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Overconfidence and Optimism in Capital Budget Decisions: Corporate Finance from a Behavioral Point of View

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A B S T R A C T

This article, as a result of the literature review carried out, presents a comparative analysis between the process of evaluating investment decisions, from traditional financial theory, and a new complementary approach arising from corporate finance. based on behavior (Behavioral Corporate Finance), a growing field of research in which emotional and cognitive influences are incorporated in order to achieve a better understanding of business decision-making. In particular, the way in which behavioral biases, so called overconfidence and optimism, systematically influence the capital budgeting process is analyzed. Empirical evidence shows that these biases lead to overestimating expected net cash flows and underestimating their variances, which mainly results in sub-optimal financial decisions (i.e. overinvestment and excessive exposure to risk), although they sometimes also originate practices that contribute to value of the company (i.e. speed in the execution of projects and greater commitment). The paper proposes recommendations to correct the distortions that the psychological biases of overconfidence and optimism generate about the capital budgeting process.

INTRODUCTION

Capital budget decisions are among those that generate the greatest impacts on the long-term performance of organizations. Such decisions are based mainly on projections and on the forecast of possible future behaviors of the business and its environment, variables that are largely not under the control of the company nor precisely pre-decidable (Schönbohm & Zahn, 2012). Faced with this decision-making process under uncertainty, the traditional approach to corporate finance and, in particular, the analysis of capital budget decisions is based on assumptions according to which the agents can be qualified not only as "rational" (in the sense of being logical in their Selection processes), but even more so as "hyper-rational", since they are supposed to always make optimizing decisions, have clearly defined preferences, do not have learning curves, know the set of possible outcomes -which in turn are fixed- and unequivocally choose that alternative that generates the greatest benefit (Baker &

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Wurgler, 2013; Berman, Wicks, Kotha, & Jones, 1999; R. J. Fairchild, 2009)

This assumption of the hyper-rationality of the individual agents was extended to the whole of the financial markets through the so-called Hypothesis of the Efficient Markets, a term created by Harry Roberts in 1967 (Shiller, 1999) and disseminated by Eugene Fama as a characteristic on the behavior of the stock market, which over time was extended to other financial assets (Fox, 2010). Thus, in the traditional literature on corporate finance, managers assume that financial markets are efficient and, in turn, investors assume that managers always make optimal decisions, technically calculated, aimed at maximizing the value of the company (Burton, Shah, & Shah, 2013).

In the particular case of investment decisions in fixed assets, the use of methods such as the net present value (NPV) and the internal rate of return (IRR), which despite their mathematical consistency can be influenced by subjective elements that lead to overestimate the income of a project already sub-optimize its costs, generating imprecise conclusions that result in inadequate and highly risky capital budget decisions.

"*Behavioral Corporate Finance* (BCF)" is an innovative approach in which the aforementioned assumptions of hyper-rationality are replaced by principles based on the observation of the real behavior of entrepreneurs, which is subject to value judgments and pro-pious errors of human nature. In practice, psychology has shown that decision-making processes are highly influenced by elements such as heuristics, defined as ways of "seeking the solution of a problem through non-rigorous methods, such as by trial and error and empirical rules, etc.". (Royal Spanish Academy, 2013).

Thus, through experience accumulated by trial and error, people find principles that they consider personally as general rules, but, on occasion, such a process leads to errors that become systematic behaviors. Yazdipour & Howard (2010) complement this description stating that:

> When confronted with large amounts of data and information and a display of problems to be solved, people are unable to do the complex optimization calculations that are expected of them under standard financial theory. Instead, they rely on a limited number of cognitive or heuristic strategies that simplify the complex scenarios they face when making decisions. Heuristics are shortcuts in the processing of information that result mainly from one's own experience in a field of work. Of course, such simplifying shortcuts are productive and allow humans to function in daily life. By nature, heuristics are imperfect and will consequently result in deviations and errors.

The winner of the 2002 Nobel prize for economics, Kahneman and Riepe (1998) concludes that

"investors who are prone to these biases will take risks they do not recognize, obtain results they do not anticipate, will be prone to unjustified transactions, and may end up blaming others when the results are bad". As a contribution to this debate, the present article offers a description of the main aspects that the behavioral corporate finance has developed for understanding the influence of biases i.e. optimism and overconfidence in the decisions of capital budgeting in companies while presenting a review of the most relevant literature in this regard.

