

MANAGERIAL PSYCHOLOGY AND CORPORATE INVESTMENT RATIONALITY: EVIDENCE FROM TUNISIAN LISTED FIRMS

AMEL BACCAR¹, BEN MOHAMED EZZEDDINE² and ABDELFETTAH BOURI³

Abstract

In this paper, we present an original essay that aims to explore the effect of some psychological biases on corporate investment decision's rationality. Departing from a sample of traded Tunisian firms and the annual reports of those firms, we construct proxies for the optimism, overconfidence and others behavioral biases. We find that these biases affect corporate investment rationality and our results are robust with numerous control variables attached to the firms and the CEOs characteristics. The paper contributes to the behavioral corporate finance literature since we investigate the effect of a pool of psychological biases that are still unexplored such as the disposition effect, loss aversion and the prospect theory bias on corporate investment rationality index.

Key words: *Managerial Psychology, Investment Decision rationality, Corporate Governance, behavioral biases.*

JEL classification: *G02; G30; G31; G32.*

1. INTRODUCTION

Heaton (2002) initiates a debate concerning the potential effect of CEOs optimism on corporate investment policy. He argues that beyond the traditional assumption of "super-calculator" agent economics managers can present irrational behaviors since they are may befrapped by optimism bias. Optimistic CEOs are assumed to run investment cash flow sensitivity because under their optimism bias they will perceive that the stock market undervalue their shares and so the cost of external financing will be seen as having a high cost. Optimistic CEOs will make their corporate investment conditioning with the existence of large amount of internal cash flow. They then will

^{1, 2 and 3} Faculty of Economics and Management, FSEG Sfax, Tunisia.

act an irrational manner and they will overinvest with ample cash flow while under invest with short cash. Empirical studies corroborate Heaton's (2002) theoretical prediction; Malmendier and Tate (2005a, 2005b) report that CEOs overconfidence contributes to investment cash flow sensitivity and an irrational corporate investment behavior among American firms. Lin et al., (2005) highlight that optimistic CEOs run biased and so sub-optimal corporate investment strategy. Huang et al., (2011) show that previous results around the effect of managerial optimism on explaining distortions in corporate investment are robust in the Chinese context. Recently, Ben Mohamed et al., (2014a, 2014b) corroborate the previous results on managerial optimism and investment cash flow sensitivity.

Literature on behavioral corporate finance has focused on how CEOs personal psychology influences their corporate financing policy (Shefrin 1999, Hackbarth, 2008, and Gervais et al 2003 and Ben Fatma et al., 2012). Malmendier and Tate (2008) demonstrate that overconfidence bias affect merger and acquisition decision. Lin et al., (2008) conduct an empirical study among Taiwanese firms and they conclude that optimistic managers are likely to finance deficits with debt rather than equity, which can cause irrational behavior at the corporate investment level.

A key feature in the existing literature is the absence of studies that explicitly discuss the effect of CEOs psychological biases on his/her corporate investment decision rationality. We also show that behavioral corporate finance literature rises up with optimism and overconfidence bias which are supposed to have the same effect; other behavioral biases such as dispositional effect, loss aversion and the prospect theory are still unexplored.

This paper is an essay to overcome the above cited criticism on the existing literature by exploring the effect of a pool of psychological biases on corporate investment rationality in the Tunisian context.

The remaining of this paper is organized as follows: in section two, we survey the appropriate literature and we develop our hypothesis. Section three describes our methodology and data. Section four presents our models. Section five reports results and offers discussion. Finally, section six deals with concluding remarks.

2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

The standard finance literature assumes that markets are efficient and agents are fully rational. In this traditional framework, we can talk about a rational corporate decision. The emergence of the behavioral finance largely

affects the financial literature. A new approach rises up which is the behavioral corporate finance, that is still young (Fairchild, 2005). CEOs are assumed to make corporate decision under their personal psychology effects (Heaton, 2002). In this paper, we aim to investigate the effect of managerial psychological biases on affecting corporate investment rationality. A wave of research papers demonstrates that managers can be affected by these biases and so they can opt for a suboptimal investment policy as it is previously mentioned. Our aim is to explore the effect of managerial optimism and overconfidence biases among other biases on explaining irrationalities at the corporate investment policy. Although there is a lack of studies in this field, we endeavor in what follows to draw the potential effect between CEOs psychological biases and the rationality of firm investment strategy.

2.1. CEOs psychological biases and Investment decisions rationality

In this section we essay to develop in some depth basic concepts of our study. We will concentrate on defining psychological biases that may affect CEOs in a first step then we will try to develop the story of the potential effect of managerial psychological biases on corporate policies rationality. Our aim is to discuss some well documented biases in cognitive and experimental psychology such as overconfidence and optimism. A major contribution of this study is to discuss the potential effect of some other biases that are less or never investigated in the behavioral corporate finance literature. We begin with two well documented psychological biases: the overconfidence and the optimism. Then, we discuss the prospect theory as it developed by Kahneman and Tversky (1979). We discuss also its implications on decision making and we essay to predict its possible effect on firm decisions. We then offer a discussion concerning the possible effect of other behavioral biases namely loss aversion and dispositional effect.

2.1.1. The Optimism bias

In a general way, we can refer to prior literature by Weinstein (1980) who talk about individual with a rosy view about the world and the environment where they live. Optimistic CEO often refuses to believe that probability theory applies to his personal.

