West<sup>2</sup> refer to them as two mental systems:

- *System 1*: it works quickly, effortless and automatically
- *System 2*: it is used to undertake complex mental activities which requires focus, like making calculations.

The two systems interact with each other continuously. System 1 is always working, while usually System 2 is in a sort of “stand-by” mode. The first produces inputs for the latter, like impressions, feelings and intuitions. System 2 take these inputs into account, so intuitions and impressions become beliefs. This works quite good for most of the time. Usually System 2 accepts what System 1 suggests. When System 1 is unable to accomplish a task, like computing  $123 \times 34$ , then System 2 is called to intervene. Also, System 2 intervenes whenever System 1 detects something in contrast with the reality it always refers to. This is often experienced when we are surprised: a big wave of attention pervade our body, getting us physically and mentally present in the moment. System 2 keeps track of our behavior constantly. This happens when, e.g., we avoid being impolite when angry, or when driving during night hours<sup>3</sup>.

Basically, whatever we think originates from System 1, but when things get difficult System 2 plays the main role and usually has the last word.

This division of labour is quite efficient. System 1 does pretty good what is required to do. Its model of the world is accurate and it usually reacts quickly and appropriately to changes. However, it is subject to bias and has little comprehension of logic and statistic. Furthermore it cannot be switched off. This sometimes leads to conflicts with

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<sup>1</sup> Kahneman D., “*Maps of Bounded Rationality: Psychology for Behavioral Economics*”, The American Economic Review, Vol. 93, no. 5, pp. 1449-1475, 2003

<sup>2</sup> Stanovich K., West R., “*Individual differences in reasoning: Implications for the rationality debate?*”, Behavioral and Brain Science, 23, 645-726, 2000

<sup>3</sup> Kahneman D., “*Pensieri Lenti e Veloci*”, Oscar Mondadori, 2013

System 2. With his famous test<sup>4</sup>, J.R. Stroop (1935) shows a perfect example of conflict between the two Systems. He had people reading words indicating colors. These words were printed in a different color, e.g., the word *GREEN* were printed in red. The goal was to name the color ignoring the words. This duty requires the intervention of System 2, because it is something we are not used to do. However, since System 1 cannot be turned off, it is hard to ignore the word.

The “Café wall” illusion represents<sup>5</sup> another example of conflict. In **Figure 2.1**<sup>6</sup>, the horizontal lines are parallel. However, our System 1 do not see them parallel at all. If we use a ruler, we can see that there is no doubt that those lines are parallel and yet we still see them fuzzy. We can decide to believe that those line are parallel (believing in our System 2), but can do nothing to avoid seeing them as the first time.

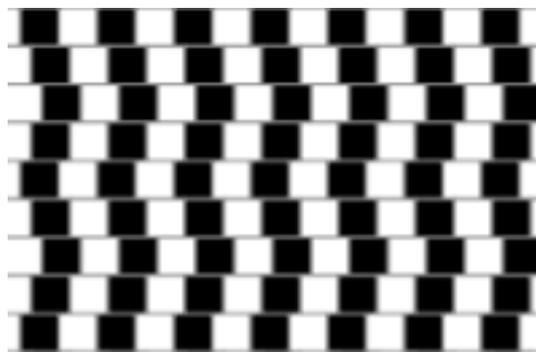


Figure 2.1

Christopher Chabris and Daniel Simons in *The Invisible Gorilla*<sup>7</sup> taped two basketball teams playing. They asked spectators to count the number of passes of one of the two teams. This is not an easy task, and to accomplish it, System 2 is needed. During the match, a woman dressed like a gorilla walked through the court, banged on her chest, and walked away. Almost half of spectators did not see the gorilla. The fact that they were counting, and even more important, the order to ignore one of the two teams, caused the blindness. Since our mental capacity is limited, an efficient partition of resources is needed. However this partition is not stable, it changes dynamically according to the task given. The more complicated the task, the more resources are

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<sup>4</sup> Stroop J.R., “*Studies of interference in serial verbal reactions*”. Journal of Experimental Psychology, 18, 643-662, 1935

<sup>5</sup> Pierce, H., “*The illusion of the kindergarten patterns*.” Psychological Review 5.3, 233, 1898 in Kahneman D., “*Pensieri Lenti e Veloci*”, Oscar Mondadori, 2013

<sup>6</sup> [http://upload.wikimedia.org/wikipedia/commons/thumb/d/d2/Café\\_wall.svg/200px-Café\\_wall.svg.png](http://upload.wikimedia.org/wikipedia/commons/thumb/d/d2/Café_wall.svg/200px-Café_wall.svg.png)

<sup>7</sup> Chabris C., Simons D., “*The Invisible Gorilla: And Other Ways Our Intuitions Deceive Us*”, Random House LLC, 2010

needed to perform it. In 1967, Daniel Kahneman and Jackson Beatty conducted a laboratory experiment to test the reliability of pupils as an indicator of mental activity<sup>8</sup>. They started asking participants some easy question while taping eyes reactions. Step by step they made the test harder and harder, asking to memorize a four digits number which appeared on a screen for few seconds. Once the number disappeared they were asked to, e.g., “add 1” to each digit. They found that pupils enlarge when mental activity increase, and vice versa. When the mental activity of participants was at its peak, they displayed for few second a letter. Participants could not see it. The more intense the mental activity, the more the blindness caused by it.

### **3.2. Automaticity**

“Automaticity refers to control of one’s internal psychological processes by external stimuli and events in one’s immediate environment, often without knowledge or awareness of such control”<sup>9</sup>. Psychology used to focus only on the conscious and intentional process of human mind. Freud’s researches started the study of the unconscious, but very little attention after him have been paid to this side of the brain. Rephrasing Kahneman words: we are much closer to his (Freud’s) works now than one hundred years ago, and we understood that we know much less than we thought<sup>10</sup>. The dual system presented above prompt the interest about the unconscious part, setting the basis of a model in which the automaticity is accomplished by a default, background regulatory function process which frees the conscious mind from the duty of analyzing million of stimuli received by the environment. Most of the early studies on automaticity focused on social perception. The lens was on whether people’s impressions of others is driven by automatic biases. Through the use of priming<sup>11</sup> techniques automatic behaviors were passively induced, showing that several different forms of social perception are triggered by the presence of particular features in the environment<sup>12</sup>. The perceptual

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<sup>8</sup> Kahneman D., Beatty J., Pollack I., “*Perceptual Deficit During a Mental Task*”, Science, 15, pp. 218-219, 1967

<sup>9</sup> Bargh J.A., Williams E.L., “*The Automaticity of Social Life*”, Current Directions in Psychological Science, vol 15, n.1, p. 1., 2006

<sup>10</sup> <http://edge.org/conversation/two-big-things-happening-in-psychology-today-class-4>

<sup>11</sup> An in depth analysis of the concept of priming will be undertaken in the next paragraph. Priming derives from the concept of “priming a pump”.

<sup>12</sup> Wegner D.M., Bargh J.A., “*Control and Automaticity in Social Life*”, in Gilbert D., Fiske S., Lindzey G., Handbook of social psychology, 4th ed. pp. 446-496. Boston, McGraw-Hill, 1998

apparatus is strongly linked with the behavioral one (see *Florida effect in the next paragraph*). The “hardware” of the perception-behavior link has been found in the so called *mirror neurons*<sup>13</sup>. These neurons are located in the premotor cortex of higher primates and have a very interesting function: they are activated both when a person watches a particular action being performed and when the action is actually performed. This shows not only the perception-behavior link, but also a deep connection to other people. It is under these hypothesis that it has been tested the automaticity of certain social behaviors. For example, when performing a task in which coordination between two persons is needed, the same areas of the brain are activated both when performing the whole task alone and when performing just a part of it, leaving the other part to the second person<sup>14</sup>. The logic of the connection between perception and behavior is that it refers to any knowledge structure automatically activated during social perception. Stereotype activation leads to stereotype-consistent behaviors. Social environment can also cause, in certain stereotyped circumstances, the automatic activation of the pursuit of a goal<sup>15</sup>. For example the socially accepted goal of a mother pursuing her child’s best rather than hers, activates an automatic mechanism that eventually lead to the automatic acceptance of the goal. The consciousness of the activation do not affect the actual realization of the goal.

An important area of research in automatic social phenomena is *motivated cognition*, most of all self-protective motives. An interesting experiment shown that participants self esteem lowering is inversely correlated to the tendency to stereotype others. Apparently, a self-defensive mechanism seems to be activated to relieve the personal failure through the denigration of others<sup>16</sup>. However stereotype influences can be mitigated in individuals who possess an automatic egalitarian and fair toward others goal. Moskowitz *et al.*<sup>17</sup>, shown that apparently, the stimulus from a minority group

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<sup>13</sup> Rizzolatti G., Fogassi L., Gallese V., “*Neurophysiological mechanisms underlying the understanding and imitation of action*”, *Nature Reviews Neuroscience*, 2, 661–670, 2001

<sup>14</sup> Sebanz N., Bekkering H., Knoblich G., “*Joint Action: Bodies and Minds moving together*”, *Trends in Cognitive Science*, Vol.10, no.2, Feb 2006

<sup>15</sup> Bargh J.A., Gollwitzer P.M., Lee-Chai A.Y., Barndollar K., Troet-Schel R., “*The automated will: Nonconscious activation and pursuit of behavioral goals*”, *Journal of Personality and Social Psychology*, 81, 1014–1027, 2001

<sup>16</sup> Spencer S.J., Fein S., Wolfe C.T., Fong C., Dunn M.A., “*Automatic activation of stereotypes: The role of self-image threat*”, *Personality and Social Psychology Bulletin*, 24, 1139–1152, 1998

<sup>17</sup> Moskowitz G.B., Gollwitzer P.M., Wasel W., Schaal B., “*Preconscious control of stereotype activation through chronic egalitarian goals*”. *Journal of Personality and Social Psychology*, 77, 167–184, 1999

member starts two processes at the same time: on one side, the stereotype is activated, on the other the egalitarian motive is activated too. This leads to a forced shut down of the former before it can have an effect on the final judgment.

The automatic side of mind has been linked with the theoretical analysis of intuition. This automaticity eventually affects decision making, most of the time doing a fairly good job<sup>18</sup>, but in a way most people are unaware. The fact that, e.g., emotions can have an influence in immediate behaviors is well-known, but these influences have been proved to persist over time<sup>19</sup>. Once mental representations are activated it takes a certain amount of time to have them back to a deactivated state. That means that they still have an effect on choices, judgments and decision making far more than it was thought. The following paragraph analyzes how the concept of automaticity has been exploited by priming technique to investigate the association mechanism.

### **3.3. Priming Effect**

#### *3.3.1. Broad Concept*

System I has been introduced as the intuitive, fast and sometime irrational part of human mind. It is identified with the automatic and mostly unconscious operations of *associative memory*<sup>20</sup>. When reading the word “vomit” an automatic mechanism is triggered evoking a series of physical reactions and ideas which simply cannot be controlled. A facial expression of disgust and a motor response of recoil are immediately generated, possibly bringing to mind past experiences, images, or thoughts somehow related to the word. The external input generated a self-enforcing circuit in which each association creates a new one, related to the former, which in turn creates new associations all connected with the first input. Often, all of this happens in less than a couple of seconds. What is incredibly interesting of the associative memory is that it does not distinguish between fiction and reality. Reading the word “vomit” created the same physical and mental reaction that the real event would have created, just in a softer way. In fact, it is the whole body reacting to events not only the mind, be

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<sup>18</sup> Lieberman M.D., “*Intuition: A social cognitive neuroscience approach*”, *Psychological Bulletin*, 126, 109–137, 2000

<sup>19</sup> Lerner J.S., Small D.A., Loewenstein G., “*Heart strings and purse strings: Carry-over effects of emotions on economic transactions*”, *Psychological Science*, 15, 337–341, 2004

<sup>20</sup> Morewedge C.K., Kahneman D., “*Associative process in Intuitive Judgment*”, in *Trends in Cognitive Science*, 14, pp 435-440, 2010

them real or unreal<sup>21</sup>. Reactions cannot be controlled. They are automatically generated by System I. Around the 80s, psychologists started realizing that each word produces an instant reaction measurable with the ease with which linked words are recalled. For example, they observed that people who first saw the word *EAT* tend to complete the word SO-P with SOUP rather than with SOAP<sup>22</sup>. It is called *priming effect*. Not only people were more sensible to the word SOUP, but also to all those words related to food. Later it has been understood that the *priming effect* is not limited to words. The Florida effect<sup>23</sup> describes the effects of priming on the whole body. A group of students was asked to put together sentences of four words starting from a sample of five. Some of the students were *primed* with words like “Florida<sup>24</sup>”, “grey”, “wrinkle” and so on, to prime the idea of elderly. Once the task was completed, students were asked to reach a different laboratory for a second experiment. What experimenters really wanted to test was the time needed to reach the lab. As a result, people primed with elderly words walked slower. What is maybe even more incredible, is that nobody noticed the fact. None of the student noticed the prime, and none of them felt influenced somehow. This is known as *ideomotor effect* (or *Carpenter Effect*). Also, it works the other way around. In a connected study, people were asked to walk with a certain number of steps per minute. Some of them were supposed to walk slower than normal, others faster. In the second part of the experiment, the first were faster in recognizing elderly-related words<sup>25</sup>. Dimberg et al., conducted a study on the automatically controlled emotional response<sup>26</sup>. They asked college students to evaluate a show while holding a pencil in their mouth. (Unconsciously) smiling students find the show funnier than (unconsciously) frowning ones. Next paragraphs will breakdown the structure of priming.

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<sup>21</sup> Niedenthal P.M., “*Embodying Emotion*”, *Science*, 316, pp.1002-1005, 2007

<sup>22</sup> Kahneman D., “*Pensieri Lenti e Veloci*”, Oscar Mondadori, 2013

<sup>23</sup> Bargh J.A., Chen M., Burrows L., “*Automaticity of Social Behavior: Direct Effects of Trait Construct and Stereotype Activation on Action*”, *Journal of Personality and Social Psychology*, 71, pp. 17-21, 2006

<sup>24</sup> In the US, Florida is a State chose by a lot of people to spend the elderly

<sup>25</sup> Mussweiler T., “*Doing is for Thinking! Stereotype Activation by Stereotypic Movements*”, *Psychological Science*, 17, pp. 17-21, 2006

<sup>26</sup> Dimberg U., Thunberg M., Grunedal S., “*Facial Reaction to Emotional Stimuli: Automatically Controlled Emotional Responses*”, *Cognition and Emotion*, 16, pp.449-471, 2002

### 3.3.2. Structure of Priming

“There are two big things happening in psychology today. One, of course, is everything that's got to do with the brain, and that's dominating psychology. But there is something else that is happening, which started out from a methodological innovation as a way to study memory, and we've always known, that's the idea of the notion of association of ideas, which has been around for 350 years at least.”<sup>27</sup>

It is indeed in 1970 that the experiments of Meyer and Schvaneveldt<sup>28</sup> prompted the flowering of research on priming. Their experiments showed that people are faster in recognizing a word when preceded by a semantically correlated one. Several steps forward has been taken since those years. There is not a unique way to classify priming. However two common aspects characterize most types of priming: negative or positive priming and perceptual or conceptual priming.

The term negative priming has been first introduced by Tipper in 1985<sup>29</sup>. According to his definition targets and distractors are processed in a different way by the brain. A good example of positive prime is the experiment done by Meyer and Schvaneveldt cited earlier. A negative prime can be exemplified looking at *Table 2*. When trying to pronounce whether the words in column A are written either in capital or in small

Table 2

A	B
ROAD	capital
tree	SMALL
YELLOW	CAPITAL
HOUSE	capital
sea	small
MOUNTAIN	capital
dog	SMALL

<sup>27</sup> <http://edge.org/conversation/two-big-things-happening-in-psychology-today-class-4>

<sup>28</sup> - Meyer D.E., Schvaneveldt R.W., "Facilitation in recognizing pairs of words: Evidence of a dependence between retrieval operations". *Journal of Experimental Psychology* 90: 227–234, 1971

- Schvaneveldt R.W., Meyer D.E., "Retrieval and comparison processes in semantic memory", in Kornblum, S., "Attention and performance IV", New York: Academic Press, pp. 395–409 1973

- Meyer, D.E.; Schvaneveldt, R.W.; Ruddy, M.G., "Loci of contextual effects on visual word recognition", in Rabbitt, P.; Dornic, S., "Attention and performance V", London: Academic Press, pp. 98–118, 1975

<sup>29</sup> Tipper S. P., "The negative priming effect: Inhibitory priming by ignored objects", *Quarterly Journal of Experimental Psychology*, 37, 571-590, 1985

letters, there is no prime: you just focus on not reading the word. When looking at column B things change. There is a conflict: System 1 read capital, but System 2 is required to pronounce small. That is the effect of a negative prime.

A positive prime speeds up processing, while a negative prime lowers it<sup>30</sup>. Positive priming activates items above a base level of activation, whereas negative priming inhibits items below<sup>31</sup>. The positive priming effect embodies the discoveries made in recent years. It was thought that the association mechanism works on a sort of linear basis, in which each thought activates a new one. This is not the case. Rather each new thought activates several coherently correlated ones. The coherence is remarkably and it unveils a rooted interconnection between different systems in human body. That is what the *Florida effect* described earlier is about. If on one hand priming is more efficient when the stimuli are in the same modality (e.g., verbal priming works best with verbal cues), on the other it works also among different modalities. For example studying the syntactic deficit in aphasia affected people, Zurif *et al.*<sup>32</sup> used cross-modal priming.

Four different theoretical approaches have been proposed to describe negative priming: the distractor inhibition model<sup>33</sup>, the episodic retrieval model<sup>34</sup>, the feature mismatch hypothesis<sup>35</sup> and the temporal discrimination model<sup>36</sup>. The first two are the most widely accepted. Therefore here we will give just a brief description of them.

The distractor inhibition model is based on the assumption that the process coding the distractor representation into a response is inhibited. Active inhibition of distracting information is the central mechanism in the process coordinating the interaction

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<sup>30</sup> Mayr S. Buchner A., "Negative Priming as a Memory Phenomenon: A Review of 20 Years of Negative Priming Research", *Journal of Psychology* 215 (1): 35, Düsseldorf, 2007

<sup>31</sup> Malley G.B., Strayer D.L., "Effect of Stimulus Repetition on Positive and Negative Identity Priming", *Perception and Psychophysics*, 57 (5), 657-667, 1995

<sup>32</sup> Zurif E.B., Swinney D., Prather P., Solomon J., Bushell C., "An on-line analysis of syntactic processing in Broca's and Wernicke's aphasia", *Brain and Language* 45 (3): 448-464, 1993

<sup>33</sup> Tipper S. P., "The negative priming effect: Inhibitory priming by ignored objects", *Quarterly Journal of Experimental Psychology*, 37, 571-590, 1985

<sup>34</sup> - Neill W.T., Valdes L.A., "Persistence of negative priming: Steady state or decay?", *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 18, 565-576, 1992  
- Neill, W.T., Valdes L.A., Terry K.M., Gorfain D.S., "Persistence of negative priming: II. Evidence for episodic trace retrieval", *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 18, 993-1000, 1992

<sup>35</sup> Park J., Kanwisher N., "Negative priming for spatial locations: Identity mismatching, not distractor inhibition", *Journal of Experimental Psychology: Human Perception and Performance*, 20, 613-623, 1994

<sup>36</sup> Milliken, B., Joordens, S., Merikle, P.M., Seiffert A.E., "Selective attention: A reevaluation of the implications of negative priming", *Psychological Review*, 105, 203-229, 1998

between parallel perceptual processes and goal-directed serial behaviors. According to the episodic retrieval model, “*negative priming is the result of retrieving the prime episode when exposed to the probe stimulus*”<sup>37</sup>. A *do-not-respond* flag is attached to the prime distractor. When the stimulus is received, the *do-not-respond* flag enters in conflict with the requirement to respond, ending up in a time consuming action. According to the model, the more likely episodic retrieval the larger the effect. Table I example perfectly exemplified the concept.

Perceptual priming differs from conceptual in the correlation between stimuli. With perceptual priming the stimuli are similar in the form. The more similar the stimuli the grater the effect. The effect of conceptual priming, on the other hand, is strengthen when the stimuli are close in the meaning. The example cited in the first paragraph of this chapter is a conceptual priming: the word *eat* primes the word *soup*, so that when asked to fill SO-P with the missing letter people will more likely write *soup* than *soap*. The difference between perceptual and conceptual priming is also visible looking at the brain regions used. Perceptual priming effect reflects indeed the use of a structural-perceptual memory system, which is localized to the occipital lobe, while conceptual priming effect are localized in the temporoparietal region reflecting operation of a lexical semantic memory system<sup>38</sup>.

The type of priming can vary in intensity, frequency, degree of correlation, it can be explicit or implicit and so on. Illustrating all kind of priming would require an entire book, and this is not the purpose of the thesis. In the following paragraphs we will describe two different priming mechanisms: haptic priming and visual priming throught he use of faces.

### **3.4. Haptic Priming**

Human mind constantly monitors, captures and analyzes several different inputs from the environment. It is well known that all these signals are “captured” through the use of five senses. Under the assumption of a coherent intercorrelation between different systems, information received influences the thoughts, the behavior and the mood of individuals. Evolution have led to a strong development of the touch which became

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<sup>37</sup> Mayr S. Buchner A., “*Negative Priming as a Memory Phenomenon: A Review of 20 Years of Negative Priming Research*”, *Journal of Psychology* 215 (1): 35, Düsseldorf, 2007

<sup>38</sup> Keane M.M., Gabrieli J.D.E., Fennema A.C., Growdon J.H., Corkin S., “*Evidence for a Dissociation Between Perceptual and Conceptual Priming in Alzheimer's Disease*”, *Behavioral Neuroscience*, Vol. 105, No. 2, 326-342, 1991

critical to interpersonal relationships. Nevertheless few scientific researches has been conducted on the topic over the years<sup>39</sup>. Active touch, in particular, had developed through the use of hands, enhancing data-processing and exploratory integration, revealing a correlation between sensory and motor systems<sup>40</sup>. That is why companies take particular care of the packaging of the product: even when the tactile cues are non-diagnostic for the actual quality of the product, the inputs received by the tactile sense enters in the total evaluation of the experience. This kind of results suggest that haptically obtained information have a broad affect on cognition<sup>41</sup>. The hypothesis proposed for such an importance of the tactile system is based on the fact that early in life sensorimotor experiences form a scaffold for the development of knowledge. The bridge between physical and mental scaffolding can be find in the use of metaphors. Specific linguistic descriptors, such as “the gravity of the situation” exemplifies how certain shared impressions coming from the tactile sensory word influence the use of words. The concept of embodiment of emotions cited above<sup>42</sup>, sustains the hypothesis that the links between sensorimotor events and scaffolded concepts are well established, and therefore touching objects may activate the processing of physical sensations and touch-related conceptual processing. The principle of *neural reuse*<sup>43</sup> explains how body-related experiences are deeply linked with high-order cognition: to better understand abstract concept physical sensations enter in the initial phase of comprehension, and become automatically connected to later activation of the abstract concept. In a study on the influence of haptic sensation on social judgments, Ackerman *et al.*<sup>37</sup>, experimented the mentioned link between physical sensation and the cognitive process. More specifically the hypothesis lying underneath the study is that tactile qualities elicit a haptic mindset. Under this assumption touching an object would trigger the application of associated concepts, e.g., the heaviness of an object may induce heaviness-related concepts like the already mentioned “the gravity of the situation”. In one of their experiment they had people holding a clipboard when evaluating a job

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<sup>39</sup> Gallace A., Spence C., “*The Science of Interpersonal Touch: an Overview*”, *Neuroscience & Biobehavioral Reviews* 34 (2), 246-259, 2010

<sup>40</sup> Lederman S.J., Klatzky R. L., “*Hand movements: A window into haptic object recognition*”, *Cognitive Psychology*, 19, 342-368, 1987

<sup>41</sup> Ackerman J.M., Nocera C.C., Bargh J.A., “*Incidental Haptic Sensations Influence Social Judgment and Decisions*”, *Science*, Vol. 328, pp. 1712-1715, 2010

<sup>42</sup> Niedenthal P.M., “*Embodying Emotion*”, *Science*, 316, pp.1002-1005, 2007

<sup>43</sup> Anderson M.L., “*The Massive Redeployment Hypothesis and the Functional Topography of the Brain*”, *Philosophical Psychology*, Vol.20, n.2., pp. 143-174, 2007

candidate. They had two treatment groups: the only difference was the weight of the clipboard, so the first group was holding a heavier clipboard than the second. The result is pretty intriguing: participants using heavy clipboards rated the candidate as better in a broad sense, and specifically as displaying more serious interest in the position. The clipboard had nothing to do with the candidate and yet it influenced participant judgment. Moreover, in line with the coherence of priming and association mechanisms, participants did not show difference in the evaluation of the “likability” of the candidate. The concept of heaviness may be metaphorically linked with seriousness and importance, but not with likability. In a correlated study, the concept of roughness and smoothness have been tested. The saying: “having a rough day” is linked with the tactile sensation of roughness. In the study participants read a passage describing social interactions and were asked to give their impression about the nature of this interaction. Before reading the passage, they had to complete a small puzzle: one group had “rough” pieces (covered with rough sandpaper) and normal (smooth) pieces. Participants with the “rough” puzzle rated the passage as more difficult and harsh. The same relation between tactile sensation and cognitive process is present even when active touch is not involved. In a subsequent study, Goldinger and Hansen<sup>44</sup> had participants sitting either on a wood chair or on a cushioned chair while imagining shopping for a new car. Those sit on the hard chair judge the employee to be more stable and less emotional. Moreover, when bargaining, they changed their offer less than people sit on the soft cushion did. Therefore hardness produce the perception of rigidity and stability and reduce chance from a hypothetical initial decision even if the tactile experience is not active. In line with the nature of priming, those result should have the same effect also on self-perceptions<sup>45</sup>.

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<sup>44</sup> Goldinger S.D., Hansen W.A., “*Remembering by the Seat of Your Pants*”, *Psychological Science*, Vol.16, n.7, pp 525-529, 2005

<sup>45</sup> Mortensen C.R., Becker D.V., Ackerman J.M., Neuberg S.L., Kenrick D.T., “*Infection Breeds Reticence: The Effects of Disease Saliense on Self-Perceptions of Personality and Behavioral Avoidance Tendencies*”, *Psychological Science*, Vol.21, no. 3, pp. 440-447, 2010

### 3.5. Visual Priming - Faces

The concept of visual propositioning proposed by Abraham and Appiah in “*Framing News Stories: The Role of Visual Imagery in Priming Racial Stereotypes*”<sup>46</sup> states that linguistic and visual resources are of use for sense making in multimodal messages. That means that the perception of the main message is constructed also on the visual cues<sup>47</sup>, be them salient or not. At the moment there are two theories concerning memory processes in multimodal presentations: “the dual-code theory” and the “single code theory”. The first assumes different modalities of encoding visual and verbal cues, hypothesizing that images are memorized in a different way under a qualitative point of view with respect to verbal cues. This implies that “*visual and verbal information are cognitively represented in different subsystems*”. However the two subsystems are strongly and deeply connected to facilitate information transfer and integration. Visual cues are particularly useful in the moment of retrieving from the memory, as they served as supplementary learning cue<sup>48</sup>. The single code theory assumes an undifferentiated encoding of the two modalities. That means that both verbal and visual cues are co-integrated in the same “slot” of memory<sup>49</sup>. On the branch of neuroscience, studies have shown that visual information often elicit priority processing in human brain<sup>50</sup>. According to Bertrand *et al.*<sup>43</sup>, visual images tend to be processed through intuitive cognitive system<sup>51</sup>. It involves memory, attention, creativity, decision making and

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<sup>46</sup> Abraham L., Appiah O., “*Framing News Stories: The Role of Visual Imagery in Priming Racial Stereotypes.*” *The Howard Journal of Communications*, 17: 183–203, 2006

<sup>47</sup> Gibson R., Zillman D., “*Reading between photographs: The influence of incidental pictorial information on issue perception*”, *Journalism & Mass Communication Quarterly*, 77: 355–366, 2000

<sup>48</sup> Paivio, A. “*Imagery and verbal processes*”. Holt, Rinehart, & Winston, New York, 1971

<sup>49</sup> Pezdek K., “*Cross-modality semantic integrations of sentence and picture memory.*” *Journal of Experimental Psychology: Human Learning and Memory*, 13: 551–558, 1977

<sup>50</sup> Vuilleumier P., Armony J., Driver J., Dolan R., “*Distinct spatial frequency sensitivities for processing faces and emotional expressions.*” *Nature Neuroscience*, 6: 624–631, 2003

<sup>51</sup> Bertrand M., Karlan D., Mullainathan S., Shafir E., Zinman J., “*What’s Advertising Content Worth? Evidence From a Consumer Credit Marketing Field Experiment*”, *The Quarterly Journal of Economics*, Vol. 125, no.1, pp. 263-306, 2010

problem solving<sup>52</sup>. For instance, it has been shown<sup>53</sup> that completely random background images affect hypothetical shopping choices. Advertising companies know this very well, however very little evidences and measure of the effect were collected so far. In 2010, a huge experiment by Bertrand et al.<sup>48</sup>, tested, among others, the effect of background images, and more specifically faces, on bank's clients choices. The results were remarkably effective: non informative background manipulation, like the picture of an attractive woman, increased loan demand as much as a 25% reduction in the interest loan. Whenever the race or gender matched with the participant the effect was even larger. This result is well supported by former studies: for example Evans in 1963<sup>54</sup> found that similarities between clients and salespersons affect choices to the level, in certain cases, of overweighting expertise and credibility<sup>55</sup>. Memory for faces is enhanced when people are supposed to make judgments concerning, e.g., likeability, rather than when replying to emotionally neutral questions<sup>56</sup>; also when pictures contains emotions rather than a neutral content<sup>57</sup>. The memory we are referring to is the *explicit* memory, which is the conscious recollection of past experiences and information. Concerning the *implicit* memory - a type of memory in which previous experiences aid in the performance of a task without conscious awareness<sup>58</sup>- priming works as well. Johnson, Kim and Risse<sup>59</sup> asked participants affected by Korsakoff's

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<sup>52</sup> - Chen C., Czerwinski M., "Spatial ability and visual navigation: An empirical study". New Review of Hypermedia and Multimedia, Vol.3, no.1, 67–89, 1997

- Conati C., Maclaren H., "Exploring the Role of Individual Differences in Information Visualization", Advanced Visual Interfaces (AVI), 199–206, 2008

- Dou W., Ziemkiewicz C., Harrison L., Jeong D., Ryan R., Ribarsky W., Wang X., Chang, R., "Comparing different levels of interaction constraints for deriving visual problem isomorphs". IEEE VAST, 194–202, 2010

- Green T., Fisher B., "Towards the Personal Equation of Interaction: The Impact of Personality Factors on Visual Analytics Interface Interaction". IEEE VAST (2010), 203–210, 2010

<sup>53</sup> Mandel N., Johnson E.G.. "When web pages influence choice: effects of visual primes on experts and novices.", Journal of Consumer Research, Vol. 29, no.2, pp. 235-245, 2002

<sup>54</sup> Evans, Franklin B., "Selling as a Dyadic Relationship", American Behavioral Scientist, 6, 76–79, 1963

<sup>55</sup> Cialdini, Robert, "Influence: Science and Practice", 4 ed. (Needham Heights, MA: 2001)

<sup>56</sup> Biber C., Butters N., Rosen J., Gerstman L., Mattis S., "Encoding strategies and recognition of faces by alcoholic Korsakoff and other brain-damaged patients", Journal of Clinical Neuropsychology, 3(4), 315–330, 1981

<sup>57</sup> Hamann S., Ely T., Grafton S., Kilts C., "Amygdala activity related to enhanced memory for pleasant and aversive stimuli", Nature Neuroscience, Vol. 15 no. 4, 289–293, 1999

<sup>58</sup> Schacter D. L., "Implicit Memory: History and Current Status", Journal of Experimental Psychology: Learning, Memory, and Cognition, 13, 501-518., 1987

<sup>59</sup> Johnson H. I. L., Kim J. K., Risse G., "Do alcoholic Korsakoff's syndrome patients acquire affective reactions?", Journal of Experimental Psychology: Learning, Memory and Cognition, 11, 22–36, 1985

syndrome to rate a “story”. The fact that the face attached to the story was whether positive or negative influenced how much they liked the story, even if their explicit memory was impaired. In decision making theories the role of priming mechanism, and most of all of visual priming, is rarely considered relevant. As seen in previous paragraph, priming a face activates a series of interconnected reaction in the whole body. Emotions generate facial expressions, but facial expressions generate emotions as well. Emotional states do play a role in decision making, as researches on behavioral economics, neuroscience and psychology have shown<sup>60</sup>. According to Huang emotions affect risk perception, eventually altering the balance in the decision process, but they can also affect trustworthiness. In a famous experiment, DeBruine<sup>61</sup> used morphed faces to substitute partners in a trust game. Participants having opponents that resembled themselves trusted significantly more than other opponents.

An interesting experiment is the one proposed by Herman Chernoff in 1973<sup>62</sup>. He found the way to translate multivariate data in a shape of a human face. People have an incredible ability in recognizing faces<sup>63</sup> and expressions<sup>64</sup>. Theoretically, if mapped appropriately to underlying variables, Chernoff Faces can help in detecting patterns, clusters or temporal trends very quickly. Each element of the face is created by the distribution of a random variable, while the features like shape and size identify particular data point and relationships.

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<sup>60</sup> Camerer C., Loewenstein G., Prelec D., “*Neuroeconomics: Why economics needs brains.*” *Scandinavian Journal of Economics*, 106: 555–579, 2004  
- Knutson B., Rick S., Wimmer G., Prelec D., Loewenstein, G, “*Neural predictors of purchases*”, *Neuron*, 53: 147–156, 2007  
- Tversky A, Kahneman D., “*Availability: A heuristic for judging frequency and probability.*” *Cognitive Psychology*, 5: 207–232, 1973

<sup>61</sup> DeBruine L, “*Facial resemblance enhances trust*”, *Proceedings of the Royal Society of London Series B: Biological Sciences*, 269.1498: 1307-1312. 2002.

<sup>62</sup> Chernoff H., “*The use of faces to represent points in k-dimensional space graphically*”, *Journal of the American Statistical Association*, 68(342): 361–368, 1973

<sup>63</sup> Aggarwal P., McGill A.L., “*Is That Car Smiling at me? Schema Congruity as a Basis for Evaluating Anthropomorphized Products*”, *Journal of Consumer Research*, Vol.34, 2007.

<sup>64</sup> Ekman P, Friesen W.V. “*Unmasking the face: A guide to recognizing emotions from facial clues*”. Ishk, 2003.

## 4. Knowledge: the impact of financial literacy in financially related decisions

### 4.1 Literature Overview

Heuristics and bias lead to systemic deviations from the stereotype of consumer's decision making in neoclassical economics and finance. The proliferation of a whole new body of literature as Behavioral Finance witnesses it. Daniel Kahneman in his bestseller "*Thinking, Fast and Slow*" refers to what economists call *Consumer* as the *Econ* - the logic, rational and emotionless creature - opposed to the *Human*.

When looking to financial markets, several studies have shown that investors do not behave as *Econ*, and their deviation from what expected causes several inefficiencies. Moreover, if we take into account the distortion that advertising priming may have in the information acquisition process, the probability of erroneous financially related decisions increase drastically. The problem of financial illiteracy is widespread and recognized worldwide<sup>1</sup>. The concept of financial literacy refers to the capability of understanding finance. It is related to the knowledge and skills requested to take financially related choices, in a informed and rational way. However there is not a clear definition, since the term encompasses the concepts of financial knowledge, but also financial products awareness, including financial capability and financial planning. The World Bank funded national initiatives and programs to foster financial knowledge given the evidences of the necessity of intervention<sup>2</sup>. Some other authors believe that regardless of deviations from rational behavior, financial choices would never be optimal, sustaining that there is no direct evidence that an improvement of financial literacy would imply better financial choices<sup>3</sup>. In 2003 the OCSE prompted

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<sup>1</sup> Xu L., Zia B., "*Financial Literacy Around the World: An Overview of the Evidence with Practical Suggestions for the Way Forward*", World Bank Policy Research Working Paper No. 6107, 2012

<sup>2</sup> Lusardi A., Mitchell O.S., "*Financial literacy and retirement preparedness- evidence and implications for financial education*", Business Economics, 42.1, pp.35-44, 2007

<sup>3</sup> Willis L.E., "*Against Financial Literacy Education*", Iowa Law Review, vol. 94., 2008

a project to improve financial literacy and raise standard which currently are very low. A couple of years later two papers were published focusing on the growing importance of financial literacy. It has been indirectly given a definition of financial education as “[...] the process by which financial consumers/investors improve their understanding of financial products and concepts and, through information, instruction and/or objective advice, develop the skills and confidence to become more aware of financial risks and opportunities, to make informed choices, to know where to go for help, and to take other effective actions to improve their financial well being”<sup>4</sup>.

The paper verified a very low level of financial understanding among surveys’ respondents and a correlation with education and income levels. Also, participants believed to know more than they actually did, and an important percentage finds financial information difficult to interpret. This last finding in particular have strong implications. As seen in the previous section, visual information are perceived and processed differently: people rely more on graph and visual cues to take decisions, in particular when information are difficult to be elaborated.

The National Council on Economic Education’s report<sup>5</sup> showed a diffused scarcity of knowledge regarding basic economic notions among high school students, confirming similar results by the Jump\$tart Coalition for Personal Financial Literacy<sup>6</sup>. The body of literature is considerable, starting from Bernheim<sup>7</sup> in 1995 - one of the first highlighting the low level of financial literacy among consumers - to Hilgert,

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<sup>4</sup> OCSE, *“Improving Financial Literacy”*, Directorate for financial and Enterprise Affairs, p.26, 2005

<sup>5</sup> National Council on Economic Education (NCEE), *“What American teens and adults know about economics”*, Washington, D.C., 2005

<sup>6</sup> Mandell L., *“Financial Education in High School”*, in Annamaria Lusardi (ed.), *“Overcoming the Saving Slump: How to Increase the Effectiveness of Financial Education and Saving Programs”*, Chicago: University of Chicago Press, pp. 257-279.

<sup>7</sup> Bernheim D., *“Do households appreciate their financial vulnerabilities? An analysis of actions, perceptions, and public policy,”* in *Tax Policy and Economic Growth*, American Council for Capital Formation, Washington, DC, pp. 1-30, 1995.

Hogarth and Beverly<sup>8</sup> that showed how most Americans fail in understanding the fundamentals of finance. In the Euro zone, the Survey of Health, Aging and Retirement in Europe (SHARE) put in evidence the difficulties of respondents on financial numeracy and literacy scale<sup>9</sup>. Lusardi and Mitchell<sup>10</sup> found that financial literacy is linked to aging, and that means that those who actually take more financial related choices (like retirement plans), are those who know less. Financial literacy is linked to saving behaviors and portfolio choices. In fact, less financially literate people are those who are less likely to plan for retirement,<sup>11</sup> to accumulate wealth<sup>12</sup> and to participate in the stock market<sup>13</sup>. There is also some study that indicates financial literacy affect debt as well. People with scarce knowledge are more likely to have a costly mortgage<sup>14</sup>, while people with low income and education level - both strongly related with financial literacy<sup>15</sup> - are less likely to refinance their mortgages when it would be appropriate<sup>16</sup>. The experiments undertaken in this work are in line with these body of literature: financially illiterate people are more likely to be influenced and therefore take inefficient choices, as those with low education level.

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<sup>8</sup> Hilgert M., Hogarth J., Beverly S., *"Household Financial Management: The Connection between Knowledge and Behavior"*, *Federal Reserve Bulletin*, 309-32, 2003

<sup>9</sup> Dimitris C., Jappelli T., Padula M., *"Cognitive abilities and portfolio choice,"* mimeo, University of Salerno, 2008

<sup>10</sup> Lusardi A., Mitchell O.S., *"Financial Literacy and Planning: Implications for Retirement Wellbeing"*, MRRRC Working Paper n. 2006-144., 2006

<sup>11</sup> Lusardi A., Mitchell O.S., Curto V., *"Financial Literacy Among the Young"*, mimeo, Dartmouth College, 2008

<sup>12</sup> Stango V., Zinman J., *"Exponential Growth Bias and Household Finance"*, Working Paper, Dartmouth College, 2008

<sup>13</sup> Van Rooij M., Lusardi A., Alessie R., *"Financial Literacy and Stock Market Participation"*, *Journal of Financial Economics*, 101, pp. 449-472, 2007

<sup>14</sup> Moore D. (2003), *"Survey of Financial Literacy in Washington State: Knowledge, Behavior, Attitudes, and Experiences"*, Technical Report n. 03-39, Social and Economic Sciences Research Center, Washington State University, 2003

<sup>15</sup> Lusardi A., Tufano P., *"Debt literacy, financial experiences, and overindebtedness"*, No. w14808. National Bureau of Economic Research, 2009

<sup>16</sup> Campbell J., *"Household Finance"*, *Journal of Finance* 61, pp. 1553-1604, 2006

#### 4.1.1. Debt Literacy

As already seen, there is strong evidence in financial illiteracy among consumers, and some step has been taken so far to face it. However, concerning debt literacy, little research has been done to study the relationship between financial literacy and indebtedness<sup>17</sup>. The current financial crisis highlighted a rapid growth of household debt, leading to the question of whether the lack of knowledge makes individuals incur in unaffordable credit card debt or take costly mortgages. Citing Lusardi, debt literacy refers to “*the ability to make simple decisions regarding debt contracts, applying basic knowledge about interest compounding to everyday financial choices*”<sup>21</sup>. As for financial literacy, empirical result shown very low level of debt literacy, with only one-third of respondents able to apply concepts of interest compounding or to understand credit cards functioning. Also, not surprisingly, it has been found a link between debt literacy and overindebtedness; those with lower debt knowledge tend to declare to be unsure of the appropriateness of their debt position. Of particular interest is the result coming from the elderly, that think to know more they actually do.

## 4.2. Measuring Financial Literacy

As seen in the previous paragraph financial literacy is a broad concept which encompass several meanings. The absence of a clear definition was the first obstacle in measuring financial literacy. Different ways have been proposed, and all of them measured different things, but they all witness one thing: financial knowledge is really low both in developed and undeveloped countries. In 2004 Lusardi and Mitchell created and fielded a survey for the Health and Retirement Study (HRS)<sup>18</sup>, today included in the National Longitudinal Survey of Youth (NLSY). In our first experiment we decided to use the three “basic” questions included in the HRS plus two “advanced” questions to test our respondents literacy. The basic questions aim

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<sup>17</sup> Lusardi A., Tufano P., “*Debt literacy, financial experiences, and overindebtedness*”, No. w14808. National Bureau of Economic Research, 2009

<sup>18</sup> Lusardi A., Mitchell O.S., “*Financial literacy and retirement preparedness: evidence and implications for financial education*”, Business Economics, 42.1, pp.35-44, 2007

at investigating people ability to compute and comprehend compound interests, inflation and stock risks. The questions are the following:

1. Suppose you had \$100 in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow: more than \$102, exactly \$102, less than \$102?
2. Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, would you be able to buy more than, exactly the same as, or less than today with the money in this account?
3. Do you think that the following statement is true or false? "Buying a single company stock usually provides a safer return than a stock mutual fund."

The original survey had participants over their fifties: only fifty percent of respondents were able to answer to the first two questions and only on third could answer the third question. To better understand and analyze the financial literacy we used two more questions: one from Lusardi's<sup>19</sup> which investigates the relationship between interest rate and bond price, and the other one from the National Financial Capability Study funded by FINRA Investor Education Foundation in consultation with the U.S. Department of the Treasury and President Bush's Advisory Council, which investigates the understanding of mortgage concepts. Here are the questions:

4. If the interest rate falls, what should happen to bond prices, rise, fall or stay the same?
5. A 15-year mortgage typically requires higher monthly payments than a 30-year mortgage, but the total interest over the life of the loan will be less. True or False?

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<sup>19</sup> Lusardi A., "Financial Literacy: An Essential Tool for Informed Consumer Choice?", No. w14084. National Bureau of Economic Research, 2008.

The five questions are currently used by the FINRA and showed that while the correct response to some individual questions reaches 75%, only 14% of respondents are able to answer all five questions correctly, and 39% are able to answer at least four questions correctly<sup>20</sup>. We decided to use these five questions to measure financial literacy in the first experiment. However, in the second one, in light of the results obtained, we decided to double the scale of the measure and insert five more questions, three advanced debts questions<sup>21</sup> and two more “advanced” questions<sup>18</sup> to increase the scope of our data<sup>22</sup>.

6. Suppose you owe \$1,000 on your credit card and the interest rate you are charged is 20% per year compounded annually. If you didn't pay anything off, at this interest rate, how many years would it take for the amount you owe to double? (i) 2 years; (ii) Less than 5 years; (iii) 5 to 10 years; (iv) More than 10 years; (v) Do not know. (vi) Prefer not to answer.
7. You owe \$3,000 on your credit card. You pay a minimum payment of \$30 each month. At an Annual Percentage Rate of 12% (or 1% per month), how many years would it take to eliminate your credit card debt if you made no additional new charges? (i) Less than 5 years; (ii) Between 5 and 10 years; (iii) Between 10 and 15 years; (iv) Never, you will continue to be in debt; (v) Do not know; (vi) Prefer not to answer
8. You purchase an appliance which costs \$1,000. To pay for this appliance, you are given the following two options: a) Pay 12 monthly installments of \$100 each; b) Borrow at a 20% annual interest rate and pay back \$1,200 a year from now. Which is the more advantageous offer? (i) Option (a); (ii) Option (b); (iii) They are the same; (iv) Do not know; (v) Prefer not to answer.

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<sup>20</sup> Financial Capability in the United States, 2012 Report of National Findings, FINRA Investor Education Foundation

<sup>21</sup> Lusardi A., Tufano P., *“Debt literacy, financial experiences, and overindebtedness”*, No. w14808. National Bureau of Economic Research, 2009

<sup>22</sup> The abbreviation DK stands for *“Don't Know”*

9. True or false? Stocks are normally riskier than bonds. (i) True; (ii) False; (iii) DK; (iv) Refuse.

10. Normally, which asset displays the highest fluctuations over time? (i) Savings accounts; (ii) Bonds; (iii) Stocks; (iv) DK; (v) Refuse.

Question number six further investigate people knowledge of interest compounding. Also question number seven is about compounding interest and try to assess to which level individuals can perform simple interest-rate calculations. The eighth question try to evaluate whether people understand the notion of the time value of money and how skillful they are in comparing payment options. Questions nine and ten are about risk comprehension: basic difference between stocks and bonds and their respective variance is asked. In this way we tried to have a complete and meaningful understanding of respondents financial capability, in order to scrutinize whether there is a relationship between financial literacy and visual representation affection.

### **4.3. Effects of Knowledge on Decision Making**

The importance of knowledge and expertise in efficient decision making is remarkable, nevertheless little empirical research has been done. In 1979 Bettman developed an information processing theory of consumer choice<sup>23</sup>. The concept underlying their *constructive view of choice* is that consumers have elements of heuristics in memory, rather than complete rules. Such elements are combined during the decision process to create a heuristic. That implies the absence of a unique procedure, but rather a dynamic construction process that varies from one situation to the next. Following this first research, Bettman and Park in two different studies about consumer's behavior try to understand how decision making process

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<sup>23</sup> Bettman J.R., "An Information Processing Theory of Consumer Choice", Journal of Marketing, Vol. 43, No.3, pp 124 -126., 1979, Reviewed by Ross I., "An Information Processing Theory of Consumer Choice by James R. Bettman", American Marketing Association

change according to the level of knowledge, experience<sup>24</sup> and familiarity<sup>25</sup>. They assumed that the presence of prior knowledge structure affects the type of information processed and the heuristic used in each stage of the construction process. In the same line of thought is the work of Lussier and Olshavsky in 1979<sup>26</sup>, where comparing attribute levels to standards eliminates brands in the early stages of a choice process. Prior knowledge and experience may function as standards and therefore they can be used early in the decision process, while new consumers may need time to develop such standards. That means that the knowledge structure may affect the way choice process occur. Back to Bettman and Park, they found that people with moderate level of prior knowledge and experience process available information more and rely on prior knowledge less than others. The explanation they gave, was that who has very little background information may not have the ability to face the task, that leads to a low level of motivation which eventually makes them give up and seek a simple solution. On the other hand, people with high level of experience and knowledge have enough ability to process information but they actually do not need it, since prior information may be enough. That is why people who are between these two extremes have both the ability and motivation to put effort on the required task<sup>27</sup>.

The works of Lusardi and Mitchell we mentioned in the first paragraph about the connection between financial literacy, retirement planning and wealth can be seen as a study of prior knowledge effect on decision making. In the U.S. retirement planning is part of every citizen life, and yet, financial literacy is very low among people, especially among the elderly. Their works witnessed the link between financial education and retirement planning. After all determining how much to save for

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<sup>24</sup> Bettman J.R., Park C.W.. *"Effects of prior knowledge and experience and phase of the choice process on consumer decision processes: A protocol analysis"*, Journal of Consumer Research 7.3, 234, 1980

<sup>25</sup> Park C.W., Parker L.V., *"Familiarity and Its Impact on Consumer Decision Biases and Heuristics"*, Journal of Consumer Research, Vol.8, 223-230, 1981

<sup>26</sup> Lussier D.A., Olshavsky R.W., *"Task complexity and contingent processing in brand choice"*, Journal of Consumer Research, 154-165, 1979

<sup>27</sup> Bettman J.R., Park C.W.. *"Effects of prior knowledge and experience and phase of the choice process on consumer decision processes: A protocol analysis"*, Journal of Consumer Research 7.3, 234, 1980

retirement is a complex task, considering that notions of compound interest, risk diversification and inflation play a big role. The results from this study are unequivocal: “*financial literacy is a key determinant of retirement planning*” and “*respondent literacy is higher when they were exposed to economics in school and to company-based financial education programs*”<sup>28</sup>. These two results have several implications: first of all, knowledge of finance leads people to think more about their retirement. Looking at this result under the lens of knowledge’s impact on decision making, and more specifically under the perspective of Bettman and Park’s work, prior knowledge makes people consider the retirement planning issue as important to their life simply because they know that it is. Illiterate people cannot even start the process. Second, having already some exposure to financial concepts may be interpreted as a first experience that implies familiarity with financial decisions. That means that even a low level of literacy makes a significant difference in the decision making process. As before, first experience and knowledge may be used to create initial heuristics which eventually become standards against which it is possible to evaluate new information.

Given the empirical evidences presented above, we expected an impact of financial literacy on decision making and on the influence visual priming may have. The following section will illustrate the empirical studies conducted to investigate the effects of priming on the financial decision process.

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<sup>28</sup> Lusardi A., Mitchell O.S., “*Financial Literacy and Planning: Implications for Retirement Wellbeing*”, MRRC Working Paper n. 2006-144., 2006

# **Section 3**

## **5. Experiment I**

### **5.1 Description**

We decided to launch an on line survey to test our hypothesis about how the decisional process is affected. Participants have been divided into three treatment groups. The first, called *Control*, was supposed to choose between two loan offers: one with a fixed interest rate, the other with a variable one. We added two invented forecasts for the 12-month Euribor trend (on which the variable interest rate is calculated). The second group, called *Smiling Fixed*, was asked to take exactly the same choice. There was only one difference: to each offer (fixed and variable) was associated an image. Both images represent the same person with different facial expression: one neutral and the other smiling. The smiling face is the treatment, therefore in the *Smiling Fixed* group the smiling face was associated to the fixed offer. The third group, called *Smiling Variable*, received the same survey as the *Smiling Fixed* group but with images switched, i.e., the smiling face was associated to the variable offer.

### **5.2. Prediction and Hypothesis**

The loan structure was conceived to be as fair as possible. Hypothesizing a strong risk aversion, in line with Prospect Theory when a certain outcome is present, we created two forecasts which can be labelled as *positive* and *negative*. In fact, if comparing the *positive* forecasts with the fixed interest rate option, the total amount of interests paid at the end of the five years (the length of the loan) is lower. The opposite with the *negative* forecast. The hypotheses were the following: in such a scenario, with no treatments, a strong preference for the fixed interest rate would have emerged, even if, after having computed the expected value of the two forecasts, the most rational choice would have been the variable. However, since the scenarios were really fair, there could be some ambiguity in the choice, and some other (non relevant) information could have been taken into account in the evaluation, e.g., the images. We hypothesized also, that this kind of reasoning is more likely to occur among those who have little knowledge of finance. Those who actually know how to make calculations should be less affected by visual stimuli.

This prediction has been made based assuming that ambiguity of choices lead human mind to look for shortcuts. When System 2 cannot give a sure answer, System 1 become more important in the final choice. We also assumed that, in line with the

literature presented in the previous chapter, images are processed differently than words and have a strong impact on people decisions; and human faces are a particularly effective way to influence choices.

**H1:** When comparing the two offers, smiling face will influence the decision making process by driving them to choose the offer which it is associated with

**H2:** Financially illiterate participants will be more influenced by the stimuli than financially literate ones.

### **5.3. Overview of the Sample Frame Characteristics and Experimental Apparatus**

Amazon Mechanical Turk (AMT) is an online crowdsourcing service where anonymous online workers complete web-based tasks for small sums of money<sup>1</sup>. The traditional method of surveying college students has been provide bias result, since American students are a quite atypical population upon which drawing general conclusions<sup>2</sup>. AMT is a platform which guarantees a diversified subject pool, low-cost and fast means to collect data. Moreover it turned out that the principle of priming can be successfully studied and analyzed with the AMT platform<sup>3</sup>. The infrastructure allows an easy payment process, guarantees the anonymity and identifiability of participants at the same time. The design, the structure but also the content of each HIT (Human Intelligence Task) can be effectively tailored to the specific subject population. Also, the fact that participants do not really know they are taking part at an experiment eliminates, or at least reduces, the so called “experimenter effect”, in which the participants, knowing or guessing what the final result should be, actually “produce” the effect. Probably the most important feature, in our case, was the accessibility to a variegated target pool, allowing both financial literate and illiterate people to take the survey. We selected Turkers with 95% acceptance rate and that had already completed at least one thousand surveys. Furthermore we restricted sample population to Americans for two reasons: first, the prime was a white young man, and priming has been proved to work at best when the stimulus resemble the participant

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<sup>1</sup> Crump M., McDonnell J., Gureckis, T., “Evaluating Amazon’s Mechanical Turk as a Tool for Experimental Behavioral Research: e57410” PLoS One, 8(3), 2013

<sup>2</sup> Henrich J., Heine S. J., Norenzayan A., “The Weirdest People in the World?” SSRN eLibrary, 2010

<sup>3</sup> Heer J., Bostock M., “Crowdsourcing Graphical Perception: Using Mechanical Turk to Assess Visualization Design”, In “Conference on Human Factors in Computing Systems”, page 28th. SIGCHI: ACM Special Interest Group on Computer-Human Interaction, ACM, New York, NY, USA, 2010

characteristics<sup>4</sup>. Cheating is a real problem on web-based surveys, as the faster in completing a HIT the more workers can earn. In a study<sup>5</sup> on AMT, it has been proved that selecting “High Reputation” workers is enough to obtain unbiased and high quality data.

We used the online research tool Qualtrics.com. It allows the creation of custom surveys through the use of an interactive and realistic user interface. It is employed for market, academic and customer insights from all over the world. It is extremely useful and intuitive in the design of the survey, providing also a complete choice of samples to compare your work with those of other researchers. It enabled us to create a fluent question flow, randomization and tailored experimental logistics. Responses can be tracked and checked in real time, allowing an efficient collecting activity. Control questions were used, to rule out low-attention Turkers.

#### **5.4. Loan Offers Structure**

As anticipated above, the experiment was thought to have participants choosing between two offers as fair as possible. Workers<sup>6</sup> were asked to imagine to be client of a fictitious bank, called  $\Omega$ Bank, and that they received an email with two offers, namely, the *Fixed* offer and the *Variable* one<sup>7</sup>. The length of the loan, i.e., the number of years to pay the loan back, is five years. The amount of capital can vary from a minimum of one thousand to a maximum of one hundred thousand. *Table 5.1* summarizes the two offers.

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<sup>4</sup> Evans, Franklin B., “*Selling as a Dyadic Relationship*”, *American Behavioral Scientist*, 6, 76–79, 1963  
Cialdini, Robert, “*Influence: Science and Practice*”, 4 ed. (Needham Heights, MA: 2001)  
Bertrand M., Karlan D., Mullainathan S., Shafir E., Zinman J., “*What’s Advertising Content Worth? Evidence From a Consumer Credit Marketing Field Experiment*”, *The Quarterly Journal of Economics*, Vol. 125, no. 1, pp. 263-306, 2010

<sup>5</sup> Peer E., Vosgerau J., Acquisti A., “*Reputation as a sufficient condition for data quality on Amazon Mechanical Turk*”, *Behavior Research Method*, 2013

<sup>6</sup> Participants in AmazonMechanicalTurk are called Workers or Turkers. I will use both terms hereafter interchangeably.

<sup>7</sup> Fixed offer relates to the fixed-interest rate loan. Variable offer relates to the variable interest loan.

	Capital	Annual Interest rate	Years
<b>Fixed</b>	from \$1,000 to \$100,000	2.5% (fixed)	5
<b>Variable</b>	from \$1,000 to \$100,000	euribor + 2% spread	5

Table 5.1

Since the *Variable* offer depends on the Euribor trend, and more precisely on the 12-month Euribor (as explained in the survey to participants), two forecasts were added.

Years	Forecast A	Forecast B
1	0.30%	0.45%
2	0.25%	0.65%
3	0.20%	0.90%
4	0.30%	0.70%
5	0.50%	0.35%

Table 5.2

Both Forecast A and B are completely invented and have been conceived in such a way that there would not be a clear trend. Workers were told that those forecasts were introduced to help them in the assessment, but they are not the two only possible scenarios. They are presented as elaborated by  $\Omega$ Bank's analysts. Even with a quick glance, it is easy to withdraw a couple of considerations. First of all, A and B respectively can be seen (and actually have been thought) as a *positive* and a *negative* forecast. Indeed, A is on average below the *Fixed* offer while B is on average above. However, with no further calculation it would be impossible to have a clear idea on the best offer. Workers were asked to, assumed they were interested in asking for a loan, which of the two options they would have chosen, and to motivate their answer.

## 5.5. Loan Offers Analysis

We can divide the analysis of the offer in two parts: first of all we can compute the total amount of interest to be paid in the three scenarios (fixed, variable-*positive* and variable-*negative*); Second, in order to make the final choice, we can compare the fixed offer with a weighted average between the two forecasts.

### 5.5.1 Scenarios Analysis

Suppose the amount of capital is \$10,000.00. Given the linear depreciation, and the interest rate fixed at 2.5%, the total interest paid, after five years is \$750,00 (\$10,750.00-\$10,000.00).

Fixed				
CAPITAL	Interest Rate (%)	Interest Rate (\$)	Monthly Payment	Total Monthly Payment
\$10,000				
\$8,000	2.50%	\$250.00	\$2,000	\$2,250
\$6,000	2.50%	\$200.00	\$2,000	\$2,200
\$4,000	2.50%	\$150.00	\$2,000	\$2,150
\$2,000	2.50%	\$100.00	\$2,000	\$2,100
\$0	2.50%	\$50.00	\$2,000	\$2,050
<b>Total</b>		\$750.00	\$10,000	<b>\$10,750</b>

Table 5.3.

The variable offer, on the other hand, has two forecasts, A and B, i.e., the interest rate varies every year.

Variable A				
CAPITAL	Interest Rate (%)	Interest Rate (\$)	Monthly Payment	Total Monthly Payment
\$10,000				
\$8,000	2.30%	\$230.00	\$2,000	\$2,230
\$6,000	2.25%	\$180.00	\$2,000	\$2,180
\$4,000	2.20%	\$132.00	\$2,000	\$2,132
\$2,000	2.30%	\$92.00	\$2,000	\$2,092
\$0	2.50%	\$50.00	\$2,000	\$2,050
<b>Total</b>		\$684.00	\$10,000	<b>\$10,684</b>

Table 5.3.1

<b>Variable B</b>				
<b>CAPITAL</b>	<b>Interest Rate (%)</b>	<b>Interest Rate (\$)</b>	<b>Monthly Payment</b>	<b>Total Monthly Payment</b>
<b>\$10,000</b>				
<b>\$8,000</b>	2.45%	\$245.00	\$2,000	\$2,245
<b>\$6,000</b>	2.65%	\$212.00	\$2,000	\$2,212
<b>\$4,000</b>	2.90%	\$174.00	\$2,000	\$2,174
<b>\$2,000</b>	2.70%	\$108.00	\$2,000	\$2,108
<b>\$0</b>	2.35%	\$47.00	\$2,000	\$2,047
<b>Total</b>		\$786.00	\$10,000	<b>\$10,786</b>

*Table 5.3.2*

Comparing the total interest paid, it emerges, as anticipated above, that the variable offer, in case forecast A happens, is less costly. At the end of the five years, the amount of interest paid is \$684 (Forecast A), which is \$66 less than the fixed offer. However, Forecast B is more expensive: \$786, i.e., \$36 more than the fixed. It is clear, even with this partial analysis, that the amount which is possible to save, choosing the the variable option, is greater than the possible loss. This suggests that the variable offer is the more convenient.

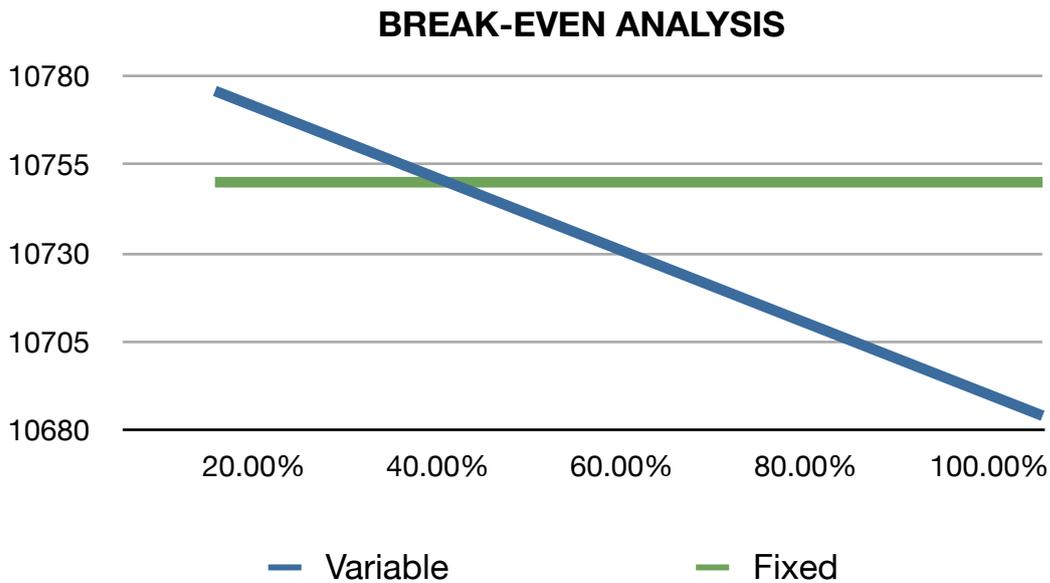
### 5.5.2. Comparative Analysis

The former analysis gave us a broad understanding of the full picture. The two offers lead to very similar results. There exists a difference, but it is subtle. To have a full comprehension of the situation, a comparative analysis is needed.

<b>Probability Forecast A</b>	<b>Probability Forecast B</b>	<b>W.A. Variable Offer</b>	<b>Fixed Offer</b>	<b>Variable - Fixed</b>
10%	90%	\$10,775.80	\$10,750	\$25.80
20%	80%	\$10,765.60	\$10,750	\$15.60
30%	70%	\$10,755.40	\$10,750	\$5.40
40%	60%	\$10,745.20	\$10,750	-\$4.80
50%	50%	\$10,735.00	\$10,750	-\$15.00
60%	40%	\$10,724.80	\$10,750	-\$25.20
70%	30%	\$10,714.60	\$10,750	-\$35.40
80%	20%	\$10,704.40	\$10,750	-\$45.60
90%	10%	\$10,694.20	\$10,750	-\$55.80
100%	0%	\$10,684.00	\$10,750	-\$66.00

*Table 5.4*

Table 4 shows that the variable interest rate will leads to lower costs seven times out of ten. The first two columns indicates the probability associated with the forecast. For example, when there is a 20% probability that the *positive* forecast happens, the variable offer would be more costly than the fixed. On the other hand, with 70% probability the opposite is true. The following graph, obtained from *Appendix 1*, shows the trend of the two offers according to the distribution of probability between the two forecasts. It turns out that when the *positive* forecast has a level of probability greater than 35%



the variable offer is always less costly than the fixed. The percentage is significantly lower than 50%, which hypothetically represents the indifference point. That means, rationally speaking, that the variable offer is the optimal choice.

## 5.6. Method

### 5.6.1. Participants

Through the AMT platform we recruited a total of 374 people, only 234 of them were taken into account in the analysis: those who failed the control question, and took less than five seconds to read the problem were ruled out<sup>8</sup>. The population was composed as follows: 159 males and 75 females, among them, the mean age was 32.5 (minimum 13 maximum 67). White people were 35% and asians 60% of the population. The remaining 5% is other races (hispanic, african american, multiple races). Detailed summary of the population can be find in *Table 5.5*.

<sup>8</sup> we did not want to rule out what it may be a “gut guess” but at the same time people who took less than five seconds simple pressed random buttons to go ahead and finish the survey. Those 6 people did not enter any response in the descriptive boxes, and press all buttons on one side of the page.

Table 5.5

<b>RESPONDENTS</b>	<b>TOTAL</b>	<b>PROPORTION</b>
<b>TOTAL</b>	234	
<b>GENDER</b>		
MALE	159	67.95%
FEMALE	75	32.05%
<b>AGE</b>		
13-30 YEARS	131	55.98%
31-45 YEARS	76	32.48%
46-67 YEARS	27	11.54%
<b>EDUCATION</b>		
HIGH SCHOOL	13	5.56%
COLLEGE BUT NO DEGREE	24	10.26%
ASSOCIATE DEGREE	10	4.27%
BACHELOR DEGREE	120	51.28%
GRADUATE DEGREE	53	22.65%
PROFESSIONAL	14	5.98%
<b>RACE</b>		
AFRICAN AMERICAN	4	1.71%
WHITE	82	35.04%
ASIAN	141	60.26%
HISPANIC	5	2.14%
OTHER	2	0.85%
<b>EMPLOYMENT</b>		
FULL TIME	153	65.38%
PART TIME	46	19.66%
UNEMPLOYED	17	7.26%
NOT WORKING	12	5.13%
RETIRED	4	1.71%
DISABLED	1	0.43%

## 5.7. Materials

### 5.7.1. Stimuli

The experimental stimuli are represented by a picture of a human face. The photographs has been professionally taken<sup>9</sup>. The set of photograph used pictured the same person showing different facial expression. A neutral face and a smiling one has been taken. The stimuli was very subtle, i.e., the images were very small, and it was not easy to distinguish the two emotions. Moreover the smiling picture do not show what can be defined as a genuine and real smile. Eyes were only partially involved. The mouth is smiling (corners are pointing upwards), but it is missing what Duchenne found to be the main characteristic of a genuine smile<sup>10</sup>: *orbicularis oculi* muscle, which is the part just above the eyes that raises the cheeks and forms crow's feet around the eyes. We wanted to investigate if even with small and subtle differences decision making would have been affected.

### 5.7.2 Procedure

The experiment begins with the information content and the guidelines for the completion of the task. Participants are told that the survey tests the financial decision making process. The experiment can be divided in two parts: "Test and Comprehension check", and "Additional Information". In the first part, participants are required to make a choice between the fixed and the variable offer. Three questions checked their comprehension of the task. In the second phase of the experiment, it has been tested their financial literacy, based on five basic questions from Lusardi's financial literacy scale questionnaire<sup>11</sup> (See Appendix IV). The number of correct questions reflects financial literacy. Also risk aversion has been tested in two ways: first with Kramer's Safe Asset Versus Risky (SAVR) Task<sup>12</sup>, then with a self evaluation of participants risk aversion. The latter turned out to be not reliable, as in contrast with actual choices

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<sup>9</sup> <http://www.bigstockphoto.com/it/search/?order=popular&category=People&contributor=olly2>

<sup>10</sup> Ekman P., Friesen W.V., "*Giù la maschera, Come Riconoscere Le Emozioni dall'Espressione del Viso*", Giunti, 2006

<sup>11</sup> Van Rooij M., Lusardi A., Alessie R., "Financial Literacy and Stock Market Participation", *Journal of Financial Economics*, 101, pp. 449-472, 2007

<sup>12</sup> Kramer L., Weber M.J., "*This is Your Portfolio on Winter: Seasonal Affective Disorder and Risk Aversion in Financial Decision Making*", *Social Psychological and Personality Science*, 3(2), pp. 193-199, 2012

(people who said to be risk seeking indeed was those more risk averse on SAVR and on actual choices).

## 5.8. Results and Discussion

The experiment suggested very interesting results. In the Control group (no treatment), 74% of participants chose the Fixed offer. Surprisingly, the prime had the opposite effect thought: the hypothesis was that smile would have affected choice positively<sup>13</sup>, driving people to choose the offer associated with it. That did not happen: 67% of people in the Smiling Fixed group chose the fixed option, while in the Smiling Variable group the fixed offer has been chosen by 70% of Turkers. However the difference is not statistically significant (Fisher's test p-value: 0.73). Hypothesizing a stronger effect among white people, we ruled out from the analysis non-white people. The hypothesis is based on results from DeBruine where facial resemblance enhanced trust<sup>14</sup>. The new population obtained is formed by 93 people, among those 58 are males and 35 females. In this case, 75% of participants from the Control group chose the fixed option, while only 71% chose it from the Smiling Fixed group and 86.5% from the Smiling Variable one. However the p-value is around 0.2, showing the absence of significance - probably due to the small sample - but an improvement of results. Gender differences were not significant in both population samples (again, the number of participants in subgroups is very small).

We also hypothesized that there would be a stronger effect among those who can be labelled as "Financially Illiterate"<sup>15</sup>. On the Lusardi's scale, out of a maximum of 5 points, the mean was 3.09 for the Control group and 3.11 and 2.99 respectively for the Smiling Fixed and Smiling Variable group, in the total sample. In the reduced sample, values were 3.54, 4.04 and 3.46 respectively. We therefore decide to label "Financially Literate" those who responded correctly to at least 4 answers, and the opposite for the "Financially Illiterate". Among the latter, we found significance in both populations. In the total population, 74% from the Control group chose the fixed, just a 59% among those in the Smiling Fixed group, while 69% chose it in the Smiling Variable group.

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<sup>13</sup> Hamann S., Ely T., Grafton S., Kilts C., "Amygdala activity related to enhanced memory for pleasant and aversive stimuli", *Nature Neuroscience*, Vol. 15 no. 4, 289–293, 1999

<sup>14</sup> DeBruine L., "Facial resemblance enhances trust", *Proceedings of the Royal Society of London Series B: Biological Sciences*, 269.1498: 1307-1312. 2002.

<sup>15</sup> Lusardi A., Mitchell O.S., "Financial Literacy and Planning: Implications for Retirement Wellbeing", MRRRC Working Paper n. 2006-144., 2006

Results are significant with  $p\text{-value}=0.0885$ . In the subpopulation, where we supposed to find a stronger effect, we indeed found a stronger significance ( $p\text{-value}=0.0189$ ). In this case people who were in the Smiling Fixed group chose the fixed option 56% of the times, while those in the Smiling Variable group did choose the fixed 94% of the times. The significance here is strong, and it is in line with our assumptions: people with less knowledge may rely more on their System I, and therefore choosing according to biased reasoning and heuristics. The relation between smiles and choices turned out to be inverse. Probably, the stereotype of knowledge and expertise is associated with seriousness, leading to an unexpected result: the actual prime was the neutral face. Also, we found significance when comparing Control Group and integrated results from Smiling Fixed and Smiling Variable groups among those who are risk seeker ( $p\text{-value}=0.0949$ ). Also, among those who self declared risk averse the same effect is present and significant ( $p\text{-value} 0.0464$ ). Though, the subgroup populations are very limited, and this made us cautious on drawing conclusions.

This results got us thinking. We could not control for risk aversion given the small sample and lack of data. Risk aversion may have a big impact in this kind of decision, given the fact that when a certain outcome is present, the risky option must be very attractive to deviate from the original position. We therefore decided to launch a second experiment, to have data in which the risk aversion factor do not influence the choice. A full description of the structure and stimuli used in the second experiment will be explained in the following paragraph. Results of Experiment I are summarized in *Table 5.6*.

### Summarization

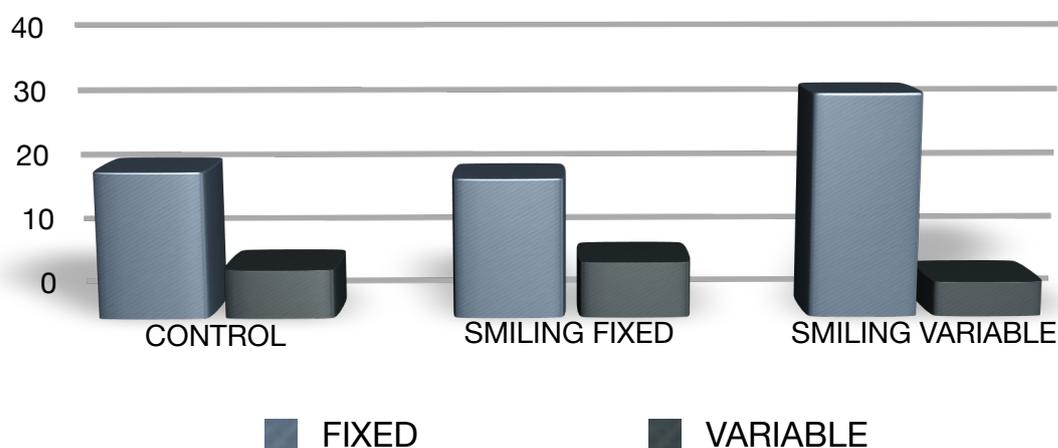


Table 5.6.

<b>SUMMARIZATION</b>			
	<b>CONTROL</b>	<b>SMILING FIXED</b>	<b>SMILING VARIABLE</b>
<b>FIXED</b>	21	20	32
<b>VARIABLE</b>	7	8	5
<b>FIXED%</b>	75.00%	71.43%	86.49%
<b>VARIABLE%</b>	25.00%	28.57%	13.51%
<b>TOTAL</b>	28	28	37
<b>P-VALUE PRIMING</b>	<b>0.21</b>		
<b>P-VALUE IMAGES</b>	<b>0.59</b>		
<b>FINANCIALLY LITERATE</b>			
	<b>CONTROL</b>	<b>SMILING FIXED</b>	<b>SMILING VARIABLE</b>
<b>FIXED</b>	14	10	17
<b>VARIABLE</b>	3	0	4
<b>FIXED%</b>	82.35%	100.00%	80.95%
<b>VARIABLE%</b>	17.65%	0.00%	19.05%
<b>TOTAL</b>	17	10	21
<b>P-VALUE PRIMING</b>	<b>0.2770</b>		
<b>P-VALUE IMAGES</b>	<b>0.6862</b>		
<b>FINANCIALLY ILLITERATE</b>			
	<b>CONTROL</b>	<b>PRIMING FIXED</b>	<b>PRIMING VARIABLE</b>
<b>FIXED</b>	7	10	15
<b>VARIABLE</b>	4	8	1
<b>FIXED%</b>	63.64%	55.56%	93.75%
<b>VARIABLE%</b>	36.36%	44.44%	6.25%
<b>TOTAL</b>	11	18	16
<b>P-VALUE PRIMING</b>	<b>0.0189</b>		
<b>P-VALUE IMAGES</b>	<b>0.7036</b>		

<b>RISK AVERSE (SELF ASSESSMENT)</b>			
<b>X&lt;3</b>	<b>CONTROL</b>	<b>SMILING FIXED</b>	<b>SMILING VARIABLE</b>
<b>FIXED</b>	8	9	11
<b>VARIABLE</b>	3	5	0
<b>FIXED%</b>	72.73%	64.29%	100.00%
<b>VARIABLE%</b>	27.27%	35.71%	0.00%
<b>TOTAL</b>	11	14	11
<b>P-VALUE PRIMING</b>	<b>0.0464</b>		
<b>P-VALUE IMAGES</b>	<b>0.6781</b>		

<b>RISK SEEKING (SELF ASSESSMENT)</b>			
<b>X&gt;7</b>	<b>CONTROL</b>	<b>SMILING FIXED</b>	<b>SMILING VARIABLE</b>
<b>FIXED</b>	0	1	5
<b>VARIABLE</b>	0	0	2
<b>FIXED%</b>		100.00%	71.43%
<b>VARIABLE%</b>		0.00%	28.57%
<b>TOTAL</b>	0	1	7
<b>P-VALUE PRIMING</b>	<b>1</b>		
<b>P-VALUE IMAGES</b>	<b>1</b>		

<b>RISK SEEKING</b>			
<b>X&gt;7</b>	<b>CONTROL</b>	<b>SMILING FIXED</b>	<b>SMILING VARIABLE</b>
<b>FIXED</b>	1	4	4
<b>VARIABLE</b>	3	1	1
<b>FIXED%</b>	25.00%	80.00%	80.00%
<b>VARIABLE%</b>	75.00%	20.00%	20.00%
<b>TOTAL</b>	4	5	5
<b>P-VALUE PRIMING</b>	<b>1</b>		
<b>P-VALUE IMAGES</b>	<b>0.0949</b>		

<b>RISK AVERSE</b>			
<b>X&lt;3</b>	<b>CONTROL</b>	<b>SMILING FIXED</b>	<b>SMILING VARIABLE</b>
<b>FIXED</b>	11	10	10
<b>VARIABLE</b>	2	5	1
<b>FIXED%</b>	84.62%	66.67%	90.91%
<b>VARIABLE%</b>	15.38%	33.33%	9.09%
<b>TOTAL</b>	13	15	11
<b>P-VALUE PRIMING</b>	<b>0.1973</b>		
<b>P-VALUE IMAGES</b>	<b>0.6942</b>		

<b>FEMALE</b>			
	<b>CONTROL</b>	<b>SMILING FIXED</b>	<b>SMILING VARIABLE</b>
<b>FIXED</b>	7	11	12
<b>VARIABLE</b>	2	2	1
<b>FIXED%</b>	77.78%	84.62%	92.31%
<b>VARIABLE%</b>	22.22%	15.38%	7.69%
<b>TOTAL</b>	9	13	13
<b>P-VALUE PRIMING</b>	<b>1</b>		
<b>P-VALUE IMAGES</b>	<b>0.5702</b>		

<b>MALE</b>			
	<b>CONTROL</b>	<b>SMILING FIXED</b>	<b>SMILING VARIABLE</b>
<b>FIXED</b>	14	9	20
<b>VARIABLE</b>	5	6	4
<b>FIXED%</b>	73.68%	60.00%	83.33%
<b>VARIABLE%</b>	26.32%	40.00%	16.67%
<b>TOTAL</b>	19	15	24
<b>P-VALUE PRIMING</b>	<b>0.1411</b>		
<b>P-VALUE IMAGES</b>	<b>1</b>		

## Experiment 2

### Description

The second experiment aims at better understanding the results obtained from experiment 1, and further investigate the effects of priming faces with different expressions on the decisional process. We kept three treatment groups: the Control group, the Smiling and the Neutral. In this experiment Control group design include an image of a globe representing planet Earth (*Figure 1*). Smiling and Neutral groups were respectively primed with a smiling and neutral face (*Figure 2 and 3*). Since we found a strong significance among financially illiterate participants - more specifically among white participants - we decided to explore this segment. We limited survey accessibility to the U.S. since it was the subgroup who gave more meaningful responses and seemed to pay more attention when answering (nevertheless the population among different subgroups was too little to draw significant conclusions). To avoid the risk aversion issue, we changed the structure of the first experiment as follows: the choice is no more between a fixed offer (certain outcome) and a variable one (risky outcome), rather participants were asked whether they are interested in the variable offer or not. The choice between the fixed and the



variable, however, is still present later on the experiment. Questions about confidence and trust were added. Most importantly, we increased the financial literacy scale, to have a greater specification of participants' knowledge. We kept questions about education, which is often linked to the financial literacy, former bank loans applications (if any), and classic demographic questions.

Figure 1

## Prediction and Hypothesis

The main structure of the experiment is the same as experiment 1. However the problem to be solved was divided into two stages. It was first asked to participants to assess a loan offer (forecasts, spread and Euribor rate were kept the same) and decide whether to accept or refuse the offer motivating their answer. Regardless to the answer given, they were to compare the variable offer with a fixed one, as in Experiment 1. Furthermore, questions about confidence in taking the choice and trustworthiness of the analyst (when there was a face) or the bank (when there was the globe). Then financial literacy was examined. We still relied on the Lusardi's scale, including advanced questions. Also, we added three questions which test debt literacy<sup>1</sup>, for a total of ten questions. We tried to cover different elements to have a proper scale to classify participants literacy. The questions used investigate people ability to compute and comprehend compound interests at different levels of difficulty, inflation, stock and bond risks, the relationship between interest rate and bond price, the understanding of mortgage concept and of the notion of time value of money. Also, in the attempt of strengthening the priming effect, we increased images size, adjusting the framing consequently. Not only the size was changed, but also the type of smile. The picture used in the first experiment was a really subtle smile: *orbiculari oculis* muscle was not involved in the expression, and that could end up looking like a fake smile. To better understand this concept a brief description of how happiness is translated into an expression is due. We refer to the work of Paul Ekman and Wallace Friesen<sup>2</sup> which describes which muscles are called to contract for each of the universal emotion<sup>3</sup>. What distinguishes a real smile from a fake one is the involvement of *orbiculari oculis* muscle. However, lips, cheeks, eyebrows and forehead muscles can be involved in different type of smiles. In each of them, lips corners are drawn back and tend upwards. Lips can remain together, can be parted

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<sup>1</sup> Lusardi A., Tufano P., "*Debt literacy, financial experiences, and overindebtedness*", No. w14808. National Bureau of Economic Research, 2009.

<sup>2</sup> Ekman P., Friesen W., "*Giù la Maschera, Come Riconoscere Le Emozioni dall'Espressione del Viso*", Giunti, 2007

<sup>3</sup> Happiness, Contempt, Disgust, Anger, Surprise, Fear, Sadness.

disclosing the teeth or the mouth can be opened showing the teeth parted and a wide grin. Also wrinkle lines run from the nose down to the area beyond mouth corners. These “naso-labial” folds are a distinctive signal of the happiness mimic. The cheeks raise, marking the folds and displaying “Crow’s feet” on the eye’s sides. The more intense the smile, the more visible the naso-labial folds, the stretching of the *orbiculari oculis*, the “Crow’s feet”, and openness of the mouth. Since the latter is the more visible is the first to be noticed and the first to be used to fake the mimic. In the first experiment we used *Figure 2*. As it can be seen, in *Figure 1* the mouth is almost opened, showing both upper and lower teeth. Rino-labial folds are more visible, cheeks are raised making look eyes smaller and the lines under the eyes are pronounced. All these signals show that the smile is more intense and therefore more effective. Since in the first experiment we found that the neutral face affected more participants than the smiling one, we increased the intensity of the smile to further check this trend. *Figure 3* represents the neutral face.



Figure 2

Figure 3

Figure 4

The hypothesis underneath the test are inevitably connected to experiment 1 results. Since the significance was strong among those with low level of financial literacy, we expected to find the same trend among low educated or financially illiterate people, since the two are strongly connected<sup>4</sup>. We also expect to have a stronger effect for the neutral face, which presumably evoke the stereotype of banker. However, given the structure of the first problem, namely accepting or

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<sup>4</sup> Lusardi A., Tufano P., “*Debt literacy, financial experiences, and overindebtedness*”, No. w14808. National Bureau of Economic Research, 2009

refusing an offer, System 1 is more likely to be called in action, maybe even among financially literate individuals. Nevertheless, when asked to compare the variable offer with the fixed one from experiment 1 (2.5% *ceteris paribus*) financial literacy may motivate the intervention of System 2. Our hypotheses were therefore that groups primed with faces would be more likely to accept the offer. Also, in the comparison between the variable offer and the fixed one, the effect will be greater for those with low levels of financial knowledge.

**H1:** neutral and smiling group, on average, would accept more the offer than the control group.

**H2:** neutral face would lead to accept the offer more than the smiling..

**H3:** the effect in H1 is not linked to financial literacy

**H4:** the effect in H2 is greater among those with low financial literacy level. .

### Loan Offers Structure

The structure of the loan is not changed with respect to experiment 1. Here as well, workers were asked to imagine to be client of a fictitious bank and that they received an email with an offer: a variable interest rate loan. Length is still five years, and the capital varies from a minimum of one thousand to a maximum of one hundred thousand dollars. The forecasts provided are the same as in the first experiment and they are shortly recapped in *Table 2*, while *Table 1* sum up the offer.

	Capital	Annual Interest rate	Years
Variable	from \$1,000 to \$100,000	euribor + 2% spread	5

*Table 1*

*Table 2*

<b>Years</b>	<b>Forecast A</b>	<b>Forecast B</b>
1	0.30%	0.45%
2	0.25%	0.65%
3	0.20%	0.90%
4	0.30%	0.70%
5	0.50%	0.35%

Of course the two forecasts are just forecasts, i.e., infinite different scenarios may still manifest. Since there are so many variables to be taken into account in this choice, and most of them are not controllable, there is not a “right” answer. If we consider only the two forecasts, we see that the range of the total cost (assuming a \$10,000 loan) goes from a minimum of \$10,684 to a maximum of \$10,755. The difference in absolute value is \$71, which is about 1% difference in the total interest paid. The structure of the loan and the forecasts, unlike in experiment 1, are supposed to represent a typical debt choice, in which people is supposed to deal with the concepts of depreciation, compounding interest rates, and understand financial concepts as spread and Euribor rate (which are explained in the offer). In such a scenario, System 1 is more likely to be called in action, maybe even among financially literate individuals. However, when asked to compare the variable offer with the fixed one from experiment 1 (2.5% *ceteris paribus*) financial literacy may motivate the intervention of System 2.

Table 3

Probability Forecast A	Probability Forecast B	Weighted Average Cost
10%	90%	\$10,775.80
20%	80%	\$10,765.60
30%	70%	\$10,755.40
40%	60%	\$10,745.20
50%	50%	\$10,735.00
60%	40%	\$10,724.80
70%	30%	\$10,714.60
80%	20%	\$10,704.40
90%	10%	\$10,694.20
100%	0%	\$10,684.00

## Method

### *Participants*

Through the AMT platform we recruited a total of 225 people, and 205 of them were taken into account for the analysis: those who did not fail the control question which was:

“How many forecasts were available? 1.None 2. Two 3. Do not Know.”

The question was very easy and simply used to rule out individuals which did not put enough effort in the survey. We believe that the control question, allowing only workers with approval HIT of 95% and a number of total HITs greater or equal than 1000, provide a very useful way to select only reliable workers. The population was composed as follows: 125 males and 80 females, among them, the mean age was 30.9 (minimum 18 maximum 71). White people were 70%, african american 8%, hispanic 6% and asians 11% of the population. We also hypothesized a relationship between marital status and familiarity (experience) with loan offers, which in turn is related to financial literacy. More than 50% of the population was single, 27% never married, 17% is living with a partner and less than 4% is divorced. Education is related to financial literacy as well: 15% finished their studies at the high school, 27% went to

college (no degree), and almost 40% got their bachelor. Only 7% have a graduate degree or higher. Detailed summary of the population can be found in *Table 5*.

*Table 5*

<b>RESPONDENTS</b>	<b>TOTAL</b>	<b>PROPORTION</b>
<b>Total</b>	205	
<b>GENDER</b>		
MALE	125	60.98%
FEMALE	80	39.02%
<b>AGE</b>		
18-25 YEARS OLD	56	27.32%
26-30 YEARS OLD	66	32.20%
31-35 YEARS OLD	37	18.05%
36-40 YEARS OLD	19	9.27%
OVER 40	27	13.17%
<b>EDUCATION</b>		
HIGH SCHOOL	32	15.61%
COLLEGE BUT NO DEGREE	52	25.37%
ASSOCIATE DEGREE	3	1.46%
BACHELOR DEGREE	80	39.02%
GRADUATE DEGREE	14	6.83%
PROFESSIONAL	3	1.46%
MBA	1	0.49%
<b>RACE</b>		
AFRICAN AMERICAN	17	8.29%
WHITE	145	70.73%
ASIAN	23	11.22%
HISPANIC	13	6.34%
OTHER	7	3.41%
<b>MARITAL STATUS</b>		
SINGLE	107	52.20%
NEVER MARRIED	56	27.32%
LIVING WITH PARTNER	35	17.07%
DIVORCED	7	3.41%

Since we found a strong significance among financially illiterate participants - more specifically among white participants - we decided to explore this segment. We limited survey accessibility to the U.S. since it was subgroup who gave more meaningful responses and seemed to pay more attention when answering (nevertheless the population among different subgroups was too little to draw significant conclusions).

## **Materials**

### *Stimuli*

The stimuli used are, as already mentioned above, a smiling face and a neutral one (respectively *Figure 2 and 4*). In the control group was inserted an image of a globe (see *Figure 1*). The image size is big enough to cover a big part of the page, unlike in experiment I in which it was very small. The smile itself is more intense, and involves more muscles. Also, the *orbiculari oculi* is involved, the naso-labial folds are deep and the mouth is opened showing the teeth. The neutral face is the same as in experiment I, and represents an emotionless face. The intensity of the priming should therefore be bigger than in the former test, at least in the part concerning the choice between fixed and variable offers.

### *Procedure*

The experiment begins with the information content and the guidelines for the completion of the task. Participants are told that the survey tests the financial decision making process. The survey is divided into two sections, and it discloses as follows: first of all participants are asked to decide whether to accept or refuse (with motivation) a loan offer proposed by their own fictitious bank. Interest rate, forecasts and explanation of the terms used are provided. Also, we added questions about confidence in the decision and trustworthiness of the analysts and the bank. We checked comprehension of the problem as well, asking for the scenario less costly. Then participants had to choose between the variable offer and the fixed one used in experiment I. The first section of the experiment is concluded. In the second section we investigated their familiarity with the “loan world”, asking if they have

ever applied for a loan, and if they have a finance related job. As said in the previous chapter, decisional process varies according to familiarity<sup>5</sup>, besides to knowledge and experience<sup>6</sup>. Then financial literacy has been tested with the questions illustrated in Chapter 1.3. Education, race, gender and marital status questions conclude the survey.

## Results and Discussion

Results from the experiment are in line with those obtained in the first one, and suggest very interesting implications. Participants not subjected to the priming (Control group), accepted the variable offer 44.29% of times, while those in the Neutral and Smiling groups respectively 36.23% and 28.79%. Although not statistically significant, this first result reveal an unexpected trend: human faces lead people to accept less the offer, maybe arousing some sort of *diffidence effect*. The trend becomes significant among women<sup>7</sup> and those which, on average, trusted the analyst/bank less than the others ("Low Trust"). In fact, females in the Control group accepted the Variable offer 52.63% of the time, whereas those in the Faces group (i.e., Neutral and Smiling group combined), accepted it 27.89% (p-value: 0.0113). Those labelled in *Table 6* as "Low Trust" accepted 31.03% of the times if they were not primed but 13.11% when they were (p-value: 0.0809). The most interesting results come from the choice between fixed and variable, and allows us to make some other assumption on what we labelled *diffidence effect*. When looking at the total population, 81.43% of the Control group and 79.26% of the Faces one chose the fixed. The difference is too weak to be statistically significant and apparently there is no effect. However, when checking education levels it turned out that there was a statistically significant effect both among those in the subgroup we labelled

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<sup>5</sup> Park C.W., Parker L.V., "Familiarity and Its Impact on Consumer Decision Biases and Heuristics", *Journal of Consumer Research*, Vol.8, 223-230, 1981

<sup>6</sup> Bettman J.R., Park C.W.. "Effects of prior knowledge and experience and phase of the choice process on consumer decision processes: A protocol analysis", *Journal of Consumer Research* 7.3, 234, 1980

<sup>7</sup> Males choices were more equilibrated, even if the trend was the same: acceptance rates were 41.18% for the Control group and 36.49% for the Faces one.

“Low Education” and in the “High Education”<sup>8</sup>. What is interesting is the trend: in the first participants chose the fixed 85.19% of the times when primed<sup>9</sup>, and 66.67% when they were not., revealing a negative relation between the acceptance and the images of faces. In the latter, though, the trend is inverted: participants in the control group chose the fixed more than those from the Faces (respectively 80% and 75.31%). Also, the effect is stronger among those with a high education level, with a p-value of 0.027 (for the low education level p-value is 0.0571). This suggest very intriguing implications. The two effects almost cancel each other out. The *diffidence effect* is only present among those with a presumably lower cultural background, while those with a high education level are more inclined to be affected by the face in a relatively positive way, namely by keeping the variable more than they would when not primed. To better understand this results we followed what the literature suggests, that is what we may call *identification effect*: since the faces used as a stimuli is from a white young guy, there may be a greater affection amongst whites. It is indeed what we found. If we take into account only white people, all effects mentioned are strengthened, and some new one emerged. The first guesses about the *diffidence effect* are further confirmed. Participants primed accepted the offer significantly less than those who were not (p-value=0.0305). In particular, acceptance rate in the Neutral group was higher than in the Smiling one (p-value=0.0667), and the effect is even stronger among males (p-value=0.0146), when comparing Neutral and Smiling. However in absolute terms participants affected with the Neutral face accepted the offer more than the Control group: the *identification effect* seems to be stronger than the *diffidence* one, though when comparing Control and Faces this trend is inverted allowing for some more intuition in line with results from experiment I. The smiling face affect the choices negatively, and the effect is stronger that the positive affection of the neutral face, i.e., *diffidence effect* becomes stronger. This is further confirmed among financially literate and with high cultural level, that accepted the offer less when primed with a smiling face (respective p-values are:

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<sup>8</sup> Those in the “Low Education” do not have a degree, unlike those in the “High Education”

<sup>9</sup> notice that the prime was in the variable offer.

0.0817 and 0.0008). Finally, when looking at the choice between fixed and variable, the general trend are strengthened in the white subgroup: people with low education level tend to choose the fixed more than they would have when not primed, and vice versa for those with high education level. In this case the effect is stronger for low education (p-value: 0.0474, and 0.0777 for the “high education” subgroup). The fact that low educated people tend to deviate from the original position more than highly educated ones may have different interpretations. On one side, we may interpret this as a stronger risk aversion: they may have little comprehension of the interest rate fluctuations and its implications, therefore preferring a certain outcome. Another interpretation may be suggested looking at combined results. High educated people tend to accept less the variable offer when primed, and even less when specifically primed with a smiling face, but they stick with their choice more than people with a lower education level. From a more in depth analysis it turned out that level of confidence and trustworthiness were affected by the priming. These results are in line with former ones. Participants with a high education level were more confident in their choices than low educated ones, and significantly trusted less when primed with the neutral face (even less with the smiling one). The general trend among those affected with the faces was an increase in confidence and a decrease in trustworthiness (confirming the *diffidence* effect hypothesis).

A summarization of all results from experiment 2 can be found below. An in depth discussion of both results from experiment 1 and 2 will be discussed in the next section.

# ALL

ACCEPT	NEUTRAL	SMILING	SIGNIFICANCE
<b>TOTAL</b>	36.23%	28.79%	not significant
<b>MALE</b>	42.50%	29.41%	not significant
<b>FEMALE</b>	27.59%	28.13%	not significant
<b>F. LIT</b>	41.03%	29.03%	not significant
<b>F. ILLIT</b>	30.00%	28.57%	not significant
<b>LOW ED.</b>	28.58%	42.31%	not significant
<b>HIGH ED.</b>	41.46%	20.00%	<b>significant at 10%</b>
<b>NO EXP.</b>	26.47%	19.23%	not significant
<b>SINGLE</b>	36.46%	44.83%	not significant
<b>LOW CONF.</b>	43.33%	33.33%	not significant
<b>HIGH CONF.</b>	30.77%	25.64%	not significant
<b>LOW TRUST</b>	10.00%	16.13%	not significant
<b>HIGH TRUST</b>	56.41%	40.00%	not significant
ACCEPT	CONTROL	FACES	
<b>TOTAL</b>	44.29%	32.59%	not significant
<b>MALE</b>	41.18%	36.49%	not significant
<b>FEMALE</b>	52.63%	27.87%	<b>significant at 5%</b>
<b>F. LIT</b>	52.78%	35.71%	not significant
<b>F. ILLIT</b>	41.18%	29.23%	not significant
<b>LOW ED.</b>	53.33%	35.19%	not significant
<b>HIGH ED.</b>	37.50%	30.86%	not significant
<b>NO EXP.</b>	35.48%	23.33%	not significant
<b>SINGLE</b>	38.46%	57.35%	not significant
<b>LOW CONF.</b>	50.00%	36.80%	not significant
<b>HIGH CONF.</b>	40.00%	28.21%	not significant
<b>LOW TRUST</b>	31.03%	13.11%	<b>significant at 10%</b>
<b>HIGH TRUST</b>	53.66%	40.63%	not significant

Table 6.1

# WHITE

ACCEPT	NEUTRAL	SMILING	SIGNIFICANCE
<b>TOTAL</b>	37.25%	18.60%	<b>significant at 10%</b>
<b>MALE</b>	48.15%	13.64%	<b>significant at 5%</b>
<b>FEMALE</b>	28.57%	36.36%	not significant
<b>F. LIT</b>	41.94%	18.18%	<b>significant at 10%</b>
<b>F. ILLIT</b>	30.00%	19.05%	not significant
<b>LOW ED.</b>	25.00%	29.41%	not significant
<b>HIGH ED.</b>	45.16%	11.54%	<b>significant at 1%</b>
<b>NO EXP.</b>	25.00%	7.14%	not significant
<b>SINGLE</b>	37.04%	37.50%	not significant
<b>LOW CONF.</b>	41.03%	36.59%	not significant
<b>HIGH CONF.</b>	30.00%	16.00%	not significant
<b>LOW TRUST</b>	15.00%	0.00%	<b>significant at 1%</b>
<b>HIGH TRUST</b>	51.61%	38.10%	<b>significant at 5%</b>
ACCEPT	CONTROL	FACES	
<b>TOTAL</b>	47.06%	28.72%	<b>significant at 5%</b>
<b>MALE</b>	42.86%	32.65%	not significant
<b>FEMALE</b>	45.71%	32.56%	not significant
<b>F. LIT</b>	55.17%	32.08%	<b>significant at 10%</b>
<b>F. ILLIT</b>	36.36%	24.39%	not significant
<b>LOW ED.</b>	50.00%	27.03%	not significant
<b>HIGH ED.</b>	44.44%	29.82%	not significant
<b>NO EXP.</b>	35.29%	18.42%	not significant
<b>SINGLE</b>	36.00%	37.21%	not significant
<b>LOW CONF.</b>	47.73%	38.75%	not significant
<b>HIGH CONF.</b>	38.46%	23.64%	not significant
<b>LOW TRUST</b>	31.82%	7.14%	not significant
<b>HIGH TRUST</b>	58.62%	46.15%	not significant

Table 6.2

# ALL

FIXED	<b>NEUTRAL</b>	<b>SMILING</b>	
<b>TOTAL</b>	76.81%	81.82%	not significant
<b>MALE</b>	70.00%	82.35%	not significant
<b>FEMALE</b>	86.21%	81.25%	not significant
<b>F. LITERATE</b>	82.05%	93.87%	not significant
<b>F. ILLITERATE</b>	70.00%	80.00%	not significant
<b>LOW ED.</b>	85.71%	84.62%	not significant
<b>HIGH ED.</b>	92.50%	70.73%	not significant
<b>NEVER APPLIED</b>	85.29%	88.46%	not significant
<b>SINGLE</b>	74.36%	79.31%	not significant
<b>LOW CONF.</b>	80.00%	74.07%	not significant
<b>HIGH CONF.</b>	74.36%	87.18%	not significant
<b>LOW TRUST</b>	86.67%	90.32%	not significant
<b>HIGH TRUST</b>	69.23%	74.29%	not significant
FIXED	<b>CONTROL</b>	<b>FACES</b>	
<b>TOTAL</b>	81.43%	79.26%	not significant
<b>MALE</b>	78.43%	75.68%	not significant
<b>FEMALE</b>	89.47%	83.61%	not significant
<b>F. LITERATE</b>	83.33%	82.86%	not significant
<b>F. ILLITERATE</b>	79.41%	75.38%	not significant
<b>LOW ED.</b>	66.67%	85.19%	<b>significant at 10%</b>
<b>HIGH ED.</b>	92.50%	75.31%	<b>significant at 5%</b>
<b>NEVER APPLIED</b>	83.87%	86.67%	not significant
<b>SINGLE</b>	79.49%	76.47%	not significant
<b>LOW CONF.</b>	80.00%	77.19%	not significant
<b>HIGH CONF.</b>	82.50%	80.77%	not significant
<b>LOW TRUST</b>	93.10%	88.52%	not significant
<b>HIGH TRUST</b>	73.17%	71.62%	not significant

Table 6.3

# WHITE

FIXED	<b>NEUTRAL</b>	<b>SMILING</b>	
<b>TOTAL</b>	78.43%	83.72%	not significant
<b>MALE</b>	74.07%	77.27%	not significant
<b>FEMALE</b>	78.57%	84.09%	not significant
<b>F. LITERATE</b>	87.10%	81.82%	not significant
<b>F. ILLITERATE</b>	65.00%	85.71%	not significant
<b>LOW ED.</b>	90.00%	88.24%	not significant
<b>HIGH ED.</b>	70.97%	80.77%	not significant
<b>NEVER APPLIED</b>	87.50%	92.86%	not significant
<b>SINGLE</b>	77.78%	75.00%	not significant
<b>LOW CONF.</b>	76.92%	75.61%	not significant
<b>HIGH CONF.</b>	76.67%	92.00%	not significant
<b>LOW TRUST</b>	85.00%	90.91%	not significant
<b>HIGH TRUST</b>	74.19%	76.19%	not significant
FIXED	<b>CONTROL</b>	<b>FACES</b>	
<b>TOTAL</b>	80.39%	80.85%	not significant
<b>MALE</b>	77.14%	75.51%	not significant
<b>FEMALE</b>	85.71%	81.40%	not significant
<b>F. LITERATE</b>	82.76%	84.91%	not significant
<b>F. ILLITERATE</b>	77.27%	75.61%	not significant
<b>LOW ED.</b>	66.67%	89.19%	<b>significant at 5%</b>
<b>HIGH ED.</b>	92.59%	75.44%	<b>significant at 10%</b>
<b>NEVER APPLIED</b>	82.35%	89.47%	not significant
<b>SINGLE</b>	76.00%	18.42%	not significant
<b>LOW CONF.</b>	79.55%	76.25%	not significant
<b>HIGH CONF.</b>	84.62%	83.64%	not significant
<b>LOW TRUST</b>	90.91%	88.10%	not significant
<b>HIGH TRUST</b>	72.41%	59.62%	not significant

Table 6.4

ALL

confidence	CONTROL	NEUTRAL	SIGNIFICANCE	trustworthiness	CONTROL	NEUTRAL	SIGNIFICANCE
<b>TOTAL</b>	6.76	7.55	significant at 10%	<b>TOTAL</b>	4.66	4.44	not significant
<b>MALE</b>	6.90	7.76	not significant	<b>MALE</b>	4.77	4.57	not significant
<b>FEMALE</b>	6.38	7.27	not significant	<b>FEMALE</b>	4.35	4.27	not significant
<b>F. LIT</b>	6.90	7.80	not significant	<b>F. LIT</b>	4.72	4.53	not significant
<b>F. ILLIT</b>	6.60	7.23	not significant	<b>F. ILLIT</b>	4.59	4.33	not significant
<b>LOW ED.</b>	6.87	7.57	not significant	<b>LOW ED.</b>	4.99	4.30	not significant
<b>HIGH ED.</b>	6.67	7.54	not significant	<b>HIGH ED.</b>	4.42	4.55	not significant
<b>&gt; MEAN</b>	8.70	9.38	significant at 1%	<b>&gt; MEAN</b>	6.41	6.38	not significant
<b>&lt; MEAN</b>	4.16	5.18	not significant	<b>&lt; MEAN</b>	2.20	1.92	not significant
confidence	<b>CONTROL</b>	<b>SMILING</b>	<b>SIGNIFICANCE</b>	trustworthiness	<b>CONTROL</b>	<b>SMILING</b>	<b>SIGNIFICANCE</b>
<b>TOTAL</b>	6.76	7.28	not significant	<b>TOTAL</b>	4.66	4.48	not significant
<b>MALE</b>	6.90	7.48	not significant	<b>MALE</b>	4.77	4.26	not significant
<b>FEMALE</b>	6.38	7.07	not significant	<b>FEMALE</b>	4.35	4.71	not significant
<b>F. LIT</b>	6.90	7.30	not significant	<b>F. LIT</b>	4.72	4.16	not significant
<b>F. ILLIT</b>	6.60	7.26	not significant	<b>F. ILLIT</b>	4.59	4.77	not significant
<b>LOW ED.</b>	6.87	7.42	not significant	<b>LOW ED.</b>	4.99	5.30	not significant
<b>HIGH ED.</b>	6.67	7.19	not significant	<b>HIGH ED.</b>	4.42	3.95	not significant
<b>&gt; MEAN</b>	8.70	9.07	significant at 10%	<b>&gt; MEAN</b>	6.41	6.27	not significant
<b>&lt; MEAN</b>	4.16	4.7	not significant	<b>&lt; MEAN</b>	2.20	2.45	not significant

ALL

confidence	CONTROL	FACES	SIGNIFICANCE	trustworthiness	CONTROL	FACES	SIGNIFICANCE
<b>TOTAL</b>	6.76	7.42	significant at 10%	<b>TOTAL</b>	4.66	4.46	not significant
<b>MALE</b>	6.90	7.63	not significant	<b>MALE</b>	4.77	4.43	not significant
<b>FEMALE</b>	6.38	7.17	not significant	<b>FEMALE</b>	4.35	4.50	not significant
<b>F. LIT</b>	6.90	7.58	not significant	<b>F. LIT</b>	4.72	4.36	not significant
<b>F. ILLIT</b>	6.60	7.25	not significant	<b>F. ILLIT</b>	4.59	4.57	not significant
<b>LOW ED.</b>	6.87	7.50	not significant	<b>LOW ED.</b>	4.99	4.78	not significant
<b>HIGH ED.</b>	6.67	7.37	not significant	<b>HIGH ED.</b>	4.42	4.25	not significant
<b>&gt; MEAN</b>	8.70	9.22	significant at 1%	<b>&gt; MEAN</b>	6.41	6.33	not significant
<b>&lt; MEAN</b>	4.16	4.95	not significant	<b>&lt; MEAN</b>	2.20	2.20	not significant
confidence	<b>SMILING</b>	<b>NEUTRAL</b>	<b>SIGNIFICANCE</b> <td>trustworthiness</td> <td><b>SMILING</b></td> <td><b>NEUTRAL</b></td> <td><b>SIGNIFICANCE</b></td>	trustworthiness	<b>SMILING</b>	<b>NEUTRAL</b>	<b>SIGNIFICANCE</b>
<b>TOTAL</b>	7.28	7.55	not significant	<b>TOTAL</b>	4.48	4.44	not significant
<b>MALE</b>	7.48	7.76	not significant	<b>MALE</b>	4.26	4.57	not significant
<b>FEMALE</b>	7.07	7.27	not significant	<b>FEMALE</b>	4.71	4.27	not significant
<b>F. LIT</b>	7.30	7.80	not significant	<b>F. LIT</b>	4.16	4.53	not significant
<b>F. ILLIT</b>	7.26	7.23	not significant	<b>F. ILLIT</b>	4.77	4.33	not significant
<b>LOW ED.</b>	7.42	7.57	not significant	<b>LOW ED.</b>	5.30	4.30	not significant
<b>HIGH ED.</b>	7.19	7.54	not significant	<b>HIGH ED.</b>	3.95	4.55	not significant
<b>&gt; MEAN</b>	9.07	9.38	not significant	<b>&gt; MEAN</b>	6.27	6.38	not significant
<b>&lt; MEAN</b>	4.70	5.18	not significant	<b>&lt; MEAN</b>	2.45	1.92	not significant

WHITE

confidence	CONTROL	NEUTRAL	SIGNIFICANCE	trustworthiness	CONTROL	NEUTRAL	SIGNIFICANCE
<b>TOTAL</b>	6.70	7.73	significant at 5%	<b>TOTAL</b>	4.78	4.57	not significant
<b>MALE</b>	6.99	8.00	not significant	<b>MALE</b>	4.84	4.71	not significant
<b>FEMALE</b>	6.08	7.42	significant at 10%	<b>FEMALE</b>	4.64	4.42	not significant
<b>F. LIT</b>	6.45	7.71	significant at 10%	<b>F. LIT</b>	4.99	4.70	not significant
<b>F. ILLIT</b>	7.04	7.77	not significant	<b>F. ILLIT</b>	4.50	4.38	not significant
<b>LOW ED.</b>	6.83	7.50	not significant	<b>LOW ED.</b>	4.67	4.24	not significant
<b>HIGH ED.</b>	6.59	7.89	significant at 5%	<b>HIGH ED.</b>	4.88	4.79	not significant
<b>&gt; MEAN</b>	8.73	9.36	significant at 5%	<b>&gt; MEAN</b>	6.40	6.19	not significant
<b>&lt; MEAN</b>	4.59	5.41	not significant	<b>&lt; MEAN</b>	2.64	2.07	not significant
confidence	<b>CONTROL</b>	<b>SMILING</b>	<b>SIGNIFICANCE</b>	trustworthiness	<b>CONTROL</b>	<b>SMILING</b>	<b>SIGNIFICANCE</b>
<b>TOTAL</b>	6.70	7.59	significant at 10%	<b>TOTAL</b>	4.78	4.20	not significant
<b>MALE</b>	6.99	7.77	not significant	<b>MALE</b>	4.84	4	not significant
<b>FEMALE</b>	6.08	7.39	significant at 10%	<b>FEMALE</b>	4.64	4.42	not significant
<b>F. LIT</b>	6.45	8.02	significant at 5%	<b>F. LIT</b>	4.99	4.19	not significant
<b>F. ILLIT</b>	7.04	7.14	not significant	<b>F. ILLIT</b>	4.50	4.22	not significant
<b>LOW ED.</b>	6.83	7.57	not significant	<b>LOW ED.</b>	4.67	5.13	not significant
<b>HIGH ED.</b>	6.59	7.6	not significant	<b>HIGH ED.</b>	4.88	3.6	significant at 5%
<b>&gt; MEAN</b>	8.73	9.18	not significant	<b>&gt; MEAN</b>	6.40	6.28	not significant
<b>&lt; MEAN</b>	4.59	5.37	not significant	<b>&lt; MEAN</b>	2.64	2.22	not significant

WHITE

confidence	CONTROL	FACES	SIGNIFICANCE	trustworthiness	CONTROL	FACES	SIGNIFICANCE
<b>TOTAL</b>	6.70	7.67	significant at 5%	<b>TOTAL</b>	4.78	4.41	not significant
<b>MALE</b>	6.99	7.90	not significant	<b>MALE</b>	4.84	4.39	not significant
<b>FEMALE</b>	6.08	7.41	significant at 5%	<b>FEMALE</b>	4.64	4.42	not significant
<b>F. LIT</b>	6.45	7.84	significant at 5%	<b>F. LIT</b>	4.99	4.49	not significant
<b>F. ILLIT</b>	7.04	7.44	not significant	<b>F. ILLIT</b>	4.50	4.30	not significant
<b>LOW ED.</b>	6.83	7.53	not significant	<b>LOW ED.</b>	4.67	4.65	not significant
<b>HIGH ED.</b>	6.59	7.76	significant at 5%	<b>HIGH ED.</b>	4.88	4.25	not significant
<b>&gt; MEAN</b>	8.73	9.27	significant at 5%	<b>&gt; MEAN</b>	6.40	6.22	not significant
<b>&lt; MEAN</b>	4.59	5.39	significant at 10%	<b>&lt; MEAN</b>	2.64	2.15	not significant

confidence	SMILING	NEUTRAL	SIGNIFICANCE	trustworthiness	SMILING	NEUTRAL	SIGNIFICANCE
<b>TOTAL</b>	7.59	7.73	not significant	<b>TOTAL</b>	4.20	4.57	not significant
<b>MALE</b>	7.77	8.00	not significant	<b>MALE</b>	4.00	4.71	not significant
<b>FEMALE</b>	7.39	7.42	not significant	<b>FEMALE</b>	4.42	4.42	not significant
<b>F. LIT</b>	8.02	7.71	not significant	<b>F. LIT</b>	4.19	4.70	not significant
<b>F. ILLIT</b>	7.14	7.77	not significant	<b>F. ILLIT</b>	4.22	4.38	not significant
<b>LOW ED.</b>	7.57	7.50	not significant	<b>LOW ED.</b>	5.13	4.24	not significant
<b>HIGH ED.</b>	7.60	7.89	not significant	<b>HIGH ED.</b>	3.60	4.79	significant at 10%
<b>&gt; MEAN</b>	9.18	9.36	not significant	<b>&gt; MEAN</b>	6.28	6.19	not significant
<b>&lt; MEAN</b>	5.37	5.41	not significant	<b>&lt; MEAN</b>	2.22	2.07	not significant

## Final Discussion

Perfect rationality is a concept we should all accept as utopian. Since Freud the existence of an unconscious, primitive and impulsive part of the mind has been theorized. Daniel Kahneman's masterpiece *Thinking, Fast and Slow* brings us back closer to Freud's theories, and most importantly sets the basis for a new way of interpreting human behaviors. Although it is evidently not possible to talk about perfect rationality anymore, it is opinion of who writes that a sort of *biased rationality* is what best describes human's cognitive processes. Heuristics are used to avoid heavy thinking, allowing System 2 to rest until it cannot be done otherwise. The dual structure of the brain proposed in the thesis, perfectly fits with phenomena such as the association mechanism, priming and the concept of biased rationality itself. Prospect Theory, inevitably rooted in the dual structure as well, brilliantly describes people's attitude towards risky choices, especially in the presence of certain outcome or losses, filling the gap Utility theory had left open for years. The advent of new disciplines such as Behavioral Economics rather than Behavioral Finance, but also new studies conducted on relatively traditional disciplines as Marketing, also contributed to this new way of interpreting individuals' decision process. Studies conducted on emotions and their translation into expression, like those by Rosenberg and Ekman<sup>1</sup>, made another step forward this new conception. Evolution shaped our System 1 to promptly react to unexpected changes and fast movements, but also to more specific things as body language, voice tone and facial expression. Humans started to communicate well before we started talking, therefore different channels of communications are far more developed. That is why

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<sup>1</sup> Rosenberg E.L., Ekman P., "*Facial Expressions and Emotions*", Neuroscience, pp. 51-52, 1993

apparently irrational decisions become rational, or better, biased-rational. The logic and coherence are deeply established in our body, but probably in a slightly different way than we thought. Emotions rather than be perceived as opposed to rationality, should be seen as fundamentally interconnected with the rational thinking, setting anchors or delimiting patterns of reasoning that are in line with the emotion felt. When feeling angry, for example, thoughts and concepts that feed the anger are more available than those that reduce it<sup>2</sup>. Given this assumption, the associative mechanism plays the fundamental role of activating or deactivating circuits, notions, and concepts according to the stimuli received, be them external or internal. Human mind is strongly and deeply connected to the whole body, and has this intriguing characteristics that makes it react in the same way regardless of the reality of the stimulus. That is what actually allowed the new body of literature to emerge: priming itself exists because of this function of the brain. Also, that is why totally and unequivocally irrelevant information, graphs or images affect individuals' decisions. The literature in favor of smiles<sup>3</sup>, the existence of the so-called *mirror neurons*<sup>4</sup>, and embodiment of emotions<sup>5</sup> made us assuming the existence of a positive relationship between the smile and the decision making process, more specifically, the financial decision making process. This was not the case. Surprisingly our first experiment led us to the opposite conclusion. On one side, we have that neutral face positively

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<sup>2</sup> Ekman P., *Emotions Revealed: Recognizing Faces and Feelings to Improve Communication and Emotional Life*, Henry Holt and Company, 2007

<sup>3</sup> Hamann S., Ely T., Grafton S., Kilts C., "Amygdala activity related to enhanced memory for pleasant and aversive stimuli", *Nature Neuroscience*, Vol. 15 no. 4, 289–293, 1999,

- Bertrand M., Karlan D., Mullainathan S., Shafir E., Zinman J., "What's Advertising Content Worth? Evidence From a Consumer Credit Marketing Field Experiment", *The Quarterly Journal of Economics*, Vol. 125, no.1, pp. 263-306, 2010

- Aggarwal P., McGill A.L., "Is That Car Smiling at me? Schema Congruity as a Basis for Evaluating Anthropomorphized Products", *Journal of Consumer Research*, Vol.34, 2007.

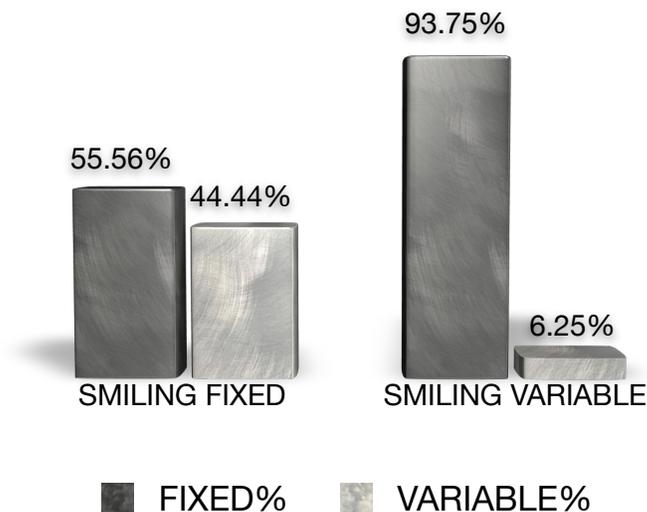
- Burton L. A., et al. "Priming effects for affective vs. neutral faces", *Brain and cognition*, 59.3, pp 322-329, 2005

<sup>4</sup> Rizzolatti G., Fogassi L., Gallese V., "Neurophysiological mechanisms underlying the understanding and imitation of action", *Nature Reviews Neuroscience*, 2, 661–670, 2001

<sup>5</sup> Niedenthal P.M., "Embodying Emotion", *Science*, 316, pp.1002-1005, 2007

primes the decision process, as confirmed from literature<sup>6</sup>. On the other, smiling face negatively affects decision making, guiding people to choose the fixed more when the smiling face was on the variable, and vice versa. If these results are weak in the total sample, they get stronger and stronger as we tailored the analysis. White people were more affected, suggesting a sort of *trust effect* due to resemblance<sup>7</sup>, which also arouses expertise and credibility<sup>8</sup>. The effect became significant among financially illiterate people, confirming the initial hypothesis of a relationship between education, experience<sup>9</sup>, familiarity<sup>10</sup> and priming. The graph below illustrates the difference between the Smiling Fixed and Smiling Variable groups.

Table 1



<sup>6</sup> Bertrand M., Karlan D., Mullainathan S., Shafir E., Zinman J., “What’s Advertising Content Worth? Evidence From a Consumer Credit Marketing Field Experiment”, *The Quarterly Journal of Economics*, Vol. 125, no.1, pp. 263-306, 2010

<sup>7</sup> DeBruine L., “Facial resemblance enhances trust”, Published online 11 June 2002, *Proc. R. Soc. Lond. B*, 2002

<sup>8</sup> Evans, Franklin B., “Selling as a Dyadic Relationship”, *American Behavioral Scientist*, 6, 76–79, 1963

<sup>9</sup> Bettman J.R., Park C.W.. “Effects of prior knowledge and experience and phase of the choice process on consumer decision processes: A protocol analysis”, *Journal of Consumer Research* 7.3, 234, 1980

<sup>10</sup> Park C.W., Parker L.V., “Familiarity and Its Impact on Consumer Decision Biases and Heuristics”, *Journal of Consumer Research*, Vol.8, 223-230, 1981

However the risk aversion factor could have played a major role in the decision process, and information we had were not enough to rule out this possibility. That is why we decided to launch the second experiment. The effect amongst whites was very strong, and there seemed to be some sort of *gender* effect, anyhow too weak to be fully understood. Also, financially literate participants were affected as well, disclosing a possible inverse relationship with respect to financially illiterate individuals. Again, the effect was too weak to draw some conclusion, but enough to make some assumption. The second experiment allowed us to shed some light on results initially obtained. Splitting the initial experiment into two stages let us breakdown the decision making process and bypass risk aversion issue. When participants were to choose whether to accept or refuse the offer, the pattern of choices was almost completely homogeneous. In line with results obtained in the first experiment, the neutral face affected more than the smiling one, i.e., the acceptance rate was higher. Notwithstanding this, the priming overall had a negative impact, reducing the acceptance rate. In fact, both Neutral and Smiling groups on average accepted the offer less than the control group. We named this phenomenon as *Diffidence Effect*. Whereas in the first experiment neutral faces positively primed individuals, i.e., they were more inclined to choose the offer associated with the neutral face, in an accept/refuse type of choice participants refused more when a face was present in the offer. Women are the only subgroup behaving oppositely, both in the first and the second experiment. In the first one, they chose the fixed offer more than the Control group even when primed with the smiling face. In the second one, they accepted the offer more when primed with the smiling face than with the neutral, even if the overall pattern do not deviate from general results: control group's acceptance rate is the highest. When considering whites, though, it was males having the stronger effect, refusing the offer more when primed with the smiling face with respect to the neutral, disclosing an inverse reaction between man and women to facial stimuli. The presence of a *Gender Effect* seems more than just a supposition and it would deserve further investigation. Unfortunately data available did not let us dig deeper. Tailoring the analysis to white people unveiled a profound coherence of results. The negative relationship between priming faces and

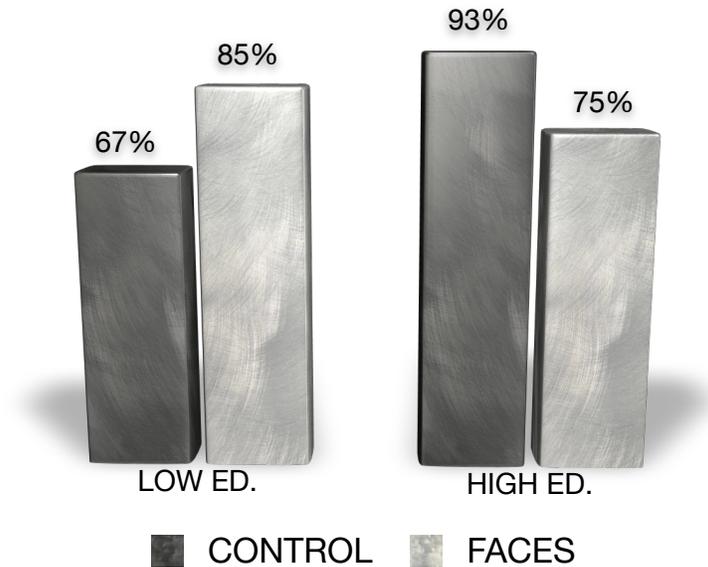
acceptance rate became significant under different categories, and most importantly at both level of comparison, namely Neutral vs. Smiling and Control vs. Faces. As in previous result, Control group's acceptance rate is the highest, with 47.06%, against 37.25% in the Neutral and 18.60% in the Smiling. We labelled the fact that white people were more influenced than other ethnic groups as *Identification Effect*. Maybe the belonging to the same ethnic group can be read as facial resemblance, but it probably has different implications. While DeBruine study cited above found a positive relationship between facial resemblance and trust, we did not find the same trend. The trustworthiness of the analyst or the bank was directly asked to participants, which on average trusted more when there were no faces, be them smiling or neutral. Results were not strong enough to be statistically significant, but they were among white people with a degree, classified as "highly educated". When primed with a smiling face, people felt the analyst less trustworthy than when primed with the neutral one. Probably the credibility and expertise of the neutral face soften the *Diffidence Effect*. The effect is the same even if we reverse the analysis. Both those who said to trust the analyst less and more than the average displayed a significant *Diffidence Effect* when primed with the smiling face. Comparing the Neutral with the Control group, trustworthiness level on average is higher when there is no treatment -even if the difference is very weak- confirming the overall trend. The study conducted in South Africa by Bertrand outlined a positive relationship between pictures of a female face and loan take-up<sup>11</sup>. Our results go in the opposite direction, suggesting that gender differences are important since they both affect and get affected differently.

We now turn the analysis to the second stage of the experiment, i.e., the choice between fixed and variable offer. Since the prime (face) was on the variable offer, and the fixed was proposed as alternative in a second phase, fixed offer's acceptance rate can be used as a measure of power for the prime. Significant effects have been found when analyzing education level comparing the combined effect of Faces with the

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<sup>11</sup> Bertrand M., Karlan D., Mullainathan S., Shafir E., Zinman J., "What's Advertising Content Worth? Evidence From a Consumer Credit Marketing Field Experiment", *The Quarterly Journal of Economics*, Vol. 125, no.1, pp. 263-306, 2010

Table 2



Control group. This kind of analysis unveiled a very intriguing result. On average, acceptance rate for the fixed offer was almost the same in both groups. This is due to a diametrically opposed behavior of people classified as “low educated” and “highly educated”. Table 2 helps in the visual representation of results. Low educated people tend to choose the fixed offer less than highly educated. The opposite happens if they are primed with either a smiling or a neutral face. It is not easy to interpret such a behavior. It is possible to argue that low educated people are inversely affected by faces with respect to highly educated. The fact that they were more likely to choose the fixed when a face is associated with the variable let us believe that they are subjected to the *Diffidence Effect*. However trustworthiness level is higher for the highly educated subgroup suggesting the opposite conclusion: since they trust less the bank they should be more likely to choose the fixed, when primed. Probably trustworthiness is not a good indicator of preferences. In contrast, confidence level disclosed meaningful results. Confidence level in their choice for highly educated individuals was higher than for low educated. It is arguable that when one feels more confident in the choice he or she is more likely to stick with it, even if a more attractive option is presented. The same trend is strengthened when considering only white people, further confirming the *Identification Effect*. This behavior is well known, and an interesting example can be used to illustrate the

concept. There is a famous statistical problem known under the name of “Monty Hall” problem<sup>12</sup>. The problem was first posed as follows:

*“Suppose you're on a game show, and you're given the choice of three doors: Behind one door is a car; behind the others, goats. You pick a door, say No. 1, and the host, who knows what's behind the doors, opens another door, say No. 3, which has a goat. He then says to you, “Do you want to pick door No. 2?” Is it to your advantage to switch your choice?”*

The solution to the question is affirmative, namely, by changing door after it has been given the possibility, the probability of winning the car doubles. However, most people would stick with their initial choice. A possible explanation for this behavior, and therefore for the behavior of those highly educated in our sample is also one of the weak points of Prospect Theory: regret. Regret is both an emotion and a punishment self-inflicted. Zeelenberg and Pieters<sup>13</sup> defined regret as something we did that should have been done differently, followed by a series of thoughts concerning the mistake made and by the desire of changing what happened. According to Kahneman<sup>14</sup>, regret is stronger when coming from action, rather than from inaction. In a survey<sup>15</sup>, he proved this point as follows:

Paul owns stocks from company A. Last year he considered to sell them to buy stocks from company B, but he did not. Now he knows that if he did, he would have gained \$1,200.

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<sup>12</sup> [http://en.wikipedia.org/wiki/Monty\\_Hall\\_problem#refWhitaker1990](http://en.wikipedia.org/wiki/Monty_Hall_problem#refWhitaker1990)

<sup>13</sup> Zeelenber M., Pieters R., “A Theory of Regret Regulation 1.0”, *Journal of Consumer Psychology*, 17, pp. 3-18, 2007

<sup>14</sup> Kahneman D., “*Pensieri Lenti e Veloci*”, Oscar Mondadori, 2013

<sup>15</sup> Kahneman D., Tversky A., “*The Simulation Heuristic*”, in Kahneman D., Slovic P., Tversky A., “*Judgment under uncertainty: Heuristics and Biases*”, Cambridge University Press, New York, pp. 160-173, 1982

George owned stocks from company B. Last year he sold them to buy stocks from company A. Now he knows that if he did not, he would have gained \$1,200.

Participants were asked who would feel more regret, and the results are unequivocal: 92% of people said George. Similarly, highly educated people, which in turn felt also more confident in their choices, may be afraid to feel some sort of regret, knowing that the variable offer is more convenient. Since they were first asked to choose whether to accept the offer or not, once accepted they may be more reluctant to change than low educated people. Confidence level are in line with these arguments and are specular when comparing financial literacy and education: higher literacy levels are positively related to confidence. Low educated people, in contrast, may simply be diffident because they do not fully understand possible outcomes, and choose a secure one to avoid feeling regret to having ignored the initial diffidence. To confirm our interpretation we undertook further analysis to check the relationship between acceptance rate in the first stage and in the second one. Significant results emerged in the comparison between Neutral and Smiling group. In the first, 52% of people that accepted the variable offer stucked with it even when the fixed offer was proposed. In the latter, only 15.79% did not change their mind. Unfortunately population is too limited to investigate effects observed before. However, even just this result suggests strong implications supporting our assumptions. When primed with the Neutral face people -on average- feel more

*Table 3*

<b>ACCEPTED OFFER</b>						
	<b>CONTROL</b>		<b>NEUTRAL</b>		<b>SMILING</b>	
<b>FIXED</b>	21	67.74%	12	48.00%	16	84.21%
<b>VARIABLE</b>	10	32.26%	13	52.00%	3	15.79%
<b>TOTAL</b>	31		25		19	
<b>P-VALUE PRIMING</b>			<b>0.0254</b>			
<b>P-VALUE IMAGES</b>	<b>0.8075</b>					

confident, and this in turn led to a lower “deviation” rate. It is noticeable that if not subjected to the prime, deviation rate is lower when compared with a neutral face and higher if compared with the smiling one. Again, supremacy of the neutral face as priming tool emerged from this analysis as well. It seems that confidence level could be a good explanation for those behaviors illustrated above. Amongst white, we found significant effects when comparing control group with Neutral, Smiling or with both combined, but we did not find any when comparing Neutral and Smiling groups. Confidence level turned out to be higher in general, when the priming was present, with no exception.

In conclusion, the present work in part confirms the current body of literature on priming and knowledge (financial literacy, education and familiarity). However, it is obvious that further information is needed to fully understand phenomena studied. For example, the fact that neutral faces are more effective than smiling one was a very surprising result. Persuasion science often refers to the smile as a very powerful tool to use to actively motivate people. The basis of this concept are rooted in the fact that emotions and feelings are strongly associated with memories, and positive memories motivate more than negative ones. Olivia Fox Cabane, in “The Charisma Myth: How Anyone Can Master the Art and Science of Personal Magnetism”<sup>16</sup> alerts that nothing can destroy charisma faster than being perceived as inauthentic. A false smile, as the one described by Paul Ekman, can be perceived as inauthentic and therefore arouse diffidence. However we found the same trend even with a truer smile, ruling out this possible explanation. We can still hypothesize that authenticity is very hard to convey through an image, and that maybe a different face can lead to different results. We chose the face of a young man to foster the stereotype of a person working in a bank (suited up, shaved, successful) but maybe the young guy can be seen also as inexperienced or simply too young to be trusted, explaining the heterogeneity of trustworthiness’ results. Also, an image of a woman would probably have affected choices differently, given the strong *Gender effect*. In sum, the experiments undertaken shed light on the decisional process under some point of

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<sup>16</sup> Cabane O.F., “*The Charisma Myth: How Anyone Can Master the Art and Science of Personal Magnetism*”, Penguin, 2012

view but at the same time made us think that we barely scratched the surface. The whole concepts of priming, association mechanism, influence of knowledge and experience on the decision making process themselves are relatively new and far from being fully understood. What we can claim with a good level of certainty is that these concepts are real, and subliminal influence is something we come across on a daily basis and we should be aware of. Also, marketing techniques, which are often hard to be measured, can benefit from the *modus operandi* and results obtained in the present work. The fact that faces, in a context in which they do not add any material information, are still taken into account in the decisional process is indisputable, and should lead to the total desertion of descriptive models based on perfect rationality.



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# Appendix I: Visual Stimuli Experiment I

## Control Group

LOANS	Capital	Annual Interest rate	Years
Fixed	from \$1,000 to \$100,000	2.5% (fixed)	5
Variable	from \$1,000 to \$100,000	euribor + 2% spread	5

Years	Forecast A	Forecast B
1	0.30%	0.45%
2	0.25%	0.65%
3	0.20%	0.90%
4	0.30%	0.70%
5	0.50%	0.35%

## Smiling Fixed Group

Loans	Agent	Capital	Annual Interest rate	Years
Fixed		from \$1,000 to \$100,000	2.5%	5
Variable		from \$1,000 to \$100,000	Euribor + 2% Spread	5
Years	Forecast A		Forecast B	
1	0.30%		0.45%	
2	0.25%		0.65%	
3	0.20%		0.90%	
4	0.30%		0.70%	
5	0.50%		0.35%	

## Smiling Variable Group

Loans	Agent	Capital	Annual Interest rate	Years
Fixed		from \$1,000 to \$100,000	2.5%	5
Variable		from \$1,000 to \$100,000	Euribor + 2% Spread	5
Years	Forecast A		Forecast B	
1	0.30%		0.45%	
2	0.25%		0.65%	
3	0.20%		0.90%	
4	0.30%		0.70%	
5	0.50%		0.35%	

# Appendix II: Visual Stimuli Experiment 2

## Control Group

### QBANK LOANS

#### Variable Interest Loan (V.I.L)



#### Details

The V.I.L is a variable interest rate loan. It is composed of two components: the 12-months Euribor (the averaged interest rate of financial transaction among Euro-zone banks) and the spread. So, for example, if the 12-months Euribor is 0.3% and the spread we apply is 2%, the total interest rate to pay is 2.30%. We apply the averaged 12-months Euribor of the year to compute the rate to apply each year.

Exclusively for you, the spread is 2%.

With the V.I.L you can take advantage of Euribor fluctuations and save on interests paid. You can

ask for any amount from \$1,000 to \$100,000, make annual payments, and start paying after one year.

The length of the loan is 5 years, i.e., 5 payments.

#### Euribor Trend

The averaged 12-months Euribor today is 0.3%.

We present you the trends (A e B) our analyst forecasted for the Euribor for the next five years.

Years	Forecast A	Forecast B
1	0.30%	0.45%
2	0.25%	0.65%
3	0.20%	0.90%
4	0.30%	0.70%
5	0.50%	0.35%

# Smiling Group

## ΩBANK LOANS

### Variable Interest Loan (V.I.L)



#### Details

The V.I.L is a variable interest rate loan. It is composed of two components: the 12-months Euribor (the averaged interest rate of financial transaction among Euro-zone banks) and the spread. So, for example, if the 12-months Euribor is 0.3% and the spread we apply is 2%, the total interest rate to pay is 2.30%. We apply the averaged 12-months Euribor of the year to compute the rate to apply each year.

Exclusively for you, the spread is 2%.

With the V.I.L you can take advantage of Euribor fluctuations and save on interests paid. You can

ask for any amount from \$1,000 to \$100,000, make annually payments, and start paying after one year.

The length of the loan is 5 years, i.e., 5 payments.

#### Euribor Trend

The averaged 12-months Euribor today is 0.3%.

We present you the trends (A e B) our analyst forecasted for the Euribor for the next five years.

Years	Forecast A	Forecast B
1	0.30%	0.45%
2	0.25%	0.65%
3	0.20%	0.90%
4	0.30%	0.70%
5	0.50%	0.35%

# Neutral Group

## ΩBANK LOANS

### Variable Interest Loan (V.I.L)



#### Details

The V.I.L is a variable interest rate loan. It is composed of two components: the 12-months Euribor (the averaged interest rate of financial transaction among Euro-zone banks) and the spread. So, for example, if the 12-months Euribor is 0.3% and the spread we apply is 2%, the total interest rate to pay is 2.30%. We apply the averaged 12-months Euribor of the year to compute the rate to apply each year.

Exclusively for you, the spread is 2%.

With the V.I.L you can take advantage of Euribor fluctuations and save on interests paid. You can

ask for any amount from \$1,000 to \$100,000, make annually payments, and start paying after one year.

The length of the loan is 5 years, i.e., 5 payments.

#### Euribor Trend

The averaged 12-months Euribor today is 0.3%.

We present you the trends (A e B) our analyst forecasted for the Euribor for the next five years.

Years	Forecast A	Forecast B
1	0.30%	0.45%
2	0.25%	0.65%
3	0.20%	0.90%
4	0.30%	0.70%
5	0.50%	0.35%

## Appendix III: Loan Analysis

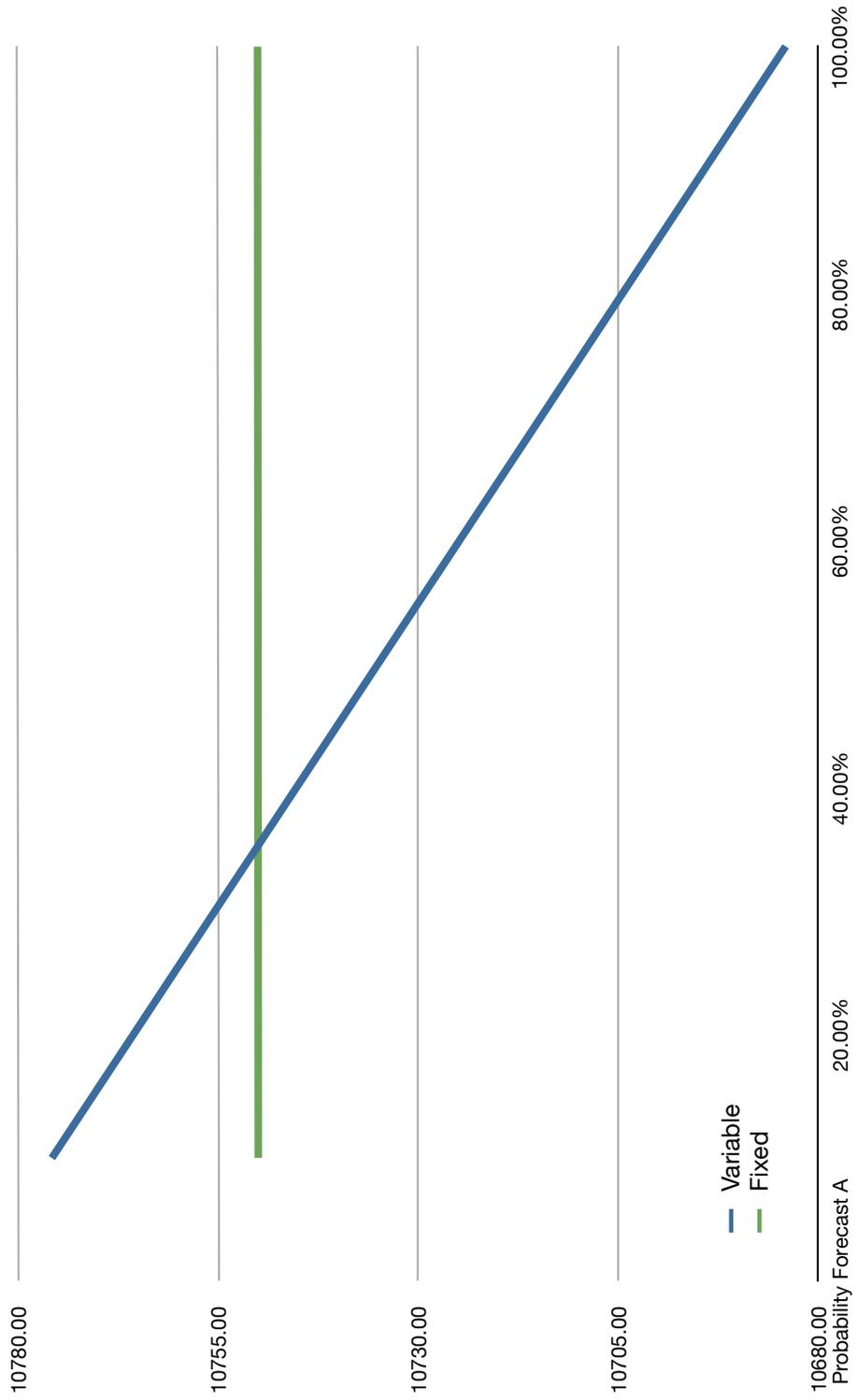
FIXED				
CAPITAL	i	j	R	Rtot
€ 10,000.00				
€ 8,000.00	2.50%	250	€ 2,000.00	€2,250
€ 6,000.00	2.50%	200	€ 2,000.00	€2,200
€ 4,000.00	2.50%	150	€ 2,000.00	€2,150
€ 2,000.00	2.50%	100	€ 2,000.00	€2,100
€ 0.00	2.50%	50	€ 2,000.00	€2,050
<b>Total</b>		<b>750</b>	<b>€10,000.00</b>	<b>€10,750</b>

VARIABLE - Forecast A				
CAPITAL	i	j	R	Rtot
€ 10,000.00				
€ 8,000.00	2.30%	230	€ 2,000.00	€2,230
€ 6,000.00	2.25%	180	€ 2,000.00	€2,180
€ 4,000.00	2.20%	132	€ 2,000.00	€2,132
€ 2,000.00	2.30%	92	€ 2,000.00	€2,092
€ 0.00	2.50%	50	€ 2,000.00	€2,050
<b>Total</b>		<b>684</b>	<b>€10,000.00</b>	<b>€10,684</b>

VARIABLE - Forecast B				
CAPITAL	i	j	R	Rtot
€ 10,000.00				
€ 8,000.00	2.45%	245	€ 2,000.00	€2,245
€ 6,000.00	2.65%	212	€ 2,000.00	€2,212
€ 4,000.00	2.90%	174	€ 2,000.00	€2,174
€ 2,000.00	2.70%	108	€ 2,000.00	€2,108
€ 0.00	2.35%	47	€ 2,000.00	€2,047
<b>Total</b>		<b>786</b>	<b>€10,000.00</b>	<b>€10,786</b>

Probability Forecast A	Probability Forecast B	W.A. VARIABLE OFFER	FIXED OFFER	VAR.-FIXED
10.00%	90.00%	€10,775.80	€ 10,750.00	€25.80
20.00%	80.00%	€10,765.60	€ 10,750.00	€15.60
30.00%	70.00%	€10,755.40	€ 10,750.00	€5.40
40.00%	60.00%	€10,745.20	€ 10,750.00	-€4.80
50.00%	50.00%	€10,735	€ 10,750.00	-€15
60.00%	40.00%	€10,724.80	€ 10,750.00	-€25.20
70.00%	30.00%	€10,714.60	€ 10,750.00	-€35.40
80.00%	20.00%	€10,704.40	€ 10,750.00	-€45.60
90.00%	10.00%	€10,694.20	€ 10,750.00	-€55.80
100.00%	0.00%	€10,684	€ 10,750.00	-€66

### BREAK-EVEN ANALYSIS



# Appendix IV: Experiment I

PLEASE DO NOT TAKE THIS SURVEY IF YOU ALREADY DID

## Informed Consent Form

### Introduction

This study attempts to collect information about financial choices.

### Procedures

Before you start you will need a piece of paper and a pocket calculator.

The experiment is divided into three parts.

First of all, we will ask you to evaluate two different loans (one with a fixed interest rate and a second one with a variable interest rate). To help you in the assessment we added the forecasts for the Euribor trend.

Then, you will be asked to answer questions concerning the assessment of the two loans. This will help us understanding your answer.

Finally, you will be asked to answer 16 questions which are not related to the loan evaluation. This questionnaire will be conducted with an on-line Qualtrics-created survey.

### Risks/Discomforts

We do not foresee any risks involved with taking this survey.

### Confidentiality

All data obtained from participants will be kept confidential and will only be reported in an aggregate format (by reporting only combined results and never reporting individual ones). All questionnaires will be concealed. The data collected will be stored in the HIPPA-compliant, Qualtrics-secure database until it has been deleted by the primary investigator.

### Compensation

\$0.40

### Participation

Participation in this research study is completely voluntary. You have the right to withdraw at anytime or refuse to participate entirely. If you desire to withdraw, please close your Internet browser and notify the principal investigator at this email: (xxx).

### **Questions about the Research**

If you have questions regarding this study, you may contact Andrea Gobbin at xxx.

### **Questions about your Rights as Research Participants**

If you have questions feel free asking the researcher.

- I have read, understood the above consent form and desire of my own free will to participate in this study.

- Yes
- No

Suppose you are a client of ΩBank and you just received the following mail.

Dear customer,

we are proud to present the new loans available at ΩBank. To promote the economy recovery, ΩBank has thought new loan formulas which are conceived to meet your needs. We propose two different loans: the difference between them is the interest rate, fixed and variable. Both follows a linear depreciation.

Fixed: it consists on a given rate which will be the same throughout the full length of the loan.

Variable: it is composed of two components: the 12-months Euribor (the averaged interest rate of financial transaction among Euro-zone banks) and the spread. So, for example, if the 12-months Euribor is 0.3% and the spread we apply is 2%, the total interest rate to pay is 2.30%. We apply the averaged 12-months Euribor of the year to compute the rate to apply each year).

The averaged 12-months Euribor today is 0.3%.

We present you the trends (A e B) our analysts forecast for the Euribor for the next five years to help you in the assessment.

LOANS	Capital	Annual Interest rate	Years
Fixed	from \$1,000 to \$100,000	2.5% (fixed)	5
Variable	from \$1,000 to \$100,000	euribor + 2% spread	5

Years	Forecast A	Forecast B
1	0.30%	0.45%
2	0.25%	0.65%
3	0.20%	0.90%
4	0.30%	0.70%
5	0.50%	0.35%

If you were interested in asking for a loan, which one would you choose?

- Fixed
- Variable

Please motivate your answer

**Breakdown**

Suppose you ask for a loan of \$100,000. How much would you pay (after 5 years) if you choose the Fixed loan?

- \$112,500
- \$107,500
- \$100,000
- Do Not Know

Which of the three scenarios is the less costly?

- Fixed
- Variable - Forecast A
- Variable - Forecast B
- Do not Know

Suppose that Forecast A has a 35% probability to happen, and that Forecast B has 65%. This means that A and B are the only possible scenarios. In this case, which offer would you prefer?

- Fixed
- Variable
- Indifferent
- Do Not Know

How many forecasts were available?

- There were no forecasts
- Two for the variable and none for the fixed
- Two for the fixed and none for the variable
- Do not know (Please Specify)

Please Specify

## Financial Literacy

Suppose you have \$100 in a savings account earning 2% interest a year. After 5 years, how much would you have?

- More than \$102
- Exactly \$102
- Less than \$102
- Do not know

Imagine that the interest rate on your savings account is 1% a year and inflation is 2% a year. After one year, how much would the money in the account?

- More than today
- The same
- Less than today
- Do not know

If the interest rates rise, what typically happens to bond prices?

- Rise
- Fall
- Stay the same
- No Relationship
- Do not know

A 15-year mortgage typically requires higher monthly payments than a 30-year mortgage, but the total interest over the life of the loan will be less.

- True
- False
- Do not know

Buying a single company's stock usually provides a safer return than a stock mutual fund.

- True
- False
- Do not know

## Risk Aversion

Suppose now you are taking part at a game structured as follows.

You can receive a guaranteed \$20 for your participation. As of now, you have earned that \$20 and have a right to receive it.

However, we would like to offer you the opportunity to "invest" that money now. Like all non-guaranteed investments, this means you might end up with more than \$20 or you might end up with less than \$20. (As explained below, you are free to elect not to participate in this investment opportunity.)

We will be asking you to indicate what percentage of your \$20 payment (if any) you would like to invest. There is a one-in-two (50:50) chance that this investment will more than double the amount you invest (i.e., it will pay a 110% return on your investment), and there is an equal probability that the risky opportunity will pay a -100% return on the amount you invest (i.e., you will lose the amount you invested).

For example:

If you invest 100% of your payment (\$20), there are equal chances that you will receive either \$42 or \$0.

If you invest 50% of your payment (\$10), then you will receive \$10 with certainty, plus there are equal chances that you will receive either \$21 or \$0. That is, your total payment will be either \$31 or \$10.

If you invest 0% of your payment, you will receive \$20 with certainty.

Let us say you are playing the game now, what percentage of your \$20 payment would you like to invest in this risky opportunity? Be aware that if you choose anything other than the last choice, you may not receive the full \$20 payment for participating (you may receive more or less).

- 100% (There are equal chances that you will receive either \$42 or \$0)
- 90% (There are equal chances that you will receive either \$39.80 or \$2)
- 80% (There are equal chances that you will receive either \$37.60 or \$4)
- 70% (There are equal chances that you will receive either \$35.40 or \$6)
- 60% (There are equal chances that you will receive either \$33.20 or \$8)
- 50% (There are equal chances that you will receive either \$31.00 or \$10)
- 40% (There are equal chances that you will receive either \$28.80 or \$12)
- 30% (There are equal chances that you will receive either \$26.60 or \$14)
- 20% (There are equal chances that you will receive either \$24.40 or \$16)
- 10% (There are equal chances that you will receive either \$22.20 or \$18)
- 0% I prefer not to participate in this investment opportunity (You will receive \$20 with certainty)

How do you see yourself: are you in general a person who takes risk or do you try to evade risks? Please self-grade your choice (10: I take a lot of risky choices, 0: I always avoid risk)

	0	1	2	3	4	5	6	7	8	9	10
Risk Propensity											

### Demographic Questions

What is your gender?

- Male
- Female
- Other

What is your age?

What is the highest level of school you have completed or the highest degree you have received?+

- Less than high school degree
- High school degree or equivalent
- Some college but no degree
- Associate degree
- Bachelor degree
- Graduate degree
- Professional/Vocational Degree (please specify)
- Other (please specify)

Which of the following categories best describes your employment status? Employed, working 40 or more hours per week

- Employed, working 1-39 hours per week
- Not employed, looking for work
- Not employed, NOT looking for work
- Retired
- Disabled, not able to work

How much total combined money did all members of your HOUSEHOLD earn in 2013? This includes money from jobs; net income from business, farm, or rent; pensions; dividends; interest; social security payments; and any other money income received by members of your HOUSEHOLD that are EIGHTEEN (18) years of age or older. Please report the total amount of money earned - do not subtract the amount you paid in taxes or any deductions listed on your tax return.

Please indicate the number of your family members.

Ethnicity Indicate your race

- Black or African-American
- White
- American Indian or Alaskan Native
- Hispanic/Latino American
- Asian
- Native Hawaiian or other Pacific Islander
- From multiple races

In your opinion, what is really this experiment testing?

# Appendix V: Experiment 2

PLEASE DO NOT TAKE THIS SURVEY IF YOU ALREADY DID

Please pay attention to your answers. **This survey is part of a student thesis, therefore your responses will have a huge impact on the final result.**

Throughout the survey we will check your attention level with control questions. If you do not give the correct answer the survey will not be collected and therefore your work rejected. The control question will just check your level of attention, all other responses do not have a "right" answer.

## Informed Consent Form

### Introduction

This study attempts to collect information about financial choices.

### Procedures

Before you start you will need a piece of paper and a pocket calculator.

The experiment is divided into three parts.

First of all, we will ask you to evaluate two different loans (one with a fixed interest rate and a second one with a variable interest rate). To help you in the assessment we added the forecasts for the Euribor trend.

Then, you will be asked to answer questions concerning the assessment of the two loans. This will help us understanding your answer.

Finally, you will be asked to answer 16 questions which are not related to the loan evaluation. This questionnaire will be conducted with an on-line Qualtrics-created survey.

### Risks/Discomforts

We do not foresee any risks involved with taking this survey.

### Confidentiality

All data obtained from participants will be kept confidential and will only be reported in an aggregate format (by reporting only combined results and never reporting individual ones). All questionnaires will be concealed. The data collected will be stored in the HIPPA-compliant, Qualtrics-secure database until it has been deleted by the primary investigator.

## **Compensation**

\$0.40

## **Participation**

Participation in this research study is completely voluntary. You have the right to withdraw at anytime or refuse to participate entirely. If you desire to withdraw, please close your Internet browser and notify the principal investigator at this email: (xxx).

## **Questions about the Research**

If you have questions regarding this study, you may contact Andrea Gobbin at xxx.

## **Questions about your Rights as Research Participants**

If you have questions feel free asking the researcher.

- I have read, understood the above consent form and desire of my own free will to participate in this study.

- Yes
- No

Suppose you are a client of  $\Omega$ Bank and you just received the following mail.

Dear customer,

we are proud to present the new loans available at  $\Omega$ Bank. To promote the economy recovery,  $\Omega$ Bank has thought new loan formulas which are conceived to meet your needs. We propose two different loans: the difference between them is the interest rate, fixed and variable. Both follows a linear depreciation.

Fixed: it consists on a given rate which will be the same throughout the full length of the loan.

Variable: it is composed of two components: the 12-months Euribor (the averaged interest rate of financial transaction among Euro-zone banks) and the spread. So, for example, if the 12-months Euribor is 0.3% and the spread we apply is 2%, the total interest rate to pay is 2.30%. We apply the averaged 12-months Euribor of the year to compute the rate to apply each year).

The averaged 12-months Euribor today is 0.3%.

We present you the trends (A e B) our analysts forecast for the Euribor for the next five years to help you in the assessment.

## QBANK LOANS

### Variable Interest Loan (V.I.L)



#### Details

The V.I.L is a variable interest rate loan. It is composed of two components: the 12-months Euribor (the averaged interest rate of financial transaction among Euro-zone banks) and the spread. So, for example, if the 12-months Euribor is 0.3% and the spread we apply is 2%, the total interest rate to pay is 2.30%. We apply the averaged 12-months Euribor of the year to compute the rate to apply each year.

Exclusively for you, the spread is 2%.

With the V.I.L you can take advantage of Euribor fluctuations and save on interests paid. You can

ask for any amount from \$1,000 to \$100,000, make annually payments, and start paying after one year.

The length of the loan is 5 years, i.e., 5 payments.

#### Euribor Trend

The averaged 12-months Euribor today is 0.3%.

We present you the trends (A e B) our analyst forecasted for the Euribor for the next five years.

Years	Forecast A	Forecast B
1	0.30%	0.45%
2	0.25%	0.65%
3	0.20%	0.90%
4	0.30%	0.70%
5	0.50%	0.35%

Would you be interested in this offer?

- Yes
- No

Please motivate your answer

How much are you confident with your decision?

Not Confident

Extremely Confident



How much trustworthy is the analyst who promoted the loan offer?

Not Trustworthy

Extremely Trustworthy



Under which of the two scenarios you will pay less?

- Variable - Forecast A
- Variable - Forecast B
- Do not Know

Suppose that you are given the opportunity to choose between the variable offer, and a Fixed interest rate loan. The interest rate is 2.5%. Which of the two offer would you choose?

- Fixed
- Variable

Please motivate your answer

Have you ever applied for a bank loan?

- Never
- I had
- I am planning to apply
- I am currently applying for a loan
- I am currently paying the loan back
- Prefer not to answer

How many forecasts were available?

- None
- Two
- Do not know (Please Specify)

### **Financial Literacy**

Suppose you have \$100 in a savings account earning 2% interest a year. After 5 years, how much would you have?

- More than \$102
- Exactly \$102
- Less than \$102
- Do not know

Imagine that the interest rate on your savings account is 1% a year and inflation is 2% a year. After one year, how much would the money in the account?

- More than today
- The same
- Less than today
- Do not know

If the interest rates rise, what typically happens to bond prices?

- Rise
- Fall
- Stay the same
- No Relationship
- Do not know

A 15-year mortgage typically requires higher monthly payments than a 30-year mortgage, but the total interest over the life of the loan will be less.

- True
- False
- Do not know

Buying a single company's stock usually provides a safer return than a stock mutual fund.

- True
- False
- Do not know

Suppose you owe 1 000 euro on your credit card and the interest rate you are charged is 20% per year compounded annually. If you didn't pay anything off, at this interest rate, how many years would it take for the amount you owe to double?

- 2 years
- less than 5 years
- 5 to 10 years
- more than 10 years
- Do not know
- Prefer not to answer

You owe 3 000 euro on your credit card. You pay a minimum payment of 30 euro each month. At an Annual Percentage Rate of 12% (or 1% per month), how many years would it take to eliminate your credit card debt if you made no additional new charges?

- Less than 5 years
- between 5 and 10 years
- Between 10 and 15 years
- Never, you will continue to be in debt
- Do not know
- Prefer not to answer

You purchase an appliance which costs 1 000 euro. To pay for this appliance, you are given the following two options:

- a) Pay 12 monthly installments of 100 euro each;
- b) Borrow at a 20% annual interest rate and pay back \$1,200 a year from now.

Which is the more advantageous offer?

- Option "a"
- Option "b"
- They are the same
- Do not know
- Prefer not to answer

Which statement is true?

- Stocks are normally riskier than bonds.
- Do not know
- Bonds are normally riskier than stocks.
- Prefer not to answer

Normally, which asset displays the highest fluctuations over time?

- Savings
- Bonds
- Stocks
- Do not know
- Prefer not to answer

### **Demographic Questions**

What is your gender?

- Male
- Female
- Other

What is your marital status?

- Single, never married
- Married
- Living with partner
- Divorced
- Other (please specify)

What is your age?

In which country were you born?

Please Indicate your race

- Black or African American
- White
- American Indian or Alaskan Native
- Hispanic/Latino American
- Asian
- Native Hawaiian or other Pacific Islander
- From multiple races

Which is your current country of residence?

What is your native language?

- English
- Other

What is the higher level of education you have completed?

- Less than high school degree
- High school degree or equivalent
- Some college (no degree)
- Associate Degree
- Bachelor Degree
- Graduate Degree
- MBA
- Professional/Vocational Degree
- Other (please specify)

Are you currently employed or have you ever be employed in a financial related job?

- Yes
- No

In your opinion, what is really this experiment testing?