Traditional Approach to the Capital Budgeting Process

The literature identifies traditionally three major decisions in the financial area of organizations: the management and administration of working capital, the capital structure and the capital budget (Brigham & Ehrhardt, 2011). This last task is related to the evaluation, selection, and execution of long-term investments of the company. The capital budget process implies the need to quantify the investments and estimate the amounts and the moments in which the revenues will take place. A process that has a direct impact on major decisions such as starting or not a new project, expanding an existing area, acquiring capital assets, reallocating resources between the different areas of the company, or carry out mergers or acquisitions, among other The most widespread approach in financial theory and business practice is to define in detail the revenues and expenditures related to the project, select a useful life or time horizon, project the expected cash flows and, given a discount interest rate that reflects the cost of capital and risk, calculate indicators such as the net present value and the internal rate of return, so that it is possible to conclude whether the project will be viable or not from the financial point of view, to finally approve the investment if it is considered that it will contribute to the objective of maximizing value for shareholders (Axelsson & Wynstra, 2002; Fornero & Monticone, 2011).

Formally, the company estimates each of its net cash flows (NCF) and projected present value using a discount rate *r* (in a basic scenario assumes constant over time) to find the net present value (NPV) like this:

$$\boldsymbol{NPV = \frac{FCF_1}{(1+r_d)^1} + \frac{FCF_2}{(1+r_d)^2} + \frac{FCF_3}{(1+r_d)^3} + \cdots + \frac{FCF_8}{(1+r_d)^8}}$$

OR

$$NPV = \sum_{i=1}^{n} \left(\frac{FCF_i}{(1 + r_d)^i} \right)$$

Since the NPV is a relative measure of the amount of money equivalent at time t = 0, which is expected the project will generate above the discount rate *r*, the company will decide to invest when NPV > 0, or not to invest if NPV < 0. To-mar the decision to execute a project with positive NPV will increase the wealth of the company and create value (Stowe & Gagne, 2012).

On the other hand, the internal rate of return (IRR) is that rate of discount that makes the NPV equal to zero, being an approximation of the profitability of the resources invested in the project (under the assumption of that all the cash flows that are released are reinvested in it, under the same conditions initially projected). With C_0 the value of the initial investment, the IRR is then the discount rate that balances the cash flows, in the following way:

$$IRR = \sum_{t-1}^{t} \frac{C_t}{(1 + r)^t} - C_0$$

Similar to NPV, the evaluation criterion is that it will be convenient for the company to invest if the amount is greater than the minimum desired income level of the project, which implies a positive NPV at the same time. This basic approach can be complemented, for example, by the projection of several scenarios and the definition of probabilities for each one, or by methods that involve the inclusion of random elements, under approaches such as real options or the Monte Carlo simulation.

The rule of net present value - formally proposed for the first time in corporate finance by Dean and Dixon (1951) - remains the main criterion for making capital budget decisions. This is a fact that authors like Graham and Harvey (2001) and Harris, Emmanuel and Komakech (2009) have documented extensively that the net present value method:

It is a static model, which fails to reflect the dynamic nature of the business and the human tendency to form judgments about the desirability of a project. The problem of projecting future cash flows and non-monetary results implies that making strategic investment decisions is not an exact science, but an estimation exercise, open to error and inaccuracy in calculations. In attempting to eliminate uncertainty,

managers naturally draw on their own past experience in similar events and their professional expertise. Larrick, Burson and Soll (2007) asserted that incase of confronting a difficult or complicated task the individual exhibit overconfidence which is directly dependent on the perception of individual to the extent he thinks himself superior than other. In this sense the overconfidence can be interpreted as an overestimation of own skill and knowledge. Infect this is how Gervais and Odean (2001), Gervais and Goldstein (2007) and (S. Gervais & Goldstein, 2007) model overconfidence.

This association between perceived skill and overconfidence is consistent with the results of March and Shapira (1987) who argued that manager of were found to believe that outcomes of the project are under their control and the project were believed to be less risky than the actual degree of risk inherent in these projects. Manager overestimated their own skill knowledge and ability to achieve the objective of project easily and efficiently, denoting the same illusion of control (Larwood & Whittaker, 1977). It is worth noting the manager are usually not optimistic the forecasting their revenue nor the consistently overestimates the expected cash flow of firms however the same manager shows overconfidence by forecasting more volatile and extremely high cash flows (Cassar & Gibson, 2007). In the same line Graham and Harvey (2008) CFOs survey reveals let them measure both the optimism and overconfidence. Their findings show that overconfidence is the main factor and optimism the least factor causing overinvestment.

In addition, the overconfidence and optimism not only cause overinvestment with overestimating cash flows but factor which that contribute to overinvestment is the biased tendency of managers to underestimation of project's cost and project completion time (Kidd, 1970; Hall, 1982; Lovallo and Kahneman, 2003). Similarly, Gilovich, Griffin and Kahneman (2002) asserted that manager show systematically opposite bias while estimating project completion time. This bias conception decreases the firm profitability in two ways, project cost is higher than plug into the NPV as most of these cost are directly link with time horizon i.e. labor cost, the delay in completion means the cash flows are also delayed and their present or discounted values are less than initially anticipated in managerial planning.

Another factor which influence greatly the profitability and cost of various project is the escalation of commitment to managers are often prone to, like the common tendency of individuals in their personal matters (Staw, 1976); Teger & Cary, 1980; Arkes and Blumer, 1985) managers usually throw good

money after bad Conlon and Garland, 1993); Ross and Staw 1993) and keep on making suboptimal decision regarding the real options (Denison, 2009).

This escalation to commitment in which managers failed to ignore the sunk cost was showed in Ross and Staw work who presented Shoreham Nuclear power plant project of Long Island Lighting Company which was having initial projected cost of $75 billion and was abandoned after having been sunk $5 billion. The Ross and Straw attributed this to the overconfidence and self-serving bias in which individuals attributes the failure to outside factor for justification of false forecasting of future cash flows.

An additional aspect is the fact that, although the same principles of the capital budget are studied around the world, the socio-cultural aspects influence the behavior of the people who make the investment decisions, so that the assumptions and the projections made vary significantly from one culture to another (Statman, Fisher, & Anginer, 2008).

|According to Hirshleifer, 2001) heuristics are "important part of psychology based dynamic asset pricing theory in its infancy". Shiller (1999) asserted that the heuristics are the vital conception for the entire financial markets. The same notion has very strongly supported by the recent study on capital markets. According to Douglas et al. (2015) heuristics are the main causes of credit spread that is being charged to firms by banks. According to Baker et al. (2012) the heuristics matters in fixing the price of firm in case of merger and acquisition further it also influences the analyst earning forecast in investment decisions. Moreover, Siddiqi (2018) argued that these heuristics and biases provides a satisfactory unified justification for many major puzzles in capital and option markets. With all the above arguments on the impact of behavioral biases in investment decision, it is very necessary to adjust the canonical Net Present Value for these heuristics (overconfidence and optimism) which is the main contribution of current study.

The current study is significant for various stakeholders. First the users of NPV must be surprised coming to know that this edited model of NPV demonstrate the internal flaws which has still not been recognized in literature. The second group who do not rely on NPV might welcome the new model encompassing the behavioral biases of managers. The third cluster, the psychologist might note that their work lead to

highlighting the logical and behavioral flaws that necessitate the invalidation of existing decision models on the basis of normative view point. The philosophers of economic and social sciences, as the context of justification has two types the normative and descriptive justifications and psychology contribute to both types, we will add the mathematicians also to the level, this study presents that optimization not untouchable realm when incorporated into economics and social sciences where the psychology and sociology has a vital role.

All the stakeholders might be attracted with notion that psychology plays a vital role in invalidating or validating decision model not only as normative but also as descriptive accounts. In addition, the scope of psychology may get broader in research with inclusion of normative cancellation of decision models. As the psychology deeply study the human behavior, judgment and cognitive process it will uncover the difference between human behavior as describes by the traditional economist and the real human behavior in various situations (Rabin, 1998).

As the psychology examine the common logic and behavior which is implied the model, it can help in assessing the reliability of decision model to making optimal decisions and is an innovative and sound epistemological stance of psychology.

The literature related to NPV indicates that managers and decision makers considers the NPV as rely of thumb. The managers use a discount rate for calculating present value and this discount rate is subjective and opposed to rational cost of capital based on market model like CAPM. Hence managers rely on a discount rate which is generated on bases of unbounded rationality and give it the flavor of bounded rationality. The current study aims at demonstrating that mixed rules might be useful, the bounded and unbounded opposition eliminates and the combined rule reveals a beneficial assistance between the unbounded / bounded rationality.