More recently, Heaton (2002) initiates a debate concerning "Managerial optimism and corporate finance". His paper makes in original contribution to the corporate finance literature and especially to the young approach; the behavioral corporate finance (Fairchild 2005).

Heaton (2002) introduces the effect of optimism bias on corporate finance. An old attempt was advanced by Roll (1986) in his hubris story. He demon-

strates that managerial optimism can have an influence on acquisition decision. The Heaton (2002) work is more explicit and it theoretically predicts the effect of optimism bias on investment and financing decisions. He synthesizes this effect especially on the investment cash-flow sensitivity that may be increased if CEOs are optimistic.

The effect of optimism bias is simply reduced to the next logic: if managers are optimistic enough, they will always perceive that the stock market undervalues their equity value and so they will make their investment strategy dependent on the availability and the level of internal cash flows. This is because they see the external financing as highly cost and so they will return to the internal liquidity as the main source of financing. Empirical validations come from Malmendier and Tate (2005a, 2005b) and Ben Mohamed et al., (2014a; 2014b) in the American context. Departing from a sample of 447 firms, Malmendier and Tate (2005a) test the investment cash-flow sensitivity and conclude that overconfidence bias can increase the investment cash flow sensitivity. In their work they associate between the overconfidence bias and the optimism one. They argue that they have the same effect on corporate finance.

Lin et al., (2005), Huang et al., (2011) and Campbell et al., (2011) corroborate Malmendier and Tate (2005a, 2005b) results. We can predict that optimism can negatively affect the rationality of corporate investment decisions. This is because if managers are affected by their optimistic bias they will not be able to invest in optimal way since they associate between the internal funds availability and its level and investment choice. Optimistic managers will probably overinvest with ample cash flows while they will under invest in the case of short cash flows. In this level of our development, we can conclude that optimistic CEOs aren't rational in the sense of Simon. They aren't a "super calculator" and they can take suboptimal corporate investment decisions. Optimistic CEOs can choose to invest in negative present value projects only because they are optimistic. Under their optimism bias they can also be more innovator than a rational manager normally does. Managerial optimism can also affect the acquisition decisions (Malmendier and Tate, 2008).

In sum, we can predict the existence of a negative relationship between investment decisions and managerial optimism. Our hypothesis can simply be formulated as follows:

H₁: managerial optimism negatively affects corporate investment decision rationality.

2.1.2. CEOs Overconfidence and its implications on corporate investment decisions

Managerial overconfidence can be considered as the most popular psychological biases in the behavioral finance literature. In the domain of gains, one of the important findings of psychology and behavioral economics is that people's future forecasts are often characterized by the dominance of an overconfidence bias. Role (1986) is one of the earliest examples of research linking overconfidence to corporate decision making. As it mentioned before, in the financial literature, especially the behavioral corporate finance literature, we find an association between the optimism bias and the overconfidence one. In this study we endeavor to distinguish between the optimism bias which will be defined as an overestimation of future incomes, while the overconfidence bias is an underestimation of risk. In a statistical term, the optimism is simply an overestimation of the mean while the overconfidence is an underestimation of the variance of the future return.

We argue that the effect of overconfidence on corporate policies is of interest since experimental studies show that individual are overconfident (Audia, Locke and Smith, 2000; Malmendier and Tate, 2001). Audia et al., (2000)' work and Malmendier and Tate (2001) arrive to common empirical conclusion: rational individuals make better decisions than those influenced by behavioral biases such as overconfidence.

There is a consensus concerning the effect of managerial overconfidence on investment decisions. Malmendier and Tate (2005a, 2005b) explain distortions in corporate investment policies by CEOs overconfidence bias. As is previously mentioned, the effect of managerial overconfidence bias is similar to that of the optimism bias. It causes firm investment to be sensitive to the existence and level of internal cash flows. This may be a major source of corporate investment decision irrationality and it may contribute to the investment inefficiency.

H₂: managerial overconfidence can reduce corporate investment decision rationality.

2.1.3. The prospect theory and corporate investment decision rationality

The prospect theory constitutes the beginning of the revolution in the recent finance literature. It has long been assumed that investors have a concave utility function that reflects their risk aversion. This form of the utility function is generalized for all economic agents. In standard corporate finance literature, manager are assumed to be full rational and they are also risk averse. Departing from experimental psychology, Khaneman and Tversky (1979) develop the Prospect Theory in a way that we can show how peo-

ple manage risk and uncertainty. This theory explains the apparent regularity in human behaviors when assessing risk under uncertainty. That is, human beings are not consistently risk-averse; rather they are risk-averse in gains but risk-takers in losses. According to Kahneman and Tversky (1979), people place much more weight on the outcomes that are perceived more certain than that are considered more probable, a feature known as the “certainty effect”.

Such conclusion should be accompanied by a full revision of the standard model of decision making. For example if CEO is affected by prospect theory, then he/she will be risk averse in the domain of gain and he/she will be risk seeking in the domain of losses. The utility function of a manager via the prospect theory has an S-shaped form. Managers may not always be risk averse. According to the prospect theory predictions, managers can be at the same time risk averse and risk seeking. This is because they reasoned in term of gains and losses which can negatively affect the rationality of their investment decision making.

