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CEO emotional bias and dividend policy: Bayesian network method

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This paper assumes that managers, investors, or both behave irrationally. In addition, even though scholars have investigated behavioral irrationality from three angles, investor sentiment, investor biases and managerial biases, we focus on the relationship between one of the managerial biases, overconfidence and dividend policy. Previous research investigating the relationship between overconfidence and financial decisions has studied investment, financing decisions and firm values. However, there are only a few exceptions to examine how a managerial emotional bias (optimism, loss aversion and overconfidence) affects dividend policies. This stream of research contends whether to distribute dividends or not depends on how managers perceive of the company's future. We will use Bayesian network method to examine this relation. Emotional bias has been measured by means of a questionnaire comprising several items. As for the selected sample, it has been composed of some 100 Tunisian executives. Our results have revealed that leader affected by behavioral biases (optimism, loss aversion, and overconfidence) adjusts its dividend policy choices based on their ability to assess alternatives (optimism and overconfidence) and risk perception (loss aversion) to create of shareholder value and ensure its place at the head of the management team.

JEL Classifications: D2, G3, L2, L5, M1

Keywords: Emotional bias, corporate finance, optimism, overconfidence, loss aversion, dividend policy, Bayesian network

Introduction

Managerial behavioral biases are receiving growing attention in corporate finance. Recent theories have illuminated how biases like overconfidence and optimism can affect various corporate decisions (Bernardo and Welch, 2001; Heaton, 2002; Goel and Thakor, 2008). There is also a nascent empirical literature that has exposed interesting evidence of the effects of managerial behavioral biases. Malmandier and Tate (2005, 2008) construct a proxy for CEO overconfidence, and document positive correlation between their proxies and aggressive capital structure as well as acquisition decisions. Puri and Robinson (2007) document that optimistic individuals exhibit systematically different choices compared to others, such as holding less diversified portfolios. Graham et al. (2007) find evidence consistent with the view that optimistic CEOs expect better future performance.

All of the above mentioned approaches hold in common one important point, namely, the implicit assumption that financial market participants, as well as company managers, always act rationally. However, an extensive and growing literature on human psychology and behavior shows that most people, including investors and managers, are subject to important limits in their cognitive processes and tend to develop behavioral biases that can significantly influence their decisions.

Indeed, individual reasons are cognitive shortcuts that influence the position, making irrational and non-optimal in terms of traditional financial theories. These biases have been identified and classified and grouped as follows: The means of representation, reasoning analog bias of conservatism and confirmation, but also emotions such as loss

aversion, optimism and the overconfidence. Given these findings, a natural question to ask is whether and how such biases in beliefs are reflected in dividend policy.

This study examines the possible influence of three closely related emotional biases that are extensively documented in behavioral research - loss aversion, optimism and overconfidence on a firm's dividend policy. Recent theoretical Behavioral Corporate Finance literature suggests that these biases can substantially influence the investment and financing decisions made by business managers. In fact, one strong prediction emerges from this body of theories: optimistic and/or overconfident (or, for short, "biased") managers will choose higher leverage ratios for their firms than they would if they were "rational" (or not biased). Therefore, these biases could rank among the determinants of dividend policy. This study offers one of the first empirical tests of this hypothesis and, at the same time, presents new evidence about the factors that better explain observed dividend distribution, using a sample of Tunisian companies.

The article is structured as follows: Section on hypothesis development presents the related literature and the theories which motivate the empirical work. Section on research method discusses the empirical strategies that were adopted. The following sections discuss the main results and present the concluding remarks.

Hypothesis development

The implications of managerial characteristics for corporate decisions have only recently begun to be explored by Behavioral Finance researchers. Some studies address the issue from the perspective of rational managers interacting with overconfident outside investors. Only recently has a smaller number of analyses emerged focusing the cognitive biases (optimism, overconfidence and loss aversion) of the managers themselves and trying to understand how they can affect their investment and financing decisions. Recently, Malmendier et al. (2011) provide evidence that overconfident CEOs display higher investment-cash flow sensitivities, are more acquisitive, and are less likely to rely on equity financing than their peers. Bertrand and Mullainathan (2003) and Graham et al. (2007) show that a significant fraction of the variation in corporate practices and executive compensation can be explained by manager fixed effects. Felton et al. 2003, justify risky investment decisions by the leader's optimism level likely to seek information and their desire to solve a given problem without considering the success of previous projects. Schrand and Zechman (2009) show that overconfident managers make optimistic forecasts and in order to meet these forecasts, exhibit higher levels of fraud and earnings management. Malmendier et al. (2007, 2010) formalize the notion of overconfidence and provide empirical evidence of the effects of CEO overconfidence on capital investment and capital structure preferences.

We investigate the influence of managerial bias (loss aversion, optimism and overconfidence) about corporate dividend policy.

Optimism and dividend policy

The role of managerial optimism in a firm's financing decisions (dividend policy) has been a subject of an ongoing debate in the corporate finance literature. Following Roll (1986) pioneering study on the role of managerial over optimism in corporate acquisitions, the merits of managers' possible departure from full rationality, and behavioral corporate finance in general, have been examined in a number of theoretical and empirical studies.

Malmendier and Tate (2005) find that the optimistic manager will use a priority on self-financing, then debt and ultimately to the issue of shares. They show the positive relationship between the means of internal financing and managerial optimism. Baker et al. (2007) show that optimistic CEOs over invest and tend to choose higher leverage. Optimist CEO overestimates this firm growth opportunities and seeks to achieve even

with the use of external financing methods. This under-investment choice involves a small dividend payment. Ben-David et al. (2007) calculate optimism and overconfidence measures. They find that firms with optimistic leaders invest more. Strengthening a leader involvement sense encourages optimism on the investment. So they refuse to pay the cash flow generated through dividends and prefer to use in financing investment projects.

Lin et al. (2008), confirm the results obtained by Heaton (2002). With the help of an empirical study, these authors found that Pecking Order Theory (POT) prediction can be explained by optimistic manager. Thus, an optimistic leader promotes self first and last a debt and equity issuance. In other words, optimistic leader is particularly sensitive to the risk of difficulties, even bankruptcy of the company; and therefore he prefers that dividends are limited, so that company has cash to meet its commitments.

Hackbarth (2009) argues that optimistic managers have a higher probability to excel in tournaments and thus may get promoted to top executive positions more often, though all managers choose riskier investments (specific investment and long term) when faced by internal competition for leadership. Leader optimistic interest is in bringing to the maximization of shareholder wealth and optimizing the flow of funds. It seeks to confirm its position at the head of his company distributing dividends even if it has not accumulated reserves. Gervais and Odean (2001), Biais et al. (2005), Chang et al. (2009), show the existence of a positive relationship between overconfidence (and / or optimism) and uncertainty. This uncertainty regarding the adequacy of available information affects decision making. This reflects the positive relationship between managerial optimism and dividend distribution.

H1: *rational leader accepts level of dividend payout greater than optimistic leader.*

Loss aversion and dividend policy

A nascent literature recognizes that the bias of loss aversion is a significant determinant of manager financing decisions. Psychological studies document that loss aversion causes people to overestimate risk, be more uncertain about forecasts and opt for making it safer to limit the likelihood of his removal.

Helliar et al. (2005) argue that loss aversion leaders seek to avoid the worst-case scenarios. They not only use the tools of risk management to reduce the variance of cash flows but rather to avoid the worst scenarios that influence the risk of bankruptcy or preventing the company to take advantage of profitable investment. Kisgen (2006) shows that the level of debt affects the credit rating in a negative way. Thus, a downpour in the loss leader seeks the minimization of the probability of loss for him and a firm. He refuses to debt financing (to avoid the risk of bankruptcy) and prefer self-financing. He denies establishment of a dividend policy that positively affects the risk of bankruptcy of their company.

Baker et al. (2007) in their excellent review of the growing literature on behavioral corporate finance, have shown several managerial behavioral biases to affect corporate decisions. Bertrand and Mullainathan (2003) argue that leaders can be encouraged not to invest so as not to be challenged in their “quiet life”. This kind of conservatism is a way to counteract the risk of loss of control (Barberis and Thaler, 2002). Thus, the loss aversion of the manager due to a hostile takeover bid (hostile takeover) forces him to not invest in projects with positive returns if financed by issuing shares. The leader seeks to retain its shareholders with the choice of a generous policy of distributing dividends. Chang et al. (2009) assume that the volatility of the securities is an important determinant of ownership structure. Thus, officer loss aversion and aware of the variation in stock returns of the business (or their value on the market) reduces its financing by issuing shares to avoid a loss under evaluation. He opts for the issuance of shares if the market overestimates the business; he seeks to retain its shareholders by offering a stable dividend payout.

H2: *rational leader accepts level of dividend payout greater than loss aversion leader.*

Overconfidence and dividend policy

Recent studies have documented the presence of managerial overconfidence and the effects it has on corporate policies. Baker et al. (2004) survey the extant research and point out that over-confidence affects many aspects of corporate financing including both investment and financing policies. Ben-David et al. (2007), Sautner and Weber (2009) use survey evidence to show that the overconfidence of top executives affects various corporate decisions, including the dividend policy of the firm.

An overconfident CEO persistently feels undervalued by the capital market, and is thus reluctant to issue risky securities to finance his projects (Heaton, 2002). The perceived undervaluation induces CEOs to abstain from to accept external financing methods (debt and/or equity). This implies an increased preference for internally generated resource and reduces the dividends paid level. Malmendier and Tate (2005, 2008) and Malmendier et al. (2007) indicate that the level of dividend payout is lower in firms managed by overconfident CEOs.

Schrand and Zechman (2010) emphasize that overconfidence is positively associated with the overestimation of the probability of success and the presence of biased financial decisions. The leader overconfidence that overestimates his personal skills tends to choose financial decisions inconsistent with the firm characteristics. It underestimates the risk of bankruptcy of his company and believes the control. These beliefs led him to increase the debt level of the business. Ho and Chang et al. (2009) postulate the presence of a positive relationship between the company financial distress and CEO overconfidence level. The executive overconfidence overestimates its powers to reduce the risk of his business. Thus, overconfidence leads the manager to underestimate the company bankruptcy probability and, therefore, a higher debt. This financial decision (external preference method) impulse leader to follow a generous policy dividends distributing to offset the losses associated with its choice.

H3: *rational leader accepts level of dividend payout greater than overconfident leader.*

Research method

Data

Our empirical study is based on quantitative research. We use a questionnaire as a method of data collection. Our questionnaire consists of four main parts, based ontreated areas in theory:

- The first part aims to identify the company (size, industry, ownership structure, debt levels, level of dividend distribution, etc.)
- The second part focuses on presenting the level of loss aversion leaders
- Part three deals with the level of optimism of the leader
- Finally, part four seeks to show the level of overconfidence of managers.

The questionnaire is addressed to CEOs of Tunisian companies. The selected sample consists of 100 managers of industrial and commercial companies listed on the Tunisian stock exchange in 2010 (28 companies) and non-listed companies (82 companies).

Our choice of listed companies is justified by the fact that they are supposed to the most efficient and meet several conditions necessary for the reliability of our study were limited companies which are usually diffuse shareholders, increasing the importance of role of the board and ownership structure and consequently increase the validity of the assumptions.

We decided to exclude financial firms: banks, insurance companies and investment companies for development and portfolio management; in fact these companies have different characteristics of non-financial businesses; and also there is a need to avoid correlation effects specific to a specific sector.

To get a representative sample of our Tunisian market we added other unlisted companies.

TABLE 1. VISITED COMPANIES

Initial BVMT sample for 2007	50
financial firms	(22)
Other non financial firms	120
Insufficient data to emotional biases	(40)
Insufficient data to board of directors compositions	(8)
Final sample	100

Variables' measurement

The objective of this section is to determine the variables' measurement.

Dividend policy choice

The variable used to measure dividends level is the distribution rate (Rozeff, 1982; Agrawal and Jayaraman, 1994). The advantage of the distribution rate is the information that is in terms of retention of earnings and, therefore, whether the flow (the retention rate is equal to 100 in the payout ratio).

$$\text{Payout ratio} = \text{Dividend per share} / \text{earnings per share}$$

Emotional bias

The questionnaire focuses on evaluating and scoring of the three emotional biases (risk aversion, optimism and overconfidence). The questions have been inspired from the questionnaires formulated by the Fern Hill and Industrial Alliance companies.

The emotional bias takes 2 follows:

- 1 if the individual has a high level for each bias
- 0 if not

Capital structure choice

The appropriate measures in the literature to evaluate three methods of financing are:

Internally generated resources (The Cash Flow). Research within the framework of financial theory of investment, have resorted to many measures of internal resources. Cash flow represents the flow generated by the activity of any business, is one of the most appropriate (Lehn and Poulsen, 1989; Molay, 2006; Naoui et al., 2008).

$$CF = \text{Net income} + \text{Depreciation} - \text{Dividend}$$

$$\text{Cash Flow rate (RCF)} = \text{CF} / \text{Total Assets}$$

To show that the leader chosen or not internally generated resources, we can use the change in flow rate. A negative change indicates the use of internal resources.

$$\text{Cash flow rate variation} = \text{RCFN} - \text{RCFN-1} / \text{RCFN-1}$$

Debt level. We observe a variety of variables that measure the level of debt in the company. Measures such as total debt service ratio have been selected by several authors (Hovakimian et al., 2004). Others have used the debt ratio in the medium and long term (Myers, 2001). The debt ratio in the short term was also used by Titman (1984).

As part of our analysis we propose to use the debt ratio as a measure of this variable. It should be noted that this ratio is calculated by:

$$\text{Leverage ratios (LEV)} = (\text{total debt} / \text{total assets})$$

This measure is also used by Koh (2003), Demaria and Dufour (2007), Jarboui and Olivero (2008), Benkraiem (2008), and Sahut and Gharbi (2008).

To show that the manager uses debt or not, we can use the change in debt ratio. A positive change indicates the use of debt.

$$\text{Leverage ratios variation} = \text{LEVN} - \text{LEVN-1} / \text{LEVN-1}$$

Equity level. This variable is measured by the value of equity in the balance sheet of the company. To show that the leader chosen or not the capital increase, we can use the variation in the percentage of investment. A positive change indicates an increase of capital.

$$\text{Level of Capital Invested (LCI)} = \text{equity} / \text{total assets}$$

$$\text{Level of Capital Invested Variation} = \text{LCIN} - \text{LCIN-1} / \text{LCIN-1}$$

The financial decision takes 7 follows:

- 1 if the manager chooses the internally generated resources: Positive variation in the cash flow rate
- 2 if the manager chooses debt: Positive variation in the leverage ratio
- 3 if the manager chooses the capital increase: Positive variation in the level of invested capital.
- 4 if the manager chooses internally generated resources + debt: Positive variation in the cash flow rate and debt ratios.
- 5 if the manager chooses internally generated resources + capital increase: Positive variation in the cash flow rate and level of capital invested.
- 6 if the manager chooses debt + capital increase: Positive variation in the leverage ratio and level of invested capital.
- 7 if the manager chooses internally generated resources + debt + capital increase: Positive variation in the cash flow rate, leverage ratio and level of invested capital.

Firms' investment decision

The purpose of this article is to show the impact of emotions on the firms' investment decision (investment nature, level and horizon). The appropriate measures in the literature to evaluate investment decision are Assets specificity, Investment level, and Investment horizon.

Assets specificity. In our study we will use the degree of assets intangibility as a proxy of the specific investments. The degree of assets intangibility can be appreciated on many levels. The France Bank and Ministry of Industry in studies devoted to the development of intangible investments in France used the ratio often intangible / tangible assets. In Tunisia, as in France, the intangible asset accounting record comes from the capitalization of such expenses. However, the unavailability of information legitimizes the use of the amount of intangible assets presented in the balance sheet, although this amount is usually surrounded by doubt as the result of discretionary choices performed by the leaders. Akin to the French context, the measurement of intangible capital in the Tunisian context has the same problems, which leads us to adopt accounting.

Based on that discussion and the availability of data of Tunisian companies we offer the following indicator of the degree of activation of intangible expenses:

$$\text{Asset Specificity Rate (ASR)} = \text{intangible assets} / \text{asset accounting}$$

This measure is used by Cazavan-Jeny (2004), Moussu and Thibierge (1997), Thibierge (2001).

Investment level. In this study we will use the presence of free cash flow and growth opportunities as two indicators of over-investment (low Future investment opportunities and free cash flow) or underinvestment (low free cash flow and Future investment opportunities). The literature differs on how to measure the free cash flow as conceptualized by Jensen (1986). In general, however, it is defined as operating income before depreciation interest expense and taxes, as well as dividends paid (Lehn and Poulsen, 1989) divided by book value of total assets to account for effects related to size.

$$\text{Free Cash Flow Rate (FCFR)} = \text{Operating profit} / \text{total assets.}$$

Future investment opportunities are measured by Tobin's Q (Skinner, 1993). Tobin's Q is defined as the ratio of market value of a firm to the replacement value of its assets (Lindenberg and Ross, 1981; Griliches, 1981; Cockburn and Griliches, 1988; Megna and Klock, 1993; Skinner, 1993). When the Tobin's Q greater than one, then the company sign a profitable investment opportunities and vice versa. In our study, we will retain an approximation of Tobin's Q, calculated as follows (Chung and Pruitt, 1994):

$$Q_{it} \cong \frac{MVS_{it} + D_{it}}{A_{it}}$$

MVS - market value of common and preferred shares; D - book value of debt, defined as current liabilities plus long-term debt plus inventories minus current assets; A - total assets.

Investment horizon. Referring to the theory of agency leaders has an obligation of result on short horizons. Their wealth is tied to the performance of the firm during the duration of their mission which is the period during which they run the firm. These leaders prefer investment projects in the short term to quickly reveal the performance of these investments and reduce uncertainty about their own value on the labor market.

In our study we will use the rate of investment operations (industrial and commercial assets) as an indicator of the investment horizon.

$$\text{Capital Expenditure Rate (CER)} = \text{operating assets} / \text{Total assets}$$

This measure is used by Cliche (2000), Gervais and Odean (2001), Malmendier and Tate (2005), Chang et al. (2009), Draief (2010).

The investment decision takes 9 forms:

- 1 if the manager chooses investment specific: Positive variation in the rate of assets specificity
- 2 if the manager chooses overinvestment: Low future investment opportunities and free cash flow
- 3 if the manager chooses underinvestment: Low free cash flow and future investment opportunities
- 4 if the manager chooses long-term investment: negative variation in the rate of capital expenditure
- 5 if the manager chooses short-term investments: Positive variation in the rate of capital expenditure
- 6 if the manager chooses (overinvestment + long-term investment): Negative variation in the rate of capital expenditure, low future investment opportunities and free cash flow
- 7 if the manager chooses (underinvestment + short-term investments): Positive variation in the rate of capital expenditure, low free cash flow and future investment opportunities
- 8 if the manager chooses (specific investment + overinvestment + long-term investment): Positive variation in the rate of assets specificity, negative variation in the rate of capital expenditure, low future investment opportunities and free cash flow
- 9 if the manager chooses specific investment + underinvestment + long-term investment: Positive variation in the rate of assets specificity, low free cash flow, future investment opportunities and negative variation in the rate of capital expenditure.

Control variables

Static trade-off theory (STT) and pecking order theory (POT) is the body of theory of reference that addressed the issue of the firm financial decision. The factors that explain the firm financial decision are mainly at the cost, size, level of risk, growth opportunities, the structure of assets and business (Booth et al., 2001; Dufour and Molay, 2010).

We include in our model three control variables that explain the effectiveness of choice of financial structure of the company. These variables are proxies for profitability, firm size and growth opportunities.

We include in our study three control variables that explain company capital structure choice. These variables are proxies for profitability, firm size and growth opportunities.

Profitability. More profitable firms have, *ceteris paribus*, more internally generated resources to fund new investments. If their managers follow a pecking order, they will be less likely to seek external financing (Fama and French, 2002). Thus, on average, these firms' leverage ratios will be lower. In trade-off models, on the other hand, this relationship is

inverted. More profitable firms are less subject to bankruptcy risks, *ceteris paribus*. Hence, their expected bankruptcy costs are reduced and they can make more use of the tax shields provided by debt, thus choosing a position of greater leverage. We will keep the ratio of return on assets ROA to measure this variable:

$$\text{ROA} = \text{Earnings before interest, tax, depreciation divided by total assets, lagged one year period}$$

Firm size. Studies suggest that the probability of bankruptcy is lower in larger firms and that, therefore, their debt capacity is higher than that of smaller ones, all else equal. On the other hand, fixed transaction costs can make new stock issues unattractive to small corporations, stimulating them to issue debt (Rajan and Zingales, 1995; Hovakimian et al., 2004; Dufour and Molay, 2010).

Indeed, most studies have applied total assets or turnover as a measure for firm size (Bujadi and Richardson, 1997). In this paper, it is measured through the log of the firm's total assets (LNSIZE).

Future investment opportunities. It is argued that future profitable investment opportunities can influence corporate financing decisions in different ways. In the context of the pecking order theory, firms that have many investment opportunities and believe that their stocks (and risky bonds) are undervalued by the market, may choose a capital structure with less debt. If they maintained high debt ratios, they would be forced to distribute precious cash flows generated by their business and could face the need to issue undervalued securities to fund new projects.

This could, in turn, induce underinvestment. A more static version of the pecking order model, on the other hand, predicts that firms with more future opportunities will be more levered, *ceteris paribus*, because they need more external financing and issuing debt is preferable to issuing new stock. (Rajan and Zingales, 1995; Booth et al., 2001; Dufour and Molay, 2010; Naoui et al., 2008).

We will keep the Tobin's Q to measure this variable. The Tobin's Q Estimated with the approximation formula proposed by Chung and Pruitt (1994):

$$Q_{it} \cong \frac{MVS_{it} + D_{it}}{A_{it}}$$

MVS - market value of common and preferred shares; D - book value of debt, defined as current liabilities plus long-term debt plus inventories minus current assets; A - total assets.

TABLE 2. OPERATIONAL DEFINITIONS OF VARIABLES

Class	Phenomena	Measure	Variables	Predictions
Endogens variables:				
Dividend policy (DIV)	The presence of a dividend policy	Payout ratio = Dividend per share / earnings per share If the payout ratio <0 or> 0: yes; presence of a policy of dividend distribution. If the payout ratio = 0: no, absence of a policy of dividend distribution		D
Exogenous variables:				
			OUI	NON

Optimism (OP)	Directors overestimate capacity of their firms	The questionnaire obtained score	OP	+	+
Lost aversion (LA)	Loss rumination and reputation	The questionnaire obtained score	LA	+	+
Overconfidence (OVER)	Directors overestimate their personal competences	The questionnaire obtained score	OVER	+	-
Capital structure choice (CSC)	Internally generated resources (The Cash Flow)	CF = Net income + Depreciation – Dividend Cash Flow rate (RCF) = CF / Total Assets Cash flow rate variation = RCF _N - RCF _{N-1} / RCF _{N-1}	CF	+	-
	Debt level	Leverage ratios (LEV)= (total debt / total assets) Leverage ratios variation = LEV _N - LEV _{N-1} / LEV _{N-1}	LEV	+	-
	Equity level	Level of Capital Invested (LCI) = equity / total assets Level of Capital Invested Variation = LCI _N - LCI _{N-1} / LCI _{N-1}	EQ	+	-
Investment decision (ID)	Assets specificity	Asset Specificity Rate (ASR) = intangible assets / asset accounting	AS	-	+
	Investment level	Free Cash Flow Rate (FCFR) = Operating profit / total assets. and $Q_{it} \equiv \frac{MVS_{it} + D_{it}}{A_{it}}$	INL	-	+
	Investment horizon	Capital Expenditure Rate (CER) = operating assets / Total assets	INH	-	+
Controls variables:					
Profitability (PF)	Reports on the company's ability to meet its commitments	ROA= Earnings before interest, tax, depreciation divided by total assets, lagged one year period	PF	+	-
Firm size (FSIZE)	Firms signaled performance	Ln (total assets)	LNSIZE	+	-
Future investment opportunities (FIO)	Indicates the productive capacity of the company	$Q_{it} \equiv \frac{MVS_{it} + D_{it}}{A_{it}}$ MVS - market value of common and preferred shares; D - book value of debt, defined as current liabilities plus long-term debt plus inventories minus current assets; A - total assets	FIO	-	+

For simplification purposes, the summary of each variable extent range in the model, its name as well as its expected impact on the capital structure choice are depicted in the following Table 2.

Bayesian Network Method

The definition of a Bayesian network can be found in many versions, but the basic form (Pearl, 1986) is stated as follows: a Bayesian network is a directed probability graph, connecting the relative variables with arcs, and this kind of connection expresses the conditional dependence between the variables. The formal definition follows.

A Bayesian network is defined as the set of $\{D, S, P\}$, where.

(1) D is a set of variables (or nodes): in our case it consists of capital structure choice, optimism, loss aversion, overconfidence, profitability, firm size and future investment opportunities.

(2) S is a set of conditional probability distributions (CPD). $S = \{p(D / \text{Parents}(D)) / D \in D\}$, $\text{Parents}(D) \subset D$ stands : for all the parent nodes for D, $p(D / \text{Parents}(D))$ is the conditional distribution of variable D.

(3) P is a set of marginal probability distributions. $P = \{p(D) / D \in D\}$ stands for the probability distribution of variable D .

In the Bayesian network, variables are used to express the events or objects. The problem could be modeled with the behavior of these variables. In general, we first calculate (or determine from expert experience) the probability distribution of each variable and the conditional probability distribution between them. Then from these distributions we can obtain the joint distributions of these variables. Finally, some deductions can be developed for some variables of interest using some other known variables.

In our study we try to show the evolution of CEO financing choices according to the evolution of his emotions and his company characteristics. Thus, theoretically, have to show that the company capital structure choice (Internally generated resources, debt and Equity) depends on: CEO emotional biases (CEO optimism level, loss aversion and overconfidence), firm profitability, firm size and firm future investment opportunities.

Defining network variables and values

The first step in building a Bayesian network expert is to list the variables recursively, starting from the target variable to the causes. In this order we present the variables in the table below:

TABLE 3. THE NETWORK VARIABLES AND THEIR VALUES

Variables	Type
Dividend policy (DV)	Discret : YES/NO
Investment decision (IND)	Discret [1 ; 2 ;3 ;4 ;5 ;6 ;7 ;8 ;9]
Capital structure choice (CSC)	Discret [1 ; 2 ;3 ;4 ;5 ;6 ;7]
Optimism (OP)	Discret : YES/NO
Loss aversion (LA)	Discret : YES/NO
Overconfidence (OVER)	Discret : YES/NO
Profitability (PF)	Discret : YES/NO
Firm size (FISIZE)	Discret [1 ; 2 ; 3]
Future investment opportunities (FIO)	Discret : YES/NO

Graphical model

The second step of Bayesian network the construction is to express the relationships between variables. According to the data that we have received through the questionnaire, we have established relationships (Figure 1).

Empirical results

The relationships discovered analysis

The relationships between the variables in the database are directed at the parent node child node. Each relationship is composed of three different measures: the Kullback-Leibler, the relative weight and the Pearson correlation (direction of relation).

Indeed, the Kullback-Leibler and the relative weight are two measures indicating the strength of relationships and the level correlation between variables, in that while the correlation measure of personal meaning and relationship significance.

The relative weight scale of 0 to 1. Thus, the table (Table 3) below shows the relationships analysis results between variables across the network Pearson correlation.

FIGURE 1. DIVIDEND POLICY: BAYESIAN NETWORK

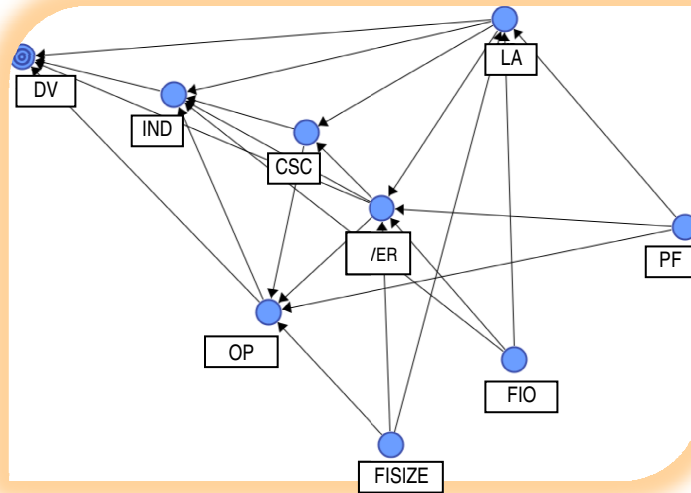


TABLE 4. THE RELATIONSHIPS ANALYSIS

Parents nodes	Childs nodes	Kullback-Leibler divergence	Poids relatif	relative weight
CSC	IND	0.976628	1.0000	0.1848*
FIO	IND	0.720238	0.7375	0.2702
OP	CSC	0.631802	0.6469	-0.0985*
OVER	IND	0.470045	0.4813	0.1531*
LA	IND	0.371970	0.3809	-0.0912*
IND	DV	0.353076	0.3615	-0.0829*
LA	CSC	0.322634	0.3304	-0.1251*
OP	IND	0.226392	0.2318	-0.1186*
OVER	CSC	0.225408	0.2308	0.3086
CSC	DV	0.208089	0.2131	-0.0486**
FISIZE	LA	0.193522	0.1982	-0.3519
FISIZE	OP	0.191295	0.1959	0.2133
FIO	OVER	0.135048	0.1383	0.0346**
PF	OVER	0.134062	0.1373	0.1251*
FISIZE	OVER	0.108402	0.1110	0.0429**
LA	DV	0.101500	0.1039	-0.0372**
OVER	DV	0.097273	0.0996	-0.1109*
FIO	OP	0.097059	0.0994	-0.0688**
PF	OP	0.096918	0.0992	0.1714*
PF	LA	0.077256	0.0791	-0.1662*
LA	OVER	0.053792	0.0551	-0.1555*
OP	DV	0.050467	0.0517	0.4937
FIO	LA	0.044916	0.0460	-0.0308**
OVER	OP	0.042004	0.0430	-0.0159**

Note: Kullback-Leibler close to 1: important correlation between the variables. Relative weight close to 1: important correlation between the variables. Pearson correlation: *, **, ***, respectively at 10%, 5%, 1%.

Table 4 examines the relationship (strength and correlation type) between networks variables.

The analysis of the relations shows the presence of a strong relationship (Kullback-Leibler=0.976/poids relatif=1) and positive ($\beta = 0.1848$) between capital structure choice and firm investment decision. This confirms the predictions of financial theory for organizational independence between the two decisions. The results also show the presence of a strong and non significant relationship between growth opportunity and investment decision (Kullback-Leibler=0.7202/0.7375 = relative weight/ β =0.2702).

In addition, the firm capital structure choice is negatively correlated with his level of optimism (β =-0.0985) and loss aversion (β =-0.1251). Finally, the investment decision is positively correlated with the CEO overconfidence level (β =0.1531) and negatively correlated with the loss aversion level (β =-0.0912) and optimism (β =-0.1186).

Network dividend policy analysis show the presence of a strong relationship (Kullback-Leibler 0.353/=relative weight 0.3615) and negative (β =-0.0829) between investment decisions and dividend payment. Also, there is a strong relationship (Kullback-Leibler=0.2080/0.2131=relative weight) and negative (β =-0.0486) between financing decisions and dividend payments. This confirms the predictions of financial theory for organizational independence between financing decisions (dividend payment and choice of financing method) and investment.

The CEO optimism level affects dividend policy of his firm (Kullback-Leibler=0.0504/0.0517=relative weight/ β =0.4937). This result contradicts our theoretical predictions (H1). This shows that optimism is not an important factor in explaining the dividend is paid.

CEO loss aversion level is correlated (Kullback-Leibler=0.1015/0.1039=relative weight) negatively (β =-0.0372) with the dividend payment. This result confirms our theoretical development (H3). This is explained by the fact that a leader downpour in the loss of remuneration or reputation limits its use of external methods of financing risky (debt: bankruptcy risk, and/or capital increase: supply risk hostile takeover). He prefers the cash flow and reduced dividend payments.

Overconfidence leader is correlated (Kullback-Leibler=0.1015/0.1039=relative weight) negatively (β =-0.0372) with the dividend payment. This finding contradicts our theoretical predictions (H3). This is explained by the fact that a leader overconfident about his company value seeks to maintain its place at the head of the management team. So it uses the financial policy of his company to assess and demonstrate its management quality. It therefore limits its use of costly external financing methods. He prefers the self-financing thereafter. This choice of self-financing avoids the dividend distribution.

The relation analysis test shows that firm size affects their emotional state. Thus, the size negatively affects the CEO loss aversion level (β =-0.3519), positively correlated with the optimism rate (β =0.2133) and his overconfidence (β =0.0429).

Future investment opportunities are positively correlated with the CEO overconfidence level (β =0.0346) and negatively with his loss aversion rate ($\beta = -0.0688$) and optimism (β =-0.0308). The company's profitability is negatively correlated with CEO loss aversion level (β =-0.1662), negatively correlated with his optimism (β =0.1714) and his overconfidence (β =0.1251). Relationship analysis shows the presence of a negative correlation between CEO loss aversion level and his overconfidence level (β =-0.1555).

Finally, the results also show the presence of a negative correlation between managerial overconfidence and his optimism level (β =-0.0159).

Target variable analysis: Dividend policy

To analyze the dividend policy, we must choose the variable dividend policy (DV) as a target variable in the Bayesian network. Then we can use the function that generates the

analysis report of the target dividend policy. In this report, the relationship between dividend policy and the other variables are measured by binary mutual information and the binary relative importance. The mutual information of two random variables is a score measuring the statistical dependence of these variables. It is measured in bits.

TABLE 5. TARGET VARIABLE ANALYSIS

DV = YES (68,65%)				
Nodes	Binary mutual information	Binary relative importance	Modal value	
OP	0.1797	1.0000	YES	75.51%
CSC	0.1183	0.6583	CF+LEV	21.59%
IND	0.0457	0.2541	OVERINV	15.94%
FSIZE	0.0150	0.0833	BIG	62.68%
OVER	0.0090	0.0501	YES	55.66%
FIO	0.0081	0.0454	YES	52.45%
PF	0.0031	0.0175	NO	53.79%
LA	0.0010	0.0056	YES	60.89%
DV = NO (31,35%)				
Nodes	Binary mutual information	Binary relative importance	Modal value	
OP	0.1797	1.0000	NO	76.81%
CSC	0.1183	0.6583	EQ	42.56%
IND	0.0457	0.2541	AS+LTIN+UNINV	20.81%
FSIZE	0.0150	0.0833	BIG	54.13%
OVER	0.0090	0.0501	YES	67.40%
FIO	0.0081	0.0454	YES	63.77%
PF	0.0031	0.0175	NO	60.83%
LA	0.0010	0.0056	YES	64.78%

Note .Mutual information: This is the amount of information given by a variable on the target value. Relative importance: The importance of this variable with respect to the target value. Modal value: The average value of the explanatory variable for each the target value.

Dividend policy analysis shows that 68.65% of Tunisian firms pay dividends.

Table 5 shows that if the leader pays dividends node is its most important optimism level (relative = 1). The other explanatory variables are the financing decision (relative importance = 0.6583), the investment decision (relative importance = 0.2541), size (relative importance = 0.0833), CEO overconfidence level (relative importance = 0.0501), the firm future opportunities level (relative importance = 0.0454) and firm profitability (relative importance = 0.0175).

Thus, the results show that 75.51% CEO optimism rate, 21.59% of his preference for the couple flow and debt, overinvestment with a probability of 15.94%, a firm large size with a probability of 62.68%, 55.66% of CEO overconfidence, the presence of growth opportunities with a probability of 52.45% and low profitability with a probability of 53.79% implies a dividend payment with a probability of 68.65%.

If the manager refuses to pay dividends the most important variable is the optimism level (relative = 1). The other explanatory variables are the capital structure choice (relative importance = 0.6583), the investment decision (relative importance = 0.2541), firm size (relative importance = 0.0833), overconfidence (relative importance = 0.0501), firm future investment opportunities (relative importance = 0.0454) and firm profitability (relative importance = 0.0175). Thus, the results show that 76.81% of CEO pessimism, 42.56% preference for the equity financing decision, the choice of specific investments, long-term and under-investment with a probability of 20.81%, a firm large size with a probability of 54.13%, 67.40% of CEO overconfidence, the presence of future investment opportunities with a probability of 63.77% and low profitability with a probability of 60.83% implies absence of a dividend payment with a probability of 31.35%.

Average target maximizing analysis

After presenting all the explanatory variables for each category of the target variable, it is necessary to introduce the variables maximizing each modality of the target variable. Thus, the target dynamic profile capability software (BayesiaLab) is used to query about an a posteriori maximization of the target average. This test shows the case to maximize the target variable value. Table 6 presents the dynamic profile of the dividend policy (DV).

TABLE 6. THE TARGET DYNAMIC PROFILE ANALYSIS

DV = NO			
Nodes	Optimal modality	Probability	Joint probability
A priori		31,35%	100.00%
OP	NO	58,89%	40.89%
IND	SA	76,28%	5,00%
CSC	CF+LEV+EQ	93,50%	1,19%
FIO	YES	100.00%	1,03%
DV = YES			
Nodes	Optimal modality	Probability	Joint probability
A priori		68,65%	100.00%
CSC	LEV	91,88%	9,50%
FISIZE	SMALL	100.00%	0.09%

Note: Optimal modality: modality is maximizing the target value. Probability: the prior probability of each variable. Joint probability: the probability that the target variable takes the value n given that the explanatory variable takes the value p.

The dividend policy dynamic profile analysis (Table 6) presents the following findings:

The decrease in the CEO optimism level of the order of 58.89%, the increase of asset specificity with a probability of 76.28%, higher preferences for the three leading modes of financing of 93.50% and firm higher future investment opportunities of 100% give an increase in the absence of a dividend payment 31.35%.

The increased preference for the leader of 91.88% debt and reducing the firm size with a 100% probability give the increase to the dividend payment of approximately 68.65%.

Conclusion

This research examines the determinants of firms' dividend policy introducing a behavioral perspective.

Theoretical analysis presented CEO emotional biases highlights role (optimism, loss aversion, overconfidence) to explain his dividend policy. Thus, leaders being optimistic and/ or overconfident with future investment opportunities of their companies believe the market undervalues their firms. They seek to prevent the use of markets to finance its investment projects (high transaction costs and costs of additional branches). Their optimism require it to minimize the loss business risk begin financing choices and investment less risky (preference for self-financing). They therefore tend to limit dividend payments to shareholders.

Instead, leaders who are optimistic and/or overconfident with future investment opportunities of their companies tend to distribute dividends. Thus, overconfidence leads the manager to underestimate the company bankruptcy probability and, therefore, a higher debt. This financial decision (external preference method) impulses leader to follow a generous policy dividends distributing to offset the losses associated with its choice.

Empirical analysis presents survey of CEOs in large private companies in Tunisia. Data analyses revealed CEO emotional biases importance in explaining his dividend policy.

Indeed, empirical relationship analysis between optimism and firm dividend policy shows behavioral dimension role in the explanation. The leader's optimism is positively correlated with the decision of the dividend distribution. This leader optimistic overestimate future returns of the shares of his company. He tends to distribute dividends to signal the performance of its business and enjoy a market reaction.

We also note that CEO loss aversion level is positively correlated with firm dividend distribution level. A leader uncertain about productive capacity of his company engages in conduct designed to respect the interests of the firm. He tries to get a hearing and to be respected by the main shareholders. This leader downpour in the reputation loss or employment chose a more generously dividends policy than its predecessor.

CEO overconfidence positively affects firm dividend policy. A confident leader agrees on the establishment of a generous dividend policy. It overestimates the future results of its business and its ability to meet its commitments on dividends distribution.

Finally, CEO dividend policy analysis by integrating the behavioral dimension is consistent with the corporate financial theory (agency theory, transaction cost and consolidation), the leader affected by behavioral biases (optimism, loss aversion, and overconfidence) adjusts its dividend policy choices based on their ability to assess alternatives (optimism and overconfidence) and risk perception (loss aversion) to create of shareholder value and ensure its place at the head of the management team.

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