DIRECTORS' BOARD, R&D INVESTMENT AND THE FIRM'S PERFORMANCE: EVIDENCE FROM THE FRENCH CASE

Zouari Ghazi*, Zouari-Hadiji Rim**

Abstract

This research paper examines the relationship between the board of directors and the firm's performance from the angle of the R&D investment level in the French context and from some perspectives of corporate governance. Our model seeks to show if the R&D investment level acts as a mediating variable between, on the one hand, the dominance of outside directors, the dual structure and the size of the board, and on the other hand, the performance. This empirical study is based on a sample of 178 French firms for the period 2008-2012. The results of the linear regressions conducted show that the relationships between the variables linked to the composition of the board and the firm's performance are meditated by the firm's R&D investment level.

Keywords: Outside Directors ; Dual Structure; Board Size ; R&D ; Performance

* *University of Sfax, Faculty of Economic Sciences and Management, Tunisia*
** *University of Monastir, Faculty of Economic Sciences and Management, Tunisia*

1. Introduction

The literature review conducted from the angle of corporate governance reveals that the majority of the work examines the direct association between governance mechanisms and the firm's performance, ignoring the indirect relationship between these two variables, except studies by Hutchinson and Gul (2004), Gani and Jermias (2006) and Le et al. (2006). These authors show the moderating role of governance mechanisms in the relationship between R&D investment and performance. According to them, the firm's performance could be enhanced through the intervention of these mechanisms that moderate the relationship between R& D expenditure and performance.

In fact, R&D investment is an important determinant of value creation and performance. And given the fact that the shareholder delegates the investment-decision rights to a manager, agency relationships are created, sources of interest conflicts and agency costs (Jensen and Meckling, 1976). These agency problems are all the more pronounced because the investment relates to activities in R&D (Baysinger et al. 1991; Lee 2005; Tihanyi et al. 2003), which are risky (Baysinger et al 1991; Finkelstein and Boyd 1998; Barker and Mueller 2002), have long-horizon return (Laverty 1996; Ryan and Wiggins 2002), and are highly specific to the firm (Goel and Ram 2001). These characteristics are all factors that enable managers to have deviant behaviour in order to maximize their wealth at the expense of stakeholders. To control managerial opportunism and ensure that R&D investment is done in the interest of the stakeholders, it is necessary to establish governance mechanisms, represented mainly by the Board of Directors (henceforth BD).

The BD, charged with representing the interests of shareholders, is placed at the top of the hierarchy of corporate governance systems (Lorsch and MacIver 1989). As a statutory authority responsible for ratifying and monitoring managerial decisions (Fama and Jensen 1983a and b)[96], the BD plays an important role in resolving conflicts of interest and orienting the behavior of managers to investments in R&D. Most work on the relationship between corporate governance systems[97] and R&D investment are

[96] Fama and Jensen (1983a and b) distinguish four stages in the decision process and corporate control: Initiative, ratification, implementation and monitoring.

[97] At firm level, any decision to invest in R & D requires financing which can be either: financing based on the market (Anglo-Saxon system) or a financing bank oriented (Germano-nippon system). These two

primarily of U.S and Japan origin (Hill and Snell 1988; Baysinger et al. 1991; O'Neill and Lee 2003; Hosono and al. 2004; Lee 2005; Zouari-Hadiji and Zouari 2010 a and b) and partly confirm the role played by the BD in reducing conflicts of interests between stakeholders, and therefore adopting R&D projects.

Based on corporate governance theory, we intend to justify the theoretical association prevailing between the BD, R&D investment and performance. These interrelationships must be specified by including the mediating concept of R&D activities. This implies that the direct relationship between the BD and performance is rather an indirect relationship through the influence of the firms' R&D investment level. In this configuration, the R&D investment level acts as a mediating variable between this internal mechanism and performance.

Thus, one might well wonder whether corporate governance theories, using the R&D investment level variable as a measurement for the detection of growth opportunities, can well explain the firm's performance.

To address this problem, a hypothetico-deductive approach has been adopted to treat the following two sections. The first section presents the theoretical model which postulates that BD can have a certain influence on performance. In the midst of this direct relationship, some variables interfere prominent among which is the R&D investment level. In addition to its being influenced by BD, this variable influences, in turn, the firm's performance. As for the second empirical section, it aims at testing the potential effect of the R&D investment level as a mediator between the BD and performance, in three separate models (one model for each BD component).

2. Literature review and hypotheses

R&D investments have their own characteristics, namely: high risk, return related to a potential long-term growth and high asset specificity. All these elements can enhance the informational (moral hazard and adverse selection) and financing (due to the specificity of R&D investment) problems and increase managerial discretion. The central roles to alleviate these problems and encourage R&D investment, is allocated to appropriate corporate governance mechanisms, including the BD.

Nevertheless, the role of the BD is not uniform; it varies depending on the type of firm[98]. It appears all the more important because the degree of ownership and decision separation is emphasized[99]. In this framework, Fama (1980) and Fama and Jensen (1983a and b) argue that the influence of BD on the nature of decisions made by managers partly depends on its composition. The tendency of managers to opt for such investment to achieve a performance depends on the composition of the BD. The latter is limited to the distinction between inside directors (insiders)[100] and outside directors (outsiders)[101]. As legal representatives of shareholders, outside directors are supposed to be more independent and competent than inside directors in exercising more effective control over the managers.

forms of financing are two alternative systems of corporate governance in which interests' conflicts between shareholders and managers is more or less attenuated. Charreaux (1997b, p.421) defines corporate governance as "the set of mechanisms that has the effect of delimiting powers and influencing the decisions of managers, in other works, of governing their conduct and defining their discretionary space".