To the best of our knowledge, there is no published previous research paper that focuses on this subject. The prospect theory is rarely studied compared with optimism or overconfidence bias. In order to explicate our argumentation we can take the case of a manager of a firm with n projects. Suppose that a project X generate in two or three successive year several losses. According to the prospect theory, managers may decide to continue to invest and they may engage more funds just because they want to reproach at least for the point of origin. We can propose that the prospect theory can reduce the rationality of corporate investment decision.

H₃: prospect theory can reduce corporate investment decision rationality.

2.1.4. The disposition effect

The disposition effect is the case when investors seem to have a preference for selling winning stocks too early and holding losing stocks too long (Shefrin and Statman, 1985). It is also defined by Odean (1998) as “the tendency of investors to hold losing new investment too long and sell winning new investment too soon”. This effect is widely studied by several authors. Among these studies we can mention Barber and Odean (2000, 2001, 2002) and Odean (1998, 1999) have shown empirically that investors tend to hold securities which generate losses and sell those making gains.

In firm level, managers can be influenced by their disposition effect bias when managing their projects. Regarding the lack of literature in behavioral corporate finance that focuses on the effect of the disposition effect on corpo-

rate decisions we can just advance a proposition about the potential role of this bias on investment decision rationality. For example, managers who are affected by the disposition effect bias can conserve an investment project which realizes successive losses during a long period. This act can negatively affect the corporate policy since it is an irrational decision that comes from just a psychological bias: the disposition effect.

H₄: The disposition effect can reduce corporate investment decision rationality.

2.1.5. The loss aversion bias

The development of the concept of loss aversion and its influence in many areas of finance and financial decision allowed better analysis and more obvious efficiency of decision-making.

Loss aversion means that the response to losses is more extreme than the response to gains. Loss aversion may also contribute to the observed discrepancies between the amount of money people are willing to pay for a good and the compensation they demand to give it up (Bishop and Herberlein 1979, Knetsch and Sinden 1984). Loss aversion is a concept similar to the risk aversion concept in various ways.

Gleitman and al., (2000) define loss aversion as a widespread reality. Evident in many aspects of decision making, in which investors seem particularly very sensitive to losses and seek by all means to avoid it.

According to Brabazon (2000), loss aversion is based on the idea that mental "penalty" associated with a given loss is greater than a "reward" mental due to a gain of the same value.

Rabin and Thaler (2001) define loss aversion as "the tendency to feel the pain of a loss more acutely than the pleasure of an equal sized gain".

Kahneman and Tversky (1979), studying the welfare of investors, show that the loss of money is greater than the pleasure associated with the gain of the same amount.

In contrast to other cited psychological biases, the loss aversion bias can positively affect the rationality in decision making. Managers with loss aversion bias may be more rational since they will be more loss avert.

H₅: Managerial loss aversion bias can increase corporate investment decision rationality.

2.2. Control variables

In this study we jointly analysis the effect of some control variables related to CEOs characteristics. We use respectively CEOs financial education, a

dummy variable equal 1 if the CEO has a financial education and 0 elsewhere, other control variables related to corporate governance mechanisms such as board of directors and ownership structure and managerial ownership are evoked here. We use the board independence measured as the number of the independent directors, the board size that is measured by the number of directors, managerial participation and the institutional investors are taken from the securities exchanges in Tunisia (BVMT). The use of corporate governance mechanisms is highly motivated since Ben Mohamed et al., (2012) show that internal corporate governance mechanisms can affect managerial optimism and so it can affect other similar biases.

2.2.1. CEOs education and corporate investment rationality

Studies by Holmstrom and Costa (1986); Scharfstein and Stein (1990) and Hirshlifer (1993) conclude that CEOs education can affect corporate investment. In fact, Lin et al., (2005) found that CEOs professional background can positively affect corporate research and development investment. More recently, Ben Mohamed et al., (2014b) report that managers' financial education can reduce the irrational behavior of running investment cash flow sensitivity. An original explanation is that such result can be the fact that financial education offers to managers a theoretical background which makes them more rational. Hence, we advance the next hypothesis:

H₆: Managerial financial education can increase corporate investment decision rationality.

2.2.2. CEOs ownership and corporate investment rationality

CEOs ownership in their firms can reduce corporate investment decision irrationality. In fact, Jensen (1986) found that an increasing share stakes managers' interests become aligned with those of the firms' shareholders. In corporate investment, Morck et al., (1988) and Pawlina et al., (2005) show that investment cash flow sensitivity decreases with CEOs ownership. A study by Ben Mohamed et al., (2014b) recommend policy makers to advance managerial participation on their ownership structure. They argue that such thing can reduce corporate investment irrationalities. Regarding these arguments, we advance the next hypothesis:

H₇: CEOs' ownership is positively associated with corporate investment decision rationality.

2.2.3. Corporate governance and corporate investment rationality

According to Jensen (1993) some characteristics of the board of directors can increase its efficiency. Especially, the board will act in efficient way if it has a small size and it is dependent. Malmendier and Tate (2005a) and Ben Mohamed et al., (2014a) show that the irrational effect of managerial optimism on investment cash-flow sensitivity can be reduced if the board is independent and it have a small size. Another important factor that can control CEOs corporate investment decision, is the presence of institutional investors in the ownership structure. He advance the next three hypothesis:

H₈: The board independence is positively associated with corporate investment decision rationality.

H₉: The board size is negatively associated with corporate investment decision rationality.

H₁₀: The presence of institutional investors is positively associated with corporate investment decision rationality.

3. DATA AND METHODOLOGY

3.1. Corporate decisions rationalities measures

In this study we are facing a real challenge since our aim is to study the effect of managerial psychological biases on corporate investment decision rationality. The difficulty derives from two sources: (i) the first one is related to the problem in quantifying CEOs psychological biases (ii) while the second one is related to the measurement of corporate investment decision rationality. We think that the second problem is more difficult because of the lack of empirical essay that tends to measure the rationality of corporate decisions.

The measurement and quantification of CEOs psychological biases are relatively an easy task compared to the corporate decisions rationality. This is because we can follow the existent literature that tries to provide us with some practical tools to detect the existence of these managerial biases and to construct proxies for them. This will be the aim of the next section.

Our interest is to discuss and define the sense of rational decision. According to Oliveira (2007), descriptive and normative decision making theories process distinct characteristics and follow specific methodologies for selecting a course of action. Rational theories of decision making are based on some fundamental axioms. This theory is normative and we can confirm the rationality of a decision if only decision makers follow these norms or axioms.

The rationality can be pronounced if a manager makes some logical steps when he/she make corporate decisions. In the normative theory of decision making, we find a full description on how a rational decision can be achieved. In a first step, decision makers should analyze a wave of possible alternatives which derive from different scenarios before selecting a choice. Oliveira (2007) affirms that these scenarios are weighted by probabilities and that decision makers can determine the expected scenario for each alternative. They should be rational enough in order to choose in the final step the best expected scenario that has the highest probability of outcome.

In economic and financial decision making, Rubinstein (1988) reduces the rational decision making to three step process. In the first step, economic agents are invited to analyze the feasibility of an alternative. In the second one, they should ponder the desirability of the alternative. Finally, at the end of the process, decision maker should choose the best alternative by combining both desirability and feasibility. The rationality can be defined as the compatibility between choice and value (Oliveira 2007). It is related to the optimization of the value of the outcomes. According to Hasite and Dawes (2000), when decision makers follow a rational methodology, it is possible to derive numbers that represent personal values. These terms are utilities as defined by Neumann and Morgenstern (1947).

One pillar of the economic and finance literature that should be evoked here is the "Expected Utility Theory". This theory can be interpreted in two ways: the analytically and the synthetically way. Oliveira (2007) affirms that according to the analytic view, choices represent revealing preferences, which are defined as implying utilities, whereas in the second way, decision makers evaluate both utilities and probabilities and the integration of these judgments leading to a decision. In sum, the normative theory of decision making assume that the decision makers are intelligent and rational enough to follow a full process and methodology described above here.

Our aim in this paper is to investigate the effect of CEOs psychological biases in their corporate decisions rationality. We will mainly focus on the rationality of corporate investment decision. In order to measure the investment decision rationality, we propose to construct four proxies on the basis of some implicit and/or explicit questions that we address to Tunisian traded firms' managers.

Discussing the rationality of corporate investment decision and regarding the base of previous theoretical development around the rational decision making theory and with reference to the behavioral corporate finance literature we can offer a description of rational corporate investment decision and then we can construct proxies for this decision rationality. Corporate finance

literature advances some criteria for investment decisions. For example, CEOs are invited to use some scientific criteria which link between the costs of an investment project and its return. The most popular criteria are the net actual value, the recuperation date and the internal return rate. A rational manager should always use these criteria in order to select the best investment project. The adjective best here means the project with the positive highest future return.

We will directly ask managers about the manner they select their investment projects. We attribute the adjective rational to the corporate investment decision in this level if CEOs are never affected by their emotion and psychological biases and they use these scientific criteria when selecting a project. However we can construct more realistic proxies for the rationality of corporate investment decision. We can talk about a degree of rationality of managerial decisions. We should be aware that rationality in the sense of a super calculator is just a theoretical adjective. Statman (2005) synthesizes that in behavioral finance by the concept of "Normal Investors". He argues that investors like all other individual (including CEOs) are not fully rational never are they fully irrational. They are simply normal so that they use the scientific criteria of the normative investment decision making theory but they are also affected by their emotions and psychological biases.

We will extremely interest in this study by constructing four proxies that take the form of an index which vary between [0, 1]. We will pose three questions that are related to the degree of the utilization of investment choice criteria that managers use them when selecting between investment projects to be taken. The second question is oriented to detect the probability through which managers are affected by their psychological biases and emotions when they make decisions related to the corporate investment decision. A full description of the measurement of corporate decisions rationality is offered at the next section which discusses in some depth the logic of scoring and the questions used to detect the investment decision rationality. It also includes a full description on the manner we construct proxies for managerial psychological biases.

3.2. The survey design, optimism and overconfidence measures

In order to investigate the relationship between managerial psychological biases and rationality in the investment decision in Tunisian traded firms, we will directly regress CEO behavioral biases to the investment rationality index. We use two data sources: a survey and annual reports of Tunisian traded firms at the Tunisian stock exchange (BVMT) in 2011.

Annual reports are an easy way to collect information concerning the

board structure of firms, CEOs ownership and the presence or not on institutional investors from our sample. The survey is oriented to detect if managers are affected by their psychology when making corporate investment decision. Our data sets consist of 40 Tunisian traded firms at the Tunisian stock exchange (BVMT).

We use a quasi random sampling procedure when choosing our sample. We develop a questionnaire on the basis of behavioral corporate finance literature. We use implicit and explicit questions in order to detect whether or not CEO is affected by psychological biases when making their decisions.

Our questionnaire is addressed to managers of traded Tunisian firms. We started to remind that the questionnaire has only an academic objective and all information will be treated in total anonymity. A preliminary version of the questionnaire was presented to few Tunisian managers to assess the proposed questionnaire's coherence and clarity.

Our survey is composed of three sections. Section one deals with CEOs personal characteristics, especially the academic education. We aim here to detect CEO's education nature; it means if he/she has a financial education. Managers are invited to choose between four items when answering the question that stipulates that "*We are invited to precise our education nature*". CEOs will choose between the financial education, technical education, general management and other to precise it.

Section two is oriented to capture the potential existence of managerial psychological biases such as optimism, overconfidence, prospect theory, loss aversion and disposition effect. This section is composed of nine questions. We use two questions to explain the optimism bias: In the first question, CEOs are asked to choose the alternative that best describes their earnings estimates. We give them four items A, B, C and D.

A: Your earnings estimates are always higher achievements.

B: Your earnings estimates are in most of the cases higher achievements.

C: Your earnings estimates are sometimes lower than achievements.

D: Your earnings estimates are always lower than achievements.

These items are inspired from Lin et al., (2005) work. In their paper, they propose a new measure of managerial optimism based on CEOs earning errors. They simply compare the difference between CEOs earning estimation and the realized result at the end of the year. If the sold between the estimated earning and the realized one is positive then the CEO will be classified as optimistic.

In our case, we define an optimistic CEO a manager that choose A or B among C and D. We use a proxy of managerial optimism that is a dichotomy variable which takes 1 if a CEO chooses alternative A or B and 0 elsewhere.

We use the next question: *In your corporate decisions:*

- A: You always underestimate the risks
- B: You underestimate in most of the cases the risks
- C: You sometime overestimate the risks
- D: You always overestimate the risks.

We define as overconfident CEOs those who choose alternative **A** or **B** while those who choose **C** or **D** are not. Our proxy for CEO overconfidence is 'Overconfidence'. It is a dummy variable that takes one if the manager choose alternative **A** or **B** (it means that he/she is optimistic) and 0 elsewhere.

To explain the loss aversion bias, we use two questions, the first: *what will be the maximum of loss you can support during one year?*

- A: I am not prepared to bear a loss whatsoever.
- B: I would be willing to assume a 5% of loss.
- C: I can tolerate a loss of 15%.
- D: I would be willing to assume only a 15% loss.
- E: I think my loss limit would be 20%.
- F: I could give a loss of more than 20%.
- G: I do not have a level of maximum loss.

The second: *Among the statements below which best describes your investment philosophy?*

- A: I cannot accept any capital fluctuation.
- B: I accept minimal fluctuations and I prefer to invest in safe investments with the lowest load.
- C: I am ready for the value of my investments will fluctuate in order to achieve greater profitability in the long run.
- D: My first occupation was to increase my long-term investments and to decrease in the short term.

To explain the disposition effect, we use this question: *if you have multiple "DAS" (project), one or more of them are no longer profitable. What will you do?*

- A: I will immediately stop the unprofitable DAS.
- B: I will keep its DAS on the short term.
- C: I will wait and keep the DAS.
- D: I will do more to disinvest.

We use two questions to explain the prospect theory bias: the first is *"If you have a choice between A and B, which do you choose?"*

- A = a gain of 25,000 TND
-

B = a 25% chance of winning 110,000 TND and a 75% chance of not winning.

The second: *“If you have a choice between A and B, which do you choose?”*

A = a gain of 25,000 TND

B = a 25% chance of winning 110,000 TND and a 75% chance of not winning.

In section three, we evoke the manager’s rationality at the investment decision, three questions are posed to better explain the investment decision of rationality managers in Tunisian traded Firms, we explore this three questions; the first: *“When your investment choices”*:

A: You are basing on scientific criteria and preliminary studies.

B: You are basing in most of the cases on scientific criteria and preliminary studies.

C: You’re used to partially follow your feelings and emotions.

D: You are used to follow completely your feelings and emotions.

The second is: *“When selecting one or more projects”*:

A: You are not at all influenced by your feelings and emotions.

B: You are not influenced in most of the cases by your feelings and emotions.

C: You are not sometimes influenced by your feelings and emotions.

D: You will undergo partial influence by your feelings and emotions.

E: You will be totally governed (guided) by your psychology.

Third question is: *“Now assume that you are faced with two investment projects which have the same characteristics perfectly. How to take your investment choices?”*

A: You agree to redo the study of each project.

B: You choose the project you sense the closest to your attitudes, skills and areas of your psychology.

Section four focuses on the mechanisms of the corporate governance. We use characteristics related to the board of directors such as size, independence and duality, also characteristics attached to ownership structure such as managerial participation, holding bloc share and institutional investors to explain the role of corporate governance to control psychological managers’ decisions.

Our data set consists of 40 Tunisian public firms that are traded at the Tunisian stock exchange (BVMT). In a first step, we choose to work on the totality of these firms. Regarding the topic of our thesis, we jointly include

the financial and non-financial firms. The choice of this sample is highly motivated by the existence of free information and details about corporate governance mechanisms and other financial variables.

3.3. Descriptive statistics and correlation matrix

Starting with the general criteria, we found that most of the CEOs have an age between 40 and 50, most of them have a high education level, most of them have a financial academic education and most of them have occupied tenure of 1 and 5 years. To explain the impact of each bias through the psychology of CEOs, we found that most of them who estimate their benefits, in most of the cases, outweigh the achievement; this shows us that CEOs in Tunisian firms are mostly optimist. By way of loss aversion, a number of very important CEOs are averse to losses. By way of prospect theory, most CEOs accept minimal fluctuations and they prefer to invest in safe investments with the lowest load. In investment decision, most CEOs are based, in most of the cases on scientific criteria and the study's preliminary, most of them prefer to choose the project they feel closer to their area of expertise and their psychology.

To have more details about our variables we can refer to table 1. This table describes in depth our four rationality index (RID1, RID2, RID3 and RID4). It reports also the basic information concerning CEOs psychological biases and the control variables.

Table 1: Summary of descriptive statistics

	RID1	RID2	RID3	RID4	Opt.	Over.	Disp.	Loss.	Prosp.	SEC.	Educ.	ManP.	Bind.	Bsize.	InIn.
Mean	0,80	0,63	0,28	0,57	0,67	0,46	0,87	0,74	0,77	0,38	0,38	9,05	0,20	0,22	0,29
Median	0,67	0,75	0,00	0,47	1,00	0,00	1,00	1,00	1,00	0,00	0,00	9,00	0,18	0,06	0,20
Maximum	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	14,00	0,40	0,82	0,85
Minimum	0,33	0,00	0,00	0,11	0,00	0,00	0,00	0,00	0,00	0,00	0,00	5,00	0,00	0,00	0,00
Std, Dev,	0,21	0,32	0,60	0,31	0,48	0,51	0,34	0,44	0,43	0,49	0,49	2,56	0,09	0,26	0,26
Skewness	-0,53	-0,26	1,97	1,05	-0,71	0,15	-2,22	-1,12	-1,28	0,47	0,47	-0,03	0,55	0,86	0,85
Kurtosis	2,43	1,86	5,58	3,34	1,50	1,02	5,95	2,24	2,63	1,23	1,23	1,78	3,78	2,39	2,56

Table 2 gives us the correlation matrix. We show the absence of significant correlation between our variables that we will use in this study.

Table 2: Correlations matrix

	RID1	RID2	RID3	RID4	Opt.	Over.	Disp.	Loss.	Prosp.	SEC.	Educ.	ManP.	Bind.	Bsize	InIn.
RID1	1,00	0,57	0,40	0,68	0,09	-0,32	-0,01	0,08	-0,05	-0,23	0,36	-0,38	0,33	-0,04	-0,24
RID2	0,57	1,00	0,46	0,77	-0,14	-0,30	-0,03	-0,23	-0,02	-0,07	0,52	-0,31	0,15	0,00	-0,25
RID3	0,40	0,46	1,00	0,90	0,15	-0,35	0,05	-0,02	-0,15	-0,02	0,07	-0,01	0,00	-0,30	-0,22
RID4	0,68	0,77	0,90	1,00	0,07	-0,40	0,02	-0,07	-0,11	-0,09	0,30	-0,20	0,13	-0,20	-0,28
Opt.	0,09	-0,14	0,15	0,07	1,00	0,33	0,05	-0,04	-0,13	0,22	0,00	-0,09	0,05	0,20	-0,36
Over.	-0,32	-0,30	-0,35	-0,40	0,33	1,00	0,20	-0,05	0,14	0,22	-0,10	-0,18	0,11	0,41	0,14
Disp.	-0,01	-0,03	0,05	0,02	0,05	0,20	1,00	-0,05	0,15	0,30	-0,17	0,04	0,11	0,15	0,09
Loss.	0,08	-0,23	-0,02	-0,07	-0,04	-0,05	-0,05	1,00	-0,04	0,10	-0,02	-0,06	0,13	-0,05	0,15
Prosp.	-0,05	-0,02	-0,15	-0,11	-0,13	0,14	0,15	-0,04	1,00	-0,07	0,18	0,11	0,00	0,05	0,21
SEC.	-0,23	-0,07	-0,02	-0,09	0,22	0,22	0,30	0,10	-0,07	1,00	0,13	0,05	0,13	0,07	-0,16
Educ.	0,36	0,52	0,07	0,30	0,00	-0,10	-0,17	-0,02	0,18	0,13	1,00	-0,18	0,00	0,14	-0,30
ManP.	-0,38	-0,31	-0,01	-0,20	-0,09	-0,18	0,04	-0,06	0,11	0,05	-0,18	1,00	-0,55	0,00	-0,09
Bind.	0,33	0,15	0,00	0,13	0,05	0,11	0,11	0,13	0,00	0,13	0,00	-0,55	1,00	-0,15	0,17
Bsize	-0,04	0,00	-0,30	-0,20	0,20	0,41	0,15	-0,05	0,05	0,07	0,14	0,00	-0,15	1,00	-0,41
InIn.	-0,24	-0,25	-0,22	-0,28	-0,36	0,14	0,09	0,15	0,21	-0,16	-0,30	-0,09	0,17	-0,41	1,00

4. THE CORPORATE INVESTMENT RATIONALITY MODELS

We use an OLS regression in order to detect the effect of CEOs psychological biases on corporate investment rationality. We will directly regress the rationality corporate investment index on CEOs psychological biases and then we will introduce our control variables. We add also a variable (SEC) to detect the effect of firms sector. This variable will take 1 if a firm has a financial nature and 0 elsewhere. For this, we will run in a first step these models:

$$R_{ID1} = \alpha_0 + \alpha_1 \text{Optimism} + \alpha_2 \text{overconf} + \alpha_3 \text{Disp} + \alpha_4 \text{Loss} + \alpha_5 \text{Prospect} + \alpha_6 \text{Sec} + \varepsilon_{it}$$

$$R_{ID2} = \alpha_0 + \alpha_1 \text{Optimism} + \alpha_2 \text{overconf} + \alpha_3 \text{Disp} + \alpha_4 \text{Loss} + \alpha_5 \text{Prospect} + \alpha_6 \text{Sec} + \varepsilon_{it}$$

$$R_{ID3} = \alpha_0 + \alpha_1 \text{Optimism} + \alpha_2 \text{overconf} + \alpha_3 \text{Disp} + \alpha_4 \text{Loss} + \alpha_5 \text{Prospect} + \alpha_6 \text{Sec} + \varepsilon_{it}$$

$$R_{ID4} = \alpha_0 + \alpha_1 \text{Optimism} + \alpha_2 \text{overconf} + \alpha_3 \text{Disp} + \alpha_4 \text{Loss} + \alpha_5 \text{Prospect} + \alpha_6 \text{Sec} + \varepsilon_{it}$$

In a second step, we will re-estimate these model but in the presence of control variables. Namely, we will test the effect of CEOs education nature

(Educ), CEO ownership (Mang P.), Board size (Bsize), Board independence (Bind) and the presence of institutional investors (InIn).

In this formulation the dependent variable is corporate investment rationality index measured into the four manners described above (R_{ID1} , R_{ID2} , R_{ID3} and R_{ID4}).

5. RESULTS

Table 1 reports regression results of models 1, 2, 3 and 4. A common result is that optimism bias can reduce the rationality of the corporate investment decision and our results are significant in the second and the fourth models. As previously explained, the optimism bias can create investment cash flow sensitivity as is initiated by Heaton (2002) and empirically validated by Malmendier and Tate (2005a), (2005 b), Linet al., (2005), Huang et al., (2011) and Ben Mohamed et al., (2014a; 2014b).

Optimism bias can also push managers to be irrational and they may opt for a rosy view of the world as described by Weinstein (1980). This can be largely explained by the negative correlation between corporate investment rationality and this psychological bias. Optimism so can push CEOs to act an irrational way and he/she can overinvest or under invest as predicted by Heaton (2002).

The overconfidence bias can also reduce corporate investment decision's rationality. This negative effect is significant in model 1 and four. As it predicted above here, overconfident managers will underestimate risk and so they make sub-optimal investment decisions.

The positive effect of the loss aversion bias on increasing the rationality index of corporate investment decisions is verified. In fact, we show a positive and significant coefficient between the loss aversion bias and the corporate investment rationality index among model 1, 2, 3 and 4. CEOs suffering from this bias are more reluctant to make risky decisions and they will do their best when making investment decisions in order to avoid possible losses. This is how this bias can reduce the irrationalities of corporate investment decision.

The dispositional effect seems having no significant effect on corporate investment decision rationality index (only in model 3 with the presence of control variables). The prospect theory have a negative influence on the quality of corporate investment decision since it reduces the rationality index of such decision. As mentioned before, CEOs under this bias will have an S-shaped utility function and so they can prone excessive risky projects.

Table 3: OLS regressions of Investment Rationality Decision (R_{ID})

Variables	R_{ID1}	R_{ID2}	R_{ID3}	R_{ID4}
Intercept	0.816	0.536	0.555	0.617
	(10.264)***	(4.531)***	(1.892)*	(4.687)***
Optimism	-0.019	-0.240	-0.118	-0.174
	(-0.332)	(-2.69)***	(-0.552)	(-1.91)**
Overconf	-0.172	-0.028	-0.253	-0.164
	(-2.599)***	(-0.267)	(-1.034)	(-1.811)*
Loss	0.131	0.385	0.105	0.181
	(2.210)**	(4.123)***	(0.483)	(1.963)*
Disp	-0.047	-0.088	-0.059	-0.04
	(-0.818)	(-0.998)	(-0.279)	(-0.409)
Prospect	-0.138	-0.043	-0.429	-0.231
	(-2.643)	(-0.535)	(-2.23)*	(-2.687)***
Sec	-0.038	-0.058	0.138	-0.051
	(-0.666)	(-0.559)	(0.642)	(-0.533)
R-Squared	0.54	0.52	0.24	0.39
Adjusted R-Squared	0.45	0.43	0.11	0.28

The financial education can also increase the investment rationality. CEOs with financial education can have enough training and they can be aware of the corporate investment criteria and so they can make rational and normative decisions and this results is significant in models 1, 2, 3 and 4. According to Malmendier and Tate (2005a), we can find that financial education of CEOs can reduce investment cash flow sensitivity which represents an irrational behavior.

An interesting result is that managerial property can increase the rationality of this decision. This is because such variable is used in the standard corporate finance literature as a proxy for managerial risk aversion. Then a risk averse CEO will try to act in an effective way in order to entrench on the market of CEOs in order to have additional tenure. This relationship is only significant in models 1 and 2.

The board independence can also reduce managerial irrationalities when they make investment decisions. As is initiated by Fama (1980) and Jensen (1993), the board independence can be a practical tool to control managerial discretion and opportunism. It may also reduce the impact of psychological biases on corporate decision making. This results is not significant in our case.

Table 4: OLS regressions of Investment Rationality Decision (R_{ID}) in the presence of control variables

	R_{ID1}	R_{ID2}	R_{ID3}	R_{ID4}
C	0.8062	0.8564	2.848	0.6467
	6.9039***	7.3357***	4.166***	2.785***
Optimism	-0.0592	-0.0479	-0.4908	-0.0634
	-1.1440	-0.9048	-1.721*	-0.6527
Overconf	-0.1953	-0.1585	-0.1804	-0.1206
	-3.5631***	-2.797***	-0.5918	-1.2394
Loss	0.0765	0.0855	-0.5523	0.1970
	1.5692	1.7050**	-2.0795	2.0373**
Disp	-0.0554	-0.0466	-0.5405	-0.0044
	-1.2095	-0.9803	-2.1285**	-0.0469
Prospect	-0.1150	-0.0705	-0.2721	-0.1441
	-2.5926***	-1.5194	-1.099	-1.5321
SEC	-0.0880	-0.0839	0.3361	-0.1005
	-1.6641*	-1.5344	1.1619	-0.9612
Educ	0.1852	0.1759	-0.5001	0.2012
	3.990***	3.6161***	-1.5968*	2.1544**
Mangp	-0.0150	-0.0228	-0.0053	0.0022
	-1.8599**	-2.7881***	-0.1223	0.1297
BIND	-0.0426	-0.0596	-0.3936	-0.0170
	-0.9147	-1.2071	-1.4480	-0.1674
BSIZE	0.0807	0.0301	1.0926	0.3971
	0.8814	0.3148	2.1383**	2.0936**
ININ	-0.0442	-0.0954	-0.4520	-0.3753
	-0.4227	-0.8976	-0.7716	-1.6955*
R-squared	0.7728	0.7567	0.4564	0.5892
Adjusted R-squared	0.6803	0.6576	0.2349	0.4155

In contrast, the board size has a negative impact on firm corporate rationality. A large board can fail to act in an effective manner Jensen, (1993), Yermack (1993). It may also fail to reduce managerial irrationalities when they make investment decisions. This relationship is only significant in models 3 and 4.

Finally, the presence of institutional investors can reduce corporate investment rationality. This is because institutional investors are by nature well diversified and so they can be extremely attracted by high return. These presences can negatively affect the quality of corporate investment decisions. CEOs can be the victim of the presence and the power of institutional investors. This relationship is only significant in model 4.

6. RESEARCH IMPLICATIONS AND RECOMMENDATIONS

This paper has both theoretical and empirical implications. It contributes to the financial literature since it advances managerial psychological biases as a major source of corporate investment irrationality. CEOs psychological biases can be considered as a solid determinant of firm failure or success.

Regarding our results, especially the effect of corporate governance mechanisms on corporate investment rationality, firms are invited to adopt efficient directors' board that should be independent and with small size. Finally, corporate governance mechanisms should evolve in order to govern CEOs personal psychology.

7. LIMITATIONS AND FUTURE RESEARCH

This paper aims to demonstrate that CEOs personal psychology has a great impact on corporate investment decision rationality. It contributes to the behavioural corporate finance literature by exploring the effect of managers' psychological biases on decision making process. However, there are several not worthy limitations. First, our sample is relatively small and it uses questionnaire to construct our data base. This can be justified by the lack of official data base around Tunisian firms. This study can so be reinforced by increasing the sample size. This has the advantage of generalizing our empirical findings.

One other limitation is that we use proxies to show if a manager suffer from psychological bias. These proxies are constructed around a survey. Managers cannot give us the right answer because they are aware that they are affected by some psychological biases and they want to hide this. For this, we use more than one proxy to control the existence of these biases. Finally, the construction of the corporate investment rationality proxy can be more realistic if we measure it by an index that includes a list of items.

8. CONCLUSION

This study presents some original essays on the effect of CEOs psychological biases, his/her financial education, firm age and corporate governance variables on affecting the rationality of investment decision. We propose some testable hypotheses on the potential effect of some psychological biases on explaining the source of irrationality in corporate policy.

We discuss the case of rationality on corporate investment decision and we construct proxies to investment rationality decision and we find that the majority of managerial psychological biases have a negative impact on decision rationality.

Firms are invited to take into consideration the potential effect of the bad effect of CEOs psychological biases since we empirically demonstrate that psychological biases are in general major sources of distortions in corporate policies. This is because they reduce the rationality of firms' decisions.

One possible solution to overcome such problems in corporate decision irrationalities is to develop an adequate corporate governance structure that can be able to align managers and shareholders interest and reduce the effect of CEOs irrationalities.

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