THEORETICAL CONTRIBUTION

We think it is simply unwise, and inefficient, to do economics without paying some attention to good psychology (Camerer, Loewenstein, & Rabin, 2004)). The success psychology currently encounters in various fields and the respect it has gained in economics are accredited, among other things, by the 2002 Nobel Prize to Professor Kahneman. The influence of psychology is epitomized by the heuristics-and-

biases program Kahneman, Slovic, Slovic, and Tversky (1982), Kahneman and Tversky (1996), Gilovich et al., (2002)), which studies deviations of actual behavior from rational behavior of normative paradigms. It is widely accepted that such discrepancies (often called "biases" or "cognitive illusions") show that human minds' reasoning is not always rational because the resulting choice behavior is nonoptimal (but see (Cosmides & Tooby, 1994; Gigerenzer, 2000; Gigerenzer & Selten, 2001; Gigerenzer & Todd, 1999; Murray, Krüger, Gigerenzer, & Morgan, 1987) for an alternative account of such phenomena and the resulting notion of ecological rationality). For example, it is commonplace that expected utility (Von Neumann & Morgenstern, 1947)) and subjective expected utility (Savage, 1954) are not valid as a description of how people make decisions. Possible explanations are then looked for and new models are proposed and studied in order to provide a rationale for the vast empirical data collected in recent decades (Bell, 1982; Fox & See, 2003; Hey, 1991; Kahneman, 1979; Loomes & Sugden, 1982; Machina, 1982; Tversky & Kahneman, 1992; Wu & Gonzalez, 1999; Wu, Zhang, & Gonzalez, 2004). As another example, it is highly recognized in the literature the systematic departure from normatively correct Bayesian reasoning (e.g. (Bar-Hillel, 1983; Kahneman & Tversky, 1996; Osherson, Smith, Wilkie, Lopez, & Shafir, 1990; Tversky & Kahneman, 1973). An entire line of research is devoted to trying to explain the nonbayesian reasoning of individuals, and numerous contributions have appeared for recommending and providing *debiasing* methods (Arkes, Christensen, Lai, & Blumer, 1987; Gigerenzer, 2000; Gigerenzer & Hoffrage, 1995; Gigerenzer & Selten, 2002; Hertwig & Gigerenzer, 1999; Plous, 1993; J. E. Russo, Schoemaker, & Russo, 1989) for the frequentist approach; see (Macchi, 1995; Mosconi & Macchi, 2001; Politzer, 1986) for the pragmatic approach.

Corporate Finances based on Behavior

The behavioral corporate finance, a field which studies the way in which psychological elements systematically influence financial decision-making, emerged as a reaction to the differences between the observed behavior of agents in the markets and the behaviors that the traditional theory (mainly expressed in the neoclassical paradigm) formulates in normative terms.

Recently, this approach has been extended to specific fields of finance such as investment decisions, capital structure and dividend policy (Fairchild, 2009). This fact allowed the configuration of a new area

called *Behavioral Corporate Finance*. This area complements the traditional theory by providing a more realistic and humane understanding of the way in which the processes of allocating financial resources in the company are carried out in practice.

The work of Herbert Simon (Nobel Prize for economics in 1978) in 1955 and Julius Margolis in 1958 were the pioneers in explicitly recognizing the need for the theory of the company to be nourished by the developments of the psychology (Gervais, 2013). However, only until recent years has this alternative approach been formally developed, in which it is assumed that managers are "rational" in decision-making but do not have the capacity or the information-or sometimes the will, according to Mattsson and Weibull (2002) it is very necessary to know the real distribution of the variables that evaluate the project. This is called "structural uncertainty" or "bounded rationality". Thanks to him, it is recognized that although business decision making is carried out by professional managers, they do not cease to be human, with limitations in the handling of information. Managers are influenced by subjective elements, preferences, beliefs, intuition, external pressures, states of mind, customs, variables that can lead to the final decision to be the one's recommended by the models, generating a crack between financial theory and practice (Graham & Harvey, 2001).

According to Bechara, Damasio and Damasio (2000) many scientists have come to believe that good decision are made only by highly rational and "cold-headed" people, who, in order to reach optimal solutions, do not allow their emotions to interfere with their reasoning. However, more and more research results indicate that in order to truly understand the economic decision-making process, it is necessary to include emotional and cognitive elements. They also conclude that the absence of emotions may in practice be a great source of sub-optimal behaviors that do not correspond to the postulates of rationality in the neoclassical sense (Bechara, Damasio, Damasio, & Anderson, 1994; Kida, Moreno, & Smith, 2001; LeDoux & Phelps, 1993).

According to Shefrin (1999) one of the most important authors of the behavioral school, groups the different psychological phenomena that affect financial decisions in three categories, namely: *a) biases*: predispositions to commit errors, *b)* heuristics: mental shortcuts to facilitate decision making and c) framing effects: changes in decision by the way in which the information is presented.

Recent research Biondi and Marzo (2011) and Hribar and Yang (2012) has shown that some of the main biases affecting the capital budget process in companies are called "optimism", consisting of the overstatement of net cash flows expected, and the "overconfidence", a tendency by which a lower variance of such net cash flows is estimated.

Thus, while traditional literature has focused on techniques for valuing cash flows, little attention has been paid to developing models that reflect the methods that managers use in practice to make long-term investment decisions and to estimate the effects that emotional and cognitive influences generate in making business financial decisions.

Focus of Competition in the Capital Budgeting

The research work in the BCF area has found evidence of the systematic influence of subjective aspects in corporate decision making. Recent developments such as Ben-David, Graham and Harvey (2010), as well as those of Sautner and Weber (2009) have empirical evidence of the way in which decisions about the acquisition of fixed assets and, in general, on the evaluation of the feasibility of a long-term investment project is usually influenced at the high level by the optimism and overconfidence biases. In the same sense Heaton (2002) affirms that overconfidence leads managers to overestimate the NPV of new projects, causing them to invest in projects that will most likely have negative NPV. This generates losses and destroys value for shareholders.

On the other hand, while more and more sophisticated methods for making financial decisions in the company are being developed in theory, in practice such decisions are often made through simple, more understandable procedures. with which the director in charge has a greater degree of familiarity. A situation in which biases, heuristics and framing effects play an important role. Studies such as those carried out by Burns and Walker (1997) and Biondi and Marzo (2011) show that the ease of information collection and calculation plays a key role when selecting the method to make the capital budget.

Among a wide range of heuristics documented in the literature, this document will focus on analyzing

the influence of "overconfidence" and "optimism" in the capital budgeting process.

Overconfidence

Overconfidence is a tendency by which people often believe that their abilities for certain activities are greater than those of the common individual. If we ask a group of people how many of them think they drive a car better than the average driver or, in a more dramatic case, how many of them think they have a higher than average life expectancy. In this respect, the works of Weinstein (1980) and Svenson (1981) can be consulted. Various studies have shown that in a wide range of business activities, individuals tend to overestimate the accuracy of the information they have, their knowledge and their skills. This is a behavior found especially in managers who have a long experience (Camerer & Lovallo, 1999; Gervais, Heaton, & Odean, 2011; Russo & Edward, 1992)This trend leads the company to invest more resources than it should and be more exposed to risks, which can result in extremely good or extremely bad performance (Baker & Wurgler, 2013).

The results of the empirical studies have shown evidence in favor of the presence of overconfidence in a large number of executive decisions. It has been verified, for example, that employees with excess confidence in their abilities are more likely to win internal calls to occupy senior management positions as Chief Executive Officer (Arévalo, 2014)). Additionally, successful executives often attribute much of their achievements to their own abilities, while attributing their failures to bad luck, which reaffirms their overconfidence (Daniel, Hirshleifer, & Subrahmanyam, 1998; Gervais & Odean, 2001).

Authors such as Graham and Harvey (2001)) find that companies with overconfident managers tend to use lower discount rates for the evaluation of their projects. They tend to finance them with higher levels of debt, which is mostly long-term (Malmendier & Tate, 2005). An interesting aspect to highlight is that entrepreneurs show excesses of confidence above the average. Koellinger, Minniti, and Schade (2007) found that the subjective and often sessed perceptions of entrepreneurs have a profound impact on their decision to start a business, Additionally, there was a direct correlation between the socio-cultural characteristics of the environment and levels of confidence in future performance, but there was an inverse correlation between such excess of confidence and the chances of survival of the new companies. A possible sign of the durability of this heuristic is that the entrepreneurs, apparently, do not significantly reduce their optimism as a result of previous failures. They relapse into the realization of overestimated

projections of their cash flows and the viability of their investments (Ucbasaran, Westhead, Wright, & Flores, 2010). Landier, Sraer and Thesmar (2009) found that, in the case of France, entrepreneurs underestimated the possibilities of failure, since only 6% of respondents felt that their business could go through difficulties. However, statistics showed that on average only half of the new companies survived after the initial three years of operation (Scarpetta, Hemmings, Tressel, & Woo, 2002).

In terms of the decision on the capital budget, overconfidence occurs mainly in the formulation and evaluation stages of a project, so that managers over invest resources, particularly in cases in which the project is financed from the cash flows of the company itself. In addition, there is a tendency for managers to project a smaller variance of net cash flows - which in practice are random processes - by defining too narrow confidence intervals or even making point forecasts. This leads to an increase in the probability of failing the projections (Hribar & Yang, 2010).

One positive aspect of overconfidence is that, as argued by Gervais (2010) and Brealey, Myers and Allen (2011), this behavior tends to contribute to the achievement of the ambitious goals proposed in the project. This is due to a greater level of commitment of the directors, which constitutes a self-fulfilling pro-faith. However, a serious problem, which results from carrying out projections by access optimistic person, is that of falling into the temptation to carry out fraud in order to manipulate, reach or overcome goals. In this sense, Schrand and Zechman (2012) found a strong relationship between levels of overconfidence on the part of executives and corporate fraud.

Optimism

Another of the heuristics that have an influence on the process of capital budgeting is optimism, which can be defined as a psychological tendency by which agents overestimate the possibility of positive future scenarios (Baker & Wurgler, 2013). In relation to the capital budget, optimism leads to overestimating the expected revenues and underestimating the expected expenditures, generating a bias in the projections of the different financial indicators for evaluating the projects.

Several studies like Pohlman, Santiago and Markel (1988) have tried to empirically verify the effect of optimism in the projections of companies. These authors, in particular, conducted a survey of 500 companies and discovered significant differences between the projected cash flows and those actually achieved, differences that were largely explained by the influence of subjacent aspects of the experience

or personality of company's managers.

In the same sense, it is not difficult to see how in practice the business decisions, including those related to the capital budget, rather than blindly applying the recommendations of the theoretical models, are based on the orientation that the management team wants to give to the organization, reflecting aspects such as the personality of its members. Evidence of this was given by Bertrand and Mullainathan (2003) demonstrated the "CEO effect" in decisions on capital structure. They showed how the companies executive decisions reflected the personal style of their managers more than the general criteria defined by the organization. For example, companies that have managers with conservative styles present higher levels of cash in their balance sheets and when defining their sources of growth prefer to make use of internal resources while companies with managers of more aggressive styles – usually young executives Adler (2004)) - they conserve less cash, are on average more leveraged and tend to issue new financial securities for their growth, exposing the company to greater risks, but obtaining on average better returns on capital. More recently, Cronqvist, Makhija ad Yonker (2012) found a robust relationship between the corporate decisions of a company's indebtedness and the personal indebtedness decisions of its CEO.

As in the case of overconfidence, the optimism bias can sometimes generate benefits for the company, not only the optimistic manager tends to be a "happier, more popular, giving more help to others and more willing to persist in their tasks " (Gervais, Heaton, & Odean, 2002, P.26) which fosters a better organizational climate, but it increase the value of company, since, unlike excessively prudent managers, optimistic executives are less likely to postpone investment decisions and, on the contrary, start projects quickly, while devoting more effort to them to obtain the projected results (Felleg, Moers, & Renders, 2012).

Another evidence of the effects of optimism is found in cases in which company managers refuse to abandon an ongoing project, even when the adjusted (NPV) calculations recommend it: the optimism that net cash flows will be better than projected. Another evidence of the effects of optimization is found in the cases in which company managers refuse to abandon an ongoing project, even when the adjusted NPV calculations recommend it: the optimism that the flows of Net cash will be better than projected (and the fear of losing already made investments) leads to adhere to investments that the indicators show as not profitable or losing one (G. Fairchild, 2004; Statman & Caldwell, 1987).

It has also been found that people tend to be more optimistic about the results they think they have under

control, as well as those coming from tasks with which they are highly engaged. Heaton (2002) provides empirical evidence in this regard, according to which managers not only "seem to be generally committed to the success of the organization," but "they believe they possess high levels of control over the performance of the company ". Finally, Shefrin and Cervellati (2011) show how an excessive optimism can not only harm the interests of the company, but also cause terrible damages to third parties Such as the case of the natural disaster caused by the oil spill in the Mexico in April 2010, in which the executives of British Petroleum (BP), in charge of the project, seem to have underestimated the possibility of occurrence of adverse events. Therefore, they cut off the maintenance costs and made very low investments in security. Moreover, the overoptimism remained in full development of the crisis, when in their public statements they repeatedly minimized the true impact of the tragedy that was occurring (Crooks, 2010).

A Basic Model of Capital Budgeting based on Behavior

In this section, we present a model developed by Gervais (2010) and Gervais et al., (2011) with some adjustments made by the author of this article in which the decision on capital budgeting is considered from a BCF view point. the overconfidence and optimism are included in the decision of the capital budget. It is assumed that the company has a projection horizon of only one period, with an agent that will be called a manager, responsible for the process of selecting long-term investments, which aims to maximize corporate value, i.e. that It is free of agency problems.

The company must incur an initial investment today for a known amount of I > 0, in exchange for which it will obtain a $\widetilde{FC}$ cash flow at the end of the period (amount unknown at the initial moment), where FC is a random variable with average $\widetilde{FC}$ and that assumes values between (- ∞, ∞). The manager chooses a discount rate r, which reflects the cost of capital and the risk of the project, and makes the decision to carry it out or not, which is expressed in the dichotomous variable D. he assumes the value of 1 in the case in which it is decided to do the project, or 0 otherwise. In this way, the NPV takes the form of a random variable, expressed as follows:

$$\widetilde{NPV} = D\left(\frac{FC}{1+r} - I\right)$$

It is now assumed that it is possible for the manager to have the ability to obtain and interpret additional

non-observable information for the company in general, on the possible income generated by the project that is being evaluated, so that by using its good judgment it can have more elements to make an investment decision that generates value. Gervais denotes this information as giving it the name of the signal, which is expressed as a weighted average between the value that will actually have the cash flow in period 1 and another possible value $\tilde{\nu}$, which has the same value. which has the same distribution like $\widetilde{FC}$ but that is independent of it

$$\tilde{S} = \tilde{\varepsilon}\,\overline{FC} + (1 - \tilde{\varepsilon})\tilde{\psi}$$

Where $\tilde{\psi}$ is a dichotomous -not observable- variable that assumes the value of 1 with probability α, and of 0 with probability (1-α), being the parameter $\alpha \in [\, 0, 1/2\,]$ the possibility that $\tilde{S}$ turns out to be the same as $\widetilde{FC}$ In other words, α expresses the true ability of the manager (not the one he perceives of himself). The foregoing implies that:

$$\mathbf{E}(\overline{\mathbf{FC}}\,|\tilde{s}) = \alpha\tilde{s} + (1 - \alpha)\overline{FC} = \overline{FC} + \alpha(s - \overline{FC})$$

The above equation implies that a positive signal $\tilde{S}$ will increase the expected value of cash flow that will actually be obtained thus the manager will project revenues higher than the average $\overline{\mathrm{FC}}$. Now, if the manager pursues overconfidence bias, he will over-estimate his own abilities, which implies in the model that his true ability α will add an additional value $ß \in [\, 0, {}^{1/2}]$, and yet the above equation will be modified in the following way:

$$E_{\beta}\left(\overline{FC}\middle|\tilde{S}\right) = (\alpha + \beta)\,\tilde{S} + (1 - \alpha - \beta)\overline{FC} = \overline{FC} + (\alpha + \beta)\left(\tilde{S} - \overline{FC}\right)$$

In this case, the manager overestimates the value of cash flow when $\tilde{\mathrm{S}} > \overline{\mathrm{FC}}$. A Higher coefficient β means that the manager gives greater importance to his or her own information, while if β = 0 the manager is free of overconfidence and makes an unbiased calculation of the information held in $\widetilde{\mathrm{FC}}$. The manager will decide to make the investment in a project when the expected value of the NPV is positive, which in this case happens if:

$$\frac{E_{\beta}(\overline{FC}|\tilde{S})}{1+r} > I$$

The presence of a parameter $\beta > 0$ causes the expected value of the cash flow to be overestimated and, therefore, it tends to project a high NPV, which results in an investment greater than that of optimal limits.

On the other hand, optimism is included as the perception that a cash flow greater than that defined by the initial distribution will be obtained, hence the average increases to $\overline{FC} + \lambda$. The optimistic manager overestimates the expected value of the cash flows of the project, as follows:

$$E_{\lambda}(\overline{FC}|\tilde{S}) = \alpha\tilde{s} + (1-\alpha)(\overline{FC} + \lambda)$$

Gervais concludes that, in this scenario, the project will be considered viable and will be developed if $\overline{FC} > FC_{\lambda}^{*}$ where the latter term is defined as:

$$FC_{\lambda}^{*} = FC + \lambda - \frac{FC + \lambda - I(1+r)}{\alpha}$$

At first, the optimism bias leads to overestimating the cash flow in the amount λ. However, this effect can be reduced to the extent that the real skill of the manager (α) is greater.

Recommendations for the Company

As presented previously, the evidence shows that the different stages of the capital budgeting process are subject to biases such as optimism and overconfidence, that lead to overestimating the net cash flows expected from a project. To correct such distortions, it is not sufficient to use a higher discount rate simply because mathematically the NPV would be reduced immediately.

If it is accepted that, as Antonio Case confirms, we are in an "imperfect but perfectible" world (Krauze, 1990) a first step to avoid the negative impacts of behavioral biases is to recognize that exist and identify

how they affect decision making. Very recently, Schön-Bohm and Zahn (2012) stated that Being aware of the pitfalls of different subjective biases provides a certain level of self-critical reflection, which could eventually lead to more reasonable projections. Some managers would improve their decision-making skills simply by creating awareness of psychological biases.

In cases where financial decisions are made that intentionally destroy value (such as those arising from agency problems), the literature recommends correcting the incentive system. However, when managers destroy value unintentionally as a result of psychological bias, probably the most appropriate way to begin is to correct the problem through education and training (Fairchild, 2009). In this way, it is possible to develop training programs first at the level of senior management and then, with their support, for the financial team in charge of carrying out the projections. These programs will not only be aimed at recognizing the inconveniences caused by psychological biases, but also at understanding how they can be used for the creation of value. It is clear that a task like this requires a willingness to reflect some degree of humility to recognize possible flaws in judgments and behaviors of one's self, a process that is often complex, since it implies the need for personal and organizational change (Nguyen & Schüßler, 2013).

It is recommended that there be communication and feedback of the capital budgeting process with a team in which the directors receive autonomous points of view, both from internal collaborators as well as from external shareholders and auditors, within the framework of a robust corporate governance. This is a task in which a professional, active and independent board of directors can play a decisive role. Equally, it is necessary to implement evaluation and compensation systems based on the medium and long-term results (Axelson, Jakovicka, & Keddache, 2002; Nguyen & Schüßler, 2013).

CONCLUSIONS

The traditional approach to capital budgeting, based on the assumptions of neoclassical theory, is based on tools such as the net present value (NPV) and the internal rate of return (IRR) to assess the financial viability of investment in fixed assets projects. This type of corporate decisions is based on the projection of cash flows that try to reflect the expected behavior of variables that are not under the total control of the company. Although the traditional financial theory incorporates elements such as risk and uncertainty, it typically assumes a perfect forecast, a perfect use of information and the absence of

emotional variables, environmental influences or cognitive errors. Despite the great conceptual and technological development of quantitative methods, it is necessary to recognize that even the most detailed calculation of financial indicators for project evaluation is subject to errors and is unable to eliminate uncertainty about the future. The BCF offers a new approach in which the different psychological phenomena that affect financial decision making (biases, heuristics and framing effects) are explicitly incorporated into the study of business reality.

The evidence shown in this article incorporates the most important studies conducted on the of optimism and overconfidence in capital budget decisions. It seems to indicate that such trends are systematic and have an important impact on the allocation of resources and the creation of value.

It can be stated that the elimination of biases in behavior is both impossible and undesirable. Perhaps it is most convenient for the company, starting with its senior management, to recognize the existence of behavioral influences in its financial decisions, identify its positive and negative impacts and introduce these elements explicitly in its decision making. so that it can increase the creation of value for shareholders and in general for society.

The influence of behavioral elements in the capital budget process is a relatively new area of study that offers ample research opportunities. There is little work in this area and, in particular, to small companies that consider variables such as culture, age or gender.

The BCF have studied only a small part of the broad set of subjective tendencies that have been recognized to date. It will be transcendental for the development of this field that interdisciplinary teams are formed in which the contributions of psychologists, sociologists, and anthropologists, among other professionals, enrich the understanding of the organizational behavior of professionals in economic and administrative sciences.

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