[98] Godard (1996) demonstrates that the relationship between BD, strategy and financial performance depends on the manager's entrenchment strategy, the shareholders' control and the nature of the environment.

[99] The more ownership is diffuse, the less wealth of each shareholder depends on the firm's performance and the more difficult it is to control effectively, individually and directly, the behavior of the managers. Control by the board thus appears decisive (Desbrières 1997).

[100] These directors are executives or employees that hierarchically depend on the management.

[101] Outside directors serve on the BD but don't exercise any function of management within the firm. For a deeper definition see Kaplan and Minton (1994) and Charreaux (1997a).

In principle, the nature of directors, through financial and/or strategic controls[102], the plurality of functions – or otherwise - as well as the size of the BD, can influence the manager's discretionary latitude to favor R&D investment and increase the performance of French firms.

2.1.1. The dominance of inside directors, R&D investment and the firm's performance

As a proxy for corporate governance, the BD is composed of both inside and outside directors. This heterogeneity may lead to different attitudes to the accomplishment of the task of control. In principle, these directors, through the implementation of performance-evaluation systems and the type of control selected (financial and / or strategic) influence corporate strategy, particularly R&D investment. The tendency of managers to increase performance by the realization of R&D investments depends on the role played by the BD, the organ charged with representing the interests of shareholders.

In French, the functioning of the BD is contingent on the ownership structure. Charreaux and Pitol-Belin (1990) tested the existence of differences in the composition and role of the board between three types of firm: family, controlled and managerial. In family firms, the shareholders (family members) dominate the board. There are fewer outside directors and the role of control is reduced. In controlled firms, the dominant shareholders sit on the board and appoint managers and directors. Compared to the family firm's BD, there are more outside directors. In the managerial firms, the percentage of outside directors is more important than in the two other types of firm. The role of BD is most pronounced. Charreaux and Pitol-Belin (1990) found that the disciplinary role of outside directors is really important only for managerial firms, which have us dominant shareholder. The degree of control exercised by the board is inversely proportional to the degree of separation of the functions of ownership and decision.

In firms with diffuse ownership, the BD can discipline the managers through the effect of outside directors on the management decision. According to the agency theory, the latter offer greater expertise to evaluate projects and greater independence from the managers. These directors who are likely to be objective and independent decide to evaluate and reward managers based on the financial indicators. Assessments based on stock and / or accounting measurements of the performance transfer some risk to the managers (Godard 1996). The exercise of financial controls pushes managers to move towards the diversification strategy and invest less in R&D activities.

French BD's, dominated by outside directors, take the initiative to dismiss managers who realize poor performance. By assessing the managers on the basis of accounting criteria, they increase the intensity of managerial effort in favor of maximizing short-term profits. Goold and Quinn (1990) posit that controls based on financial or budgetary indicators generally focus on short-term performance. The assessment framework therefore helps to shorten the horizon for decision-making managers. It encourages them to focus on projects with immediate results and to neglect investments that determine the future of the firm.

Several studies support this reflection. Dundas and Richardson (1982), Hoskisson et al. (1989), Baysinger and Hoskisson (1990), Deutsch (1995), Ellstrand et al. (2002), Xie et al. (2003) and Zouari-Hadiji and Zouari (2010a) found that greater representation of outside directors on BD is associated with greater diversification and lower concentration of R&D activities. The argument claims that less informed outside directors (low possession of specific knowledge) do not participate in the formulation of strategies and therefore, discourage R&D investment. This leads to a short-term orientation of investment decisions and reduces the firm's performance.
In sum, a BD dominated by outsides directors reduces the performance of French firms through the realization of a diversification strategy and discourages R&D investment. Hence, the implementation of financial control by outside directors has an indirect effect on performance through the R&D investment level. We deduce the following hypothesis:

> H1: There is a negative relationship between BD dominated by external directors and the performance of French firms mediated by the R&D investment level.

[102] Financial controls are based on objective financial criteria, while strategic controls constitute a more open subjective assessment permitting the capture of the finer aspects of the action of the person responsible.

2.1.2. The dual functions, R&D investment and the firm's performance

To preserve and defend the interests of different stakeholders (including shareholders), it is necessary to examine the intervention of another characteristic of the BD in strategy: the dual functions. The tendency of managers to increase performance by making R&D investments depends on the dominant decision-making structure (separation or combination) of the country.

In French, the dual structure is relatively more frequent (Godard and Schatt 2005), awarding the CEO of the firm a greater power of decision and control. For French shareholders, the combination of the two functions can be risky, since it offers the managers the opportunity to more easily defend the projects initiated and implemented at the expense of their well-being. Recognizing the inefficiency of the BD at performing its control function[103], managers have incentive to reduce R&D investment (Kor 2006; Hadiji-Zouari and Zouari 2010a), negatively affecting the firm's performance.

In summary, a dual structure in which the CEO is also chairman of the BD negatively affects performance based on low concentration of R&D activities. Therefore, duality has an indirect effect on performance through the R&D investment level. We deduce the following hypothesis:

> H2: There is a negative relationship between a dual structure and the performance of French firms mediated by the R&D investment level.

2.1.3. The size of the board of directors, R&D investment and the firm's performance

The size of board of directors' can support or oppose the strategic decisions made by managers, depending on whether it is enlarged or reduced. As an essential element of corporate governance, the size of the BD acts on managerial latitude to encourage R&D investment, creator of value.

Researchers in corporate governance theory have generally argued that the larger BD's can offer diverse opinions, skills, expert advice and more qualified managers, reducing the uncertainty surrounding the firm's development, and therefore, improving the firm's performance. But if the BD is larger and has greater diversity, to fulfill its institutional and control functions, it can become unsuitable for taking timely strategic decisions in response to fundamental environmental changes. This contradiction is reflected by the differences in the results examining the relationship between the size of Board of directors and the firm's performance (Jensen 1993; Yermack 1996; Adams et Mehran 2005; Belkhir 2009; Dogan and Yildiz 2013).

In French, Zahra and Stanton (1988) and Conyon and Simon (1998) show that the size of the BD has a negative effect on financial performance (performance measurement oriented to shareholders: Earnings per share and dividend per share). Similarly, Jensen (1993) states that the disciplinary function is better performed by a smaller BD. It offers more efficient internal control by reducing agency conflicts between shareholders and managers; whereas a BD's enlarged size may hinder its operation. The larger the size increases, the bigger the problems of coordination and communication for its members, inducing more pronounced conflicts of interest. In this framework, Ginglinger (2002) considers that a large board multiplies the frequency of expertise but also increases the problems of stowaways and potential conflicts reducing the effectiveness of decision making. Thus, managers can pursue their own interests at the expense of shareholder's wealth (Lipton and Lorsh 1992). Rao and Lee-Sing (1995) also state that a large board is negatively correlated with the R&D expenditure level. Yermack (1996) and Eisenberg et al. (1998) also found that there is a negative and significant effect of the size of the board on the firm's performance.

Hutchinson and Gul (2004) show that the effect of governance mechanisms on the firm's performance should be examined, taking into account their specificities. This motivated us to analyze the relationship between the size of the board and performance through the mediator effect of R&D activities. Indeed, a large board could reduce the firm's value by influencing the manager's decision to invest in R&D. Thus, when the number of directors is high it could result in a negative impact on the realization of new investment opportunities, and therefore, a decrease in the firm's performance. In this sense, the R&D

[103] Because it possesses a power of influence on the board.

investment level could be considered as a mediating variable in the relationship between the size of Board of directors and the firm's performance.

H3: There is a negative relationship between a large BD and the performance of French firms mediated by the R&D investment level.

As in the foregoing, we consider three variables that determine the firm's performance through the R&D investment: the dominance of inside directors, the dual structure and the board's size. The theoretical predictions are presented in the following table.

Table 1. Summary of the main explanatory variables of the firm's performance through R&D investment

Hypotheses	Explained variables	Mediator variables	Explanatory variables	Expected signs
				FR
H1	Firm's performance	R&D Investment	Dominance of inside directors	+
H2	Firm's performance	R&D Investment	Dual structure	-
H3	Firm's performance	R&D Investment	Board's size	-

2. Empirical Analysis

This section aims to test the indirect effect of BD on the firm's performance through R&D investment. Initially, we will present our sample, the explained and explanatory variables and the method of multivariate analysis (hierarchical regression). The presentation and interpretation of the results of this study will make up a second sub-section.

2.1. Presentation of data and variables measurements

The study data come from two databases (Osiris and Thomson One Banker) and the annual reports of publicly traded French (CAC40) firms over the period 2008-2012. These firms belong to industrial, commercial, tourism, technology and service sectors. The sectional heterogeneity can establish the external validity and generality of results (Lee, 2005). The financial institutions were excluded because of their atypical behaviour in financial policy. The firms whose number of employees was less than 500 were also removed to get the most interesting theoretical plausibility[104]. For statistical analysis, we selected all the firms for which we have data on the composition of BD, R&D investment (risk and horizon) and performance, that is, 178 French firms.

Given that the return of R&D appears only in the long term (Xu and Zhang 2004), we must choose an indicator of long-term performance to study the relationship between R&D investment and firm performance. Lin and Chen (2005) point out that five years seems to be appropriate for the evaluation of the fallout of R&D strategies for the firm's performance[105]. Thus, and as in previous studies (Kothari et al. 2002; Yang et al. 2007; Karjalainen 2008; Pandit et al. 2011), we define the firm's performance by two measurements, namely the average operating return on five consecutive years (Return On Assets "ROA" = operating income before depreciation and R&D / total sales, Aboody and Lev 2000; Ding et al. 2007; Yang et al. 2007) [106] and the average stock returns (Market to Book "MTB " = market capitalization / book value of equity, Bracker and Krishnan 2011; Nekhili et al. 2012; Başgoze and Cem Sayin 2013; Pramod et al. 2013) .

[104] According to Scherer (1984), only the large firms can have the motivation and ability to develop new products and engage in R&D projects. They have the ability to hedge against the inherent risks to the activity in R&D by committing several projects simultaneously.

[105] Some authors argue that the positive effect of R&D investment on stock returns is realized over periods ranging from five to seven years (Sougiannis 1994; Lev and Sougiannis 1996; Lev and Zarowin 1998).

[106] This measurement of the accounting performance has the advantage of eliminating the effect of accounting choices related to the treatment of R&D in the financial statements largely subject to the opportunism of managers.

To measure the "R&D investment level" ("R&D")[107], we use the indicators found in the literature. It can be defined as the total expenditure on R&D divided either by the asset total (Hosono et al. 2004; Hung et al. 2006; Kor 2006; Di Vito et al. 2008), by the employees' number (Hill and Snell 1988; Graves 1988; Baysinger et al. 1991) or by the sales total of the firm (Eng and Shackell 2001; O'Neill and Lee 2003; Dutta et al 2004; Berrone et al. 2007). In this study, we chose the last measurement of the intensity of R&D. It has been widely used in previous studies. This measurement allows the standardization of the R&D investment level with respect to the firm's size.

The proportion of inside directors is a quantitative variable measured by the number of inside directors over the total number of directors. Those working in the firm and having family ties with its managers were considered inside directors (Godard and Schatt 2005; Zouari-Hadiji and Zouari 2010a).
The cumulative function of CEO and Chairman of the BD is a dichotomous variable taking the value 1 if the two functions are held by the same person and 0 if otherwise (Kor 2006; Chen et al. 2007; Zouari-Hadiji and Zouari 2010a).

The size of board of directors is measured by the number of directors who sit (Yermack 1996; Godard 1996; Godard and Schatt 2005).

For more reliable results, we introduced two control variables corresponding to the firm's size and activity sector. The firm's size is measured by the natural logarithm of the total assets of the firm (Nekhili et al. 2012; Zouari and Zouari-Hadiji 2013; Liano 2013).

The activity sector is a dummy variable taking the value 1 if firms belong to high-technology industry and 0, if otherwise (Kor (2006; Chen et al. 2007; Zouari-Hadiji and Zouari 2010a; Zouari and Zouari-Hadiji 2013).

The explanatory and control variables influence the realization of R&D investment and verify its multidimensionality. They are also distinct from each other and present, as shown in Tables 2, a low and/or non-significant correlation between them.

Table 2. Correlations matrix (French Firms) [108]

	Percentage of inside directors	Duality	Board's size	Firm's size	Activity sector
Percentage of inside directors	1,00				
Duality	0,023	1,00			
Board's size	0,241	0,006	1,00		
Firm's size	0,102	0,123	0,310	1,00	
Activity sector	0,094	0,023	0,046	0,272	1,00

[107] Knowledge of the amount of R&D expenditures is closely related to the desire of managers to publish such strategic information, and select the accounting method for these expenses (fully charged or assets). Since the adoption of IAS / IFRS, capitalization of these costs has become mandatory as soon as the requirements of IAS 38 "Intangible asset" are met. Thus, to determine the total annual expenditure on R&D, we need to know both parts of these expenses as capitalized expenditure. To collect this information, we have combined the data available in the Osiris and Thomson One database with those contained in the annual reports of firms.

[108] Note that all correlations between variables are significantly smaller than 0.6 (threshold at which we begin to experience serious problems of multi-colinearity). In the Pearson test and the index of conditioning we have found that these variables are distinct from each other and are not significant (correlation thresholds above 10% and the packaging is less than 1000).

2.2. Hypotheses modeling

We test the existence of a mediating effect by means of the hierarchical regressions method[109] for the purpose of comparing the overall effect of the variables blocks. The verification of this effect is achieved by constructing three models in which each variable constituting the BD is treated through a specifically-pertinent model.

Baron and Kenny (1986) propose four conditions to test a complete mediating effect of M in the context of an X-Y relationship depicted as follows:

- Condition (1): variable X should have a significant impact on variable Y.
- Condition (2): variable X should have a significant impact on M.
- Condition (3): The supposed-mediator variable M must significantly influence variable Y, when the influence of the variable X on Y is controlled.
- Condition (4): The significant influence of the variable X on Y must vanish when the effect of M on Y is statistically controlled.

We then distinguish four stages related to three hypotheses to affirm the existence of a mediating effect of R&D investment: (1) the BD significantly influences the firm's performance (2) the BD significantly influences the R&D investment level, (3) when the influence of R&D investment on the firm's performance is taken into account, the BD will have no significant effect on performance and finally, (4) the direct effect of BD on performance should be null or reduced by the insertion of the mediator variable (R&D investment) to deduce its mediating effect within the relationship.

Econometrically, we will estimate the models one to three testing the indirect relationship between the dominance of the inside directors on the BD and the firm's performance. These models would enable us to validate the hypothesis H_1 ($H_{1\cdot1}$, $H_{1\cdot2}$, $H_{1\cdot3}$ and $H_{1\cdot4}$).

$$(1)\ PERF_i = \beta_0 + \beta_1 ADMINT_i + \beta_2 LOGTA_i + \beta_3 SECT_i + \varepsilon_i$$
$$(2)\ R\&D_i = \beta_0 + \beta_1 ADMINT_i + \beta_2 LOGTA_i + \beta_3 SECT_i + \varepsilon_i$$
$$(3)\ PERF_i = \beta_0 + \beta_1 ADMINT_i + \beta_2 R\&D_i + \beta_3 LOGTA_i + \beta_4 SECT_i + \varepsilon_i$$

The equations four to six would test the indirect relationship between the dual structure and the firm's performance through the R&D investment effect. These equations would enable us to validate the hypothesis H_2 ($H_{2\cdot1}$, $H_{2\cdot2}$, $H_{2\cdot3}$ and $H_{2\cdot4}$).

$$(4)\ PERF_i = \beta_0 + \beta_1 DUAL_i + \beta_2 LOGTA_i + \beta_3 SECT_i + \varepsilon_i$$
$$(5)\ R\&D_i = \beta_0 + \beta_1 DUAL_i + \beta_2 LOGTA_i + \beta_3 SECT_i + \varepsilon_i$$
$$(6)\ PERF_i = \beta_0 + \beta_1 DUAL_i + \beta_2 R\&D_i + \beta_3 LOGTA_i + \beta_4 SECT_i + \varepsilon_i$$

The equations seven to nine would test the indirect relationship between the size of board of directors and the firm's performance through the R&D investment effect. These equations would enable us to validate the hypothesis H_3 ($H_{3\cdot1}$, $H_{3\cdot2}$, $H_{3\cdot3}$ and $H_{3\cdot4}$).

[109] In this work, the treatment of mediating variables should follow the approach devised by Baron and Kenny (1986). This framework, which aims at testing the mediating effect, is implemented via a multiple-hierarchical regression. This analysis consists in assessing the total effect (cumulative) of the explanatory variables on a certain criterion. The method can be performed on the basis of several steps. Firstly, it undertakes to test the predictor effect (independent variable) firstly on he criterion (dependent variable) and, secondly, on the mediator using partial and simple regressions. Then, the other relationship has to be tested (predictor and mediator on the criterion). In this case, a multiple-hierarchical regression has to be applied. It consists in gradually introducing certain independent variables into the regression-equation: starting with the predictors and control variables (Step 1), then the mediating variable (Step 2). On reaching an increase in the adjusted R^2 after inserting the mediator, one is able to assume the mediator effect on the relationship between the predictor and the criterion.

$$(7)\ PERF_i = \beta_0 + \beta_1 TAILCA_i + \beta_2 LOGTA_i + \beta_3 SECT_i + \varepsilon_i$$

$$(8)\ R\&D_i = \beta_0 + \beta_1 TAILCA_i + \beta_2 LOGTA_i + \beta_3 SECT_i + \varepsilon_i$$

$$(9)\ PERF_i = \beta_0 + \beta_1 TAILCA_i + \beta_2 R\&D_i + \beta_3 LOGTA_i + \beta_4 SECT_i + \varepsilon_i$$

with,

- **PERFi**: firm i performance measured by ROA and MTB ratios,
- **R&D$_i$** : Total expenditure on R&D / total sales of firm i,
- **ADMINT$_i$** : Number of inside directors / total number of directors of the company i,
- **DUAL$_i$** : A binary variable that takes the value 1 if the two functions of CEO and Chairman of the BD are held by the same person of firm i and 0 if otherwise,
- **TAILCA$_i$** : Number of directors who sit on the board of the firm i,
- **LOGTAi**: The natural logarithm of total assets of firm i,
- **SECT$_i$**: A binary variable which takes the value 1 if the firm i belongs to a high-tech industry sector, and 0 inversely,
- $\beta_0, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5$: Parameters to be estimated,
- ε_i : The random error,

3. Presentation and interpretation of results

This section is aimed at presenting the test results of the three hypotheses binding the BD apprehended by the dominance of inside directors, the dual structure and the size of the board to the firm's performance through the R&D investment level.

3.1. Assessing the hypotheses of the model "dominance of inside directors / R&D investment / firm's performance"

The purpose of this hypothesis is to test the mediating role of the R&D investment-level variable ("R&D") in the relationship between the dominance of inside directors ("ADMINT") and the firm's performance ("ROA" and "MTB"). To present our hypothesis, we have estimated some distinct regression-models regarding each of the four steps of the Baron and Kenny (1986) procedure.

Model 1 (reduced model) encompasses the independent variable as well as the control variables, predicting the firm's performance. As for model 2 (reduced model), it seeks to explain the variation of the variable "R&D" (a third-step mediating variable) through the variable "ADMINT" along with some control variables. Regarding model 3 (full model), it includes all the variables: the independent variable (ADMINT) and the mediating variable (R&D) together with the control variables (size and sector) in a bid to explain the firm's performance.

The relationship between the variable "ADMINT" and "ROA" shows a moderately weak explanatory power (adjusted $R^2 = 0.059$). The overall quality of the model is significantly acceptable ($F = 2.042$, $p < 10\%$, Table 3.1). It is likely that at least one of the explanatory variables brings a significant contribution amidst the overall fluctuations marking the Return On Assets (ROA). However, once performance is measured by "MTB", the concerned model turns out to have to a explanatory power (adjusted $R^2 = 0.000$) along with an insignificant Fisher's test ($F = 0.885$; $p > 10\%$). As for the Student tests, they reveal that the variable "ADMINT" has a positive and significant impact on economic performance (ß = 0.234, t = 3.179, p<1%). Indeed, this result does partially **validate** the sub-hypothesis (**$H_{1\text{-}1}$**).

Model 2 is statistically significant at a threshold of 1% and the variable "ADMINT" is positively and significantly associated with the "R&D" pertinent for French firms (ß = 0.483, t = 7.201, p < 1%, see table 3.1). Thus, the second condition of the Baron and Kenny (1986) approach is verified. These results lead to accepting the sub-hypothesis (**$H_{1\text{-}2}$**).

Table 3.1. Hierarchical-regression results of steps 1 and 2 (Models 1-2)

Variables		Step 1 Model 1				Step 2 Model 2	
		Outcome: Firm's performance				Outcome: R&D investment	
		ROA		MTB			
		ß	t	ß	t	ß	t
Control variables	LOGTA	-0,069	-0,945 n.s	0,034	0,445 n.s	-0,022	-0,336 n.s
	SECT	-0,049	-0,667 n.s	0,089	1,168 n.s	0,059	0,875 n.s
Predictor	ADMINT	0,234	3,179***	0,068	0,914 n.s	0,483	7,201***
Adjusted R^2		0,059		0,000		0,212	
F value		4,177***		0,885 n.s		17,395***	

(Thresholds: *** significant at 1 %, ** significant at 5 %, * significant at 10 %, n.s: non significant).

Table 3.2 results reveal a positive and significant relationship between the R&D investment-level ("R&D") and one of the two indicators of the firm's performance ("ROA"). So the R&D investments appear to help improve the firm's economic performance in conformity with the studies conducted by Jarrell et al. (1985), McConnell and Muscarella (1985), Chan et al. (1990), Godard (1996), Zouari-hadiji and Zouari (2013).

Model 3 (full model) helps to verify the third R&D condition mediating between the variable "ADMINT" and the firm's performance ("ROA" and "MTB"). The Tests indicate that R&D investment (as a potential mediating variable) remains significant in explaining the dependent variable (both forms of the firm's performance) after considering the predictor variable. The statistical coefficient of the variable "R&D" has had a positive and significant value relative to the ROA (ß =0.199, p < 1%) and also in respect of the MTB (ß = 0.124, p < 10%). Based on these results, the third condition proves to be, in turn, entirely fulfilled. This achievement allows supporting the sub-hypothesis **(H_{1-3})**.

The ultimate condition that needs to be verified is the effect of the predictor variable ("ADMINT") on the dependent variables ("ROA" and "MTB"), which should not be significant once the potential mediator ("R&D") has been considered. The results in Table 5.2 indicate that on monitoring the "R&D", a less important, but significant, link persists between the "ADMINT" and "ROA" (ß = 0.123, t= 1.660, p < 10%) than that reached throughout the first condition verifying the Baron and Kenny (1986) procedure. Similarly, model 3 also shows that the variable "ADMINT" is positively associated with the "MTB", although this relationship does not appear to be statistically significant (ß =0.067, t= 0.899, p > 10%). The fourth condition necessary for a variable to be considered a mediator is not entirely respected. In this case, R&D investment acts as a partial mediator between "dominance of inside directors" and "firm's performance". This result leads to supporting the partial hypothesis of the mediating effect. Thus, hypothesis **(H_{1-4})** can be accepted and, consequently, **hypothesis H1 is validated by French firms.**

Table 3.2. Hierarchical-regression results of steps 3 and 4 (Model 3)

Variables		Step 3				Step 3 & Step 4 Model 3			
		Outcome: Firm's performance				Outcome: Firm's performance			
		ROA		MTB		ROA		MTB	
		ß	t	ß	t	ß	t	ß	t
Control variables	LOGTA	0,206	2,841***	0,026	0,344 n.s	-0,071	-0,995	0,020	0,264 n.s
	SECT	-0,079	-1,094 n.s	0,087	1,157 n.s	-0,068	-0,937	0,077	1,013 n.s

Mediator	**R&D**	0,198	2,780***	0,125	1,682*	0,199	2,791***	0,124	1,670*
Predictor	**ADMINT**					0,123	1,660*	0,067	0,899 n.s
Adjusted R^2		**0,084**		**0,009**		**0,182**		**0,084**	
F value		**6,602*** **		**1,557** n.s		**11,198*** **		**5,198*** **	
Adjusted R^2 variation						**0,123**		**0,084**	

(Thresholds: *** significant at 1 %, ** significant at 5 %, * significant at 10 %, n.s: non significant).

According to Table 3.2, and regarding both measurements of performance, model 3 enables us to increase the percentage of explained variance compared to Model 1. In the case where performance is measured via "ROA", adjusted R^2 goes from 0.059 to 0.182 and the F statistic presents a more significant value at a threshold of 1%. Similarly, when performance is measured through "MTB", adjusted R^2 passes from 0.000 to 0.084 and the F statistic testifies that model 3 becomes significant compared to model 1 (a non significant model). This increase in adjusted R^2 is naturally related to taking into consideration of the mediating effect of the R&D investment level. Thus, the variation in adjusted R^2 for the two models associated with the addition of the mediating variable proves to be significant (12.3% and 8.4%). This shows that this variable appears to be an affective predictor of the dependent variable, i.e. the firm's performance.

3.2. Assessing the hypotheses of the model "dual structure / R&D investment / firm's performance"

In order to identify the mediating role of the R&D investment level, Baron and Kenny (1986) affirm, as mentioned above, that four conditions need to be checked in order to test our research hypothesis. Both models: 4 (reduced model) and 5 (reduced model), contained the independent variable (dual structure "DUAL") and the control variables while successively predicting the dependent variables, namely: firm's performance (measured by ratios "ROA" and "MTB") and innovation level ("R&D" a third-step mediating variable). As for model 6 (full model), it includes all the variables: i.e. the independent variable ("DUAL"), the mediating variable ("R&D"), the control variables (size and sector) together with the dependent variable, i.e. the firm's performance.

The test of the relationship between the variable "DUAL" and the firm's performance (measured by "ROA") shows a weak (adjusted R^2 = 0.046) and significantly acceptable explanatory power ($F = 3.012$, $p < 10\%$, Table 4.1). It is likely that at least one of the explanatory variables brings a significant contribution amidst the overall fluctuations marking the Return On Assets (ROA). However, once performance is measured by "MTB", the concerned model turns out to have us explanatory power (adjusted R^2 = 0.000) along with an insignificant Fisher's test ($F = 0.627$; $p > 10\%$). As for the Student tests, they reveal that the variable "DUAL" has a negative and significant impact on economic performance ($ß = -0.231$, $t = -3.124$, $p < 1\%$). Indeed, this result does partially **validate** the sub-hypothesis (**H_{2-1}**).

Model 5 is statistically significant at a threshold of 1% and the variable "DUAL" is negatively and significantly associated with the "R&D" for French firms ($ß = -0.481$, $t = -7.166$, $p < 1\%$, see table 4.1). Thus, the second condition of the Baron and Kenny (1986) approach is verified. These results lead to accepting the sub-hypothesis (**H_{2-2}**).

Table 4.1. Hierarchical-regression results of steps 1 and 2 (Models 4-5)

Variables		Step 1 Model 4				Step 2 Model 5	
		Outcome: Firm's performance				Outcome: R&D investment	
		ROA		MTB			
		ß	t	ß	t	ß	t
Control variables	LOGTA	0,028	0,383 n.s	0,038	0,498 n.s	-0,004	-0,063 n.s
	SECT	-0,060	-0,815 n.s	0,099	1,316 n.s	0,056	0,834 n.s
Predictor	DUAL	-0,231	-3,124***	0,019	0,258 n.s	-0,481	-7,166***
Adjusted R^2		0,046		0,000		0,211	
F value		3,012***		0,627		17,348***	

(Thresholds: *** significant at 1 %, ** significant at 5 %, * significant at 10 %, n.s: non significant).

Model 6 (full model) helps to verify the third R&D condition mediating between the variable "DUAL" and the firm's performance ("ROA" and "MTB"). The results found show that R&D investment (as a potential mediating variable) remains significant in explaining the dependent variable (one of the two forms of the firm's performance) after considering the predictor variable. The statistical coefficient of the variable "R&D" has had a positive and significant value relative to the ROA (ß =0.201, p < 1%). Based on these results, the third condition proves to be, in turn, partially fulfilled. This result allows supporting the sub-hypothesis **($H_{2\text{-}3}$)**.

The results in Table 4.2 indicate that on monitoring the "R&D", a significant link persists between the "DUAL" and "ROA" (ß = -0.210, t= -2.879, p < 1%). Thus, the variable "DUAL" is positively associated with the "MTB", although this relationship does not appear to be statistically significant (ß =0.011, t= 0.144, p > 10%). The fourth condition necessary for a variable to be considered a mediator is not entirely respected. In this case, R&D investment acts as a partial mediator between "dual structure" and "firm's performance". This result leads to supporting the partial hypothesis of mediating effect. Thus, hypothesis **($H_{2\text{-}4}$)** can be accepted and, consequently, **hypothesis H2 is validated by French firms.**

Table 4.2. Hierarchical-regression results of steps 3 and 4 (Model 6) for French firms

Variables		Step 3				Step 3 & Step 4 Model 6			
		Outcome: Firm's performance				Outcome: Firm's performance			
		ROA		MTB		ROA		MTB	
		ß	t	ß	t	ß	t	ß	t
Control variables	LOGTA	-0,079	-1,094 n.s	0,026	0,344 n.s	-0,042	-0,584 n.s	0,025	0,328 n.s
	SECT	0,206	2,841***	0,087	1,157 n.s	-0,080	-1,098 n.s	0,124	1,663*
Mediator	R&D	0,198	2,780***	0,125	1,682*	0,201	2,809***	0,087	1,155 n.s
Predictor	DUAL					-0,210	-2,879***	0,011	0,144 n.s
Adjusted R^2		0,084		0,009		0,131		0,081	
F value		6,602***		1,557 n.s		8,112***		5,019***	
Adjusted R^2 variation						0,075		0,081	

(Thresholds: *** significant at 1 %, ** significant at 5 %, * significant at 10 %, n.s: non significant).

The introduction of the mediating effect to the full model enables us to improve the model's overall significance. The inclusion of the mediating variable, R&D investment, leads to a significant increase in the explanatory power of the full model in terms of adjusted R^2 [110]. This result indicates that the weak explanatory power of the traditional governance model could be explained by the quasi absence of analysis relevant to the mediating effect of intermediary variables in the causal relationship between the corporate-governance mechanisms and the firm's performance.

3.3. Assessing the hypotheses of the model "size of the board / R&D investment / firm's performance"

For the purpose of highlighting the mediating role of R&D investment in the relationship between the size of the board ("TAILCA") and the firm's performance ("ROA" and "MTB"), the approach proposed by Baron and Kenny (1986) has been undertaken and presented in the sections below.

The relationship between the variable "TAILCA" and "ROA" shows a weak explanatory power (adjusted $R^2 = 0.045$). The overall quality of the model is significantly acceptable ($F = 3.861$, $p < 1\%$, Table 5.1). It is likely that at least one of the explanatory variables brings a significant contribution amidst the overall fluctuations marking the Return On Assets (ROA). However, once performance is measured by "MTB", the concerned model presents a very weak explanatory power (adjusted $R^2 = 0.003$) along with an insignificant Fisher's test ($F = 1.200$; $p > 10\%$). As for the Student tests, they reveal that the variable "TAILCA" has a positive and significant impact on economic performance ($ß = 0.226$; $t = 2.761$, $p < 1\%$). Indeed, this result does partially **validate** the sub-hypothesis (**H_{3-1}**).

Model 8 is statistically significant at a threshold of 1% and the variable "TAILCA" is positively and significantly associated with the "R&D" for French firms ($ß = 0.187$, $t = 2.610$, $p < 1\%$, see Table 5.1). Thus, the second condition of the Baron and Kenny (1986) approach is verified. These results lead to accepting the sub-hypothesis (**H_{3-2}**).

Table 5.1. Hierarchical-regression results of steps 1 and 2 (Models 7-8)

Variables		Step 1 Model 7				Step 2 Model 8	
		Outcome: Firm's performance				Outcome: R&D investment	
		ROA		MTB			
		ß	t	ß	t	ß	T
Control variables	LOGTA	0,005	0,063 n.s	0,088	1,058 n.s	0,397	5,453***
	SECT	-0,060	-0,814 n.s	0,113	1,490 n.s	0,032	0,487 n.s
Predictor	TAILCA	0,226	2,761***	-0,109	-1,330 n.s	0,187	2,610***
Adjusted R^2		0,045		0,003		0,240	
F value		3,861***		1,200 n.s		20,274***	

(Thresholds: *** significant at 1 %, ** significant at 5 %, * significant at 10 %, n.s: non significant).

The Tests for Model 3 (full model) indicate that R&D investment (as a potential mediating variable) remains significant in explaining the dependent variable (both forms of the firm's performance) on considering the predictor variable. The statistical coefficient of the variable "R&D" has had a positive and significant value relative to the ROA ($ß = 0.199$, $p < 1\%$) and also in respect of the MTB ($ß = 0.122$, $p < 10\%$). Based on these results, the third condition proves to be, in turn, entirely fulfilled. This result allows supporting the sub-hypothesis **(H_{3-3})**.

Table 5.2 results highlight the fact that the coefficients associated with the variable "TAILCA" are by no means statistically significant whatever the performance measurement applied, though they have been

[110] In the case where performance is measured via "ROA", adjusted R^2 goes from 0.046 to 0.131. Similarly, when performance is measured through "MTB", adjusted R^2 passes from 0.000 to 0.081. Thus, the variation in adjusted R^2 for both models associated with the addition of the mediating variable proves to be significant (7.5% and 8.1%).

statistically significant over the first step of Baron and Kenny's (1986) framework. It follows that mediation through the R&D investment level is then complete between the size of the board and the firm's performance. These results allow us to accept the sub-hypothesis (**H_{3-4}**), and consequently, **hypothesis H3 is validated by French firms.**

Table 5.2. Hierarchical-regression results of steps 3 and 4 (Model 9)

Variables		Step 3				Step 3 & Step 4 Model 9			
		Outcome: Firm's performance				Outcome: Firm's performance			
		ROA		MTB		ROA		MTB	
		ß	t	ß	t	ß	t	ß	t
Control variables	LOGTA	0,206	2,841***	0,026	0,344 n.s	0,200	2,483**	0,073	0,872 n.s
	SECT	-0,079	-1,094 n.s	0,087	1,157 n.s	-0,081	-1,101 n.s	0,100	1,326 n.s
Mediator	R&D	0,198	2,780***	0,125	1,682*	0,199	2,776***	0,122	1,645*
Predictor	TAILCA					0,012	0,149 n.s	-0,105	-1,285 n.s
Adjusted R^2		**0,084**		**0,009**		**0,115**		**0,079**	
F value		**6,602*** **		**1,557 n.s**		**7,176*** **		**4,930*** **	
Adjusted R^2 variation						**0,070**		**0,076**	

(Thresholds: *** significant at 1 %, ** significant at 5 %, * significant at 10 %, n.s: non significant).

According to Table 5.2, and regarding both measurements of performance, model 9 (full model) enables us to increase the percentage of explained variance compared to Model 7. The variation in adjusted R^2 for the two models associated with the addition of the mediating variable proves to be significant (7% and 7.6%). This shows that this variable is an effective predictor of the dependent variable, i.e. the firm's performance.

In sum, the results of this study have important implications regarding both theory and practice. On the one hand, our research provides a further contribution to existing knowledge by proposing an integrative model which allows measuring the simultaneous effect of the BD characteristics on R&D investment and performance. Mediating-variable modelling regarding the current research in corporate-governance has not yet been developed. Nevertheless, this study provides an initial response both conceptually and methodologically.

In addition, our results demonstrate that French firms prove to have interesting motives and benefits leading them to invest in R&D activities, encouraged by the desire to significantly increase their performance. Moreover, if one is to focus on the individual effects of governance mechanisms, our results suggest that theses firms would take advantage from giving great importance to the internal administrator, the non-dual structure and the size of the board. In fact, three variables seem to be positively and significantly associated with the firm's performance through the R&D investment level. The R&D mediating effect, though partial, has been demonstrated for these variables. Similarly, this study provides a further contribution to the relevant literature, given the fact that, so far, it is only the shareholder's financial contribution that has been considered, overlooking its cognitive contribution.

Conclusion

The study of the role of BD in the choice of R&D investments seems interesting for a better understanding of the mechanisms of value creation. Taking into account the director's nature and the dual structure enriches the analysis of the governance mechanism. The French example is relevant, first because of the lack of research on the topic for this country, and secondly because this kind of research can improve decision making for R&D-investment in a hybrid mode of governance.

Speaking, we have defined our approach to investment from complementary angles:

- A conceptual approach to modelling of the relationship between the three concepts, namely "BD, R&D investment and performance". Given the fact that R&D investment could act as a mediating variable for a particular variable of the BD characteristics and not for another, the assessment of such a mediating effect has been achieved through the development of a three-model framework in accordance with the number of BD variables used in this study;

- An empirical approach aiming at testing the theoretical hypotheses in the setting of French firms. This approach materialized through the study of performance in 178 French firms and permitted the testing of the totality of hypotheses that have been formulated.

All hypotheses are validated by quantitative study, which reinforces the plausibility of our model. Indeed, the hierarchical regressions indicate that the variables "dominance of inside directors", "dual structure" and "the size of the board" are pertinent in determining the mediating effect on the basis of the Baron and Kenney (1986) methodology. Indeed, taking into account the mediating variable, the R&D investment level helps to significantly improve the explanatory power of the three models "dominance of inside directors / R&D / performance", "dual structure / R&D / performance" and "the size of the board / R&D / performance". It follows that the impact of the variables related to the BD characteristics on the performance of French firms appears to be simultaneously direct and indirect. The impact turns out to be indirect through the quasi-total mediation of the "R&D investment level" variable.

Following these results which permitted us to confirm and illuminate some points of our approach or certain deductions from the theory of corporate governance, our future research will attempt to test the model in longitudinal and transverse ways in order to assess the replication (internal and/or external validity) of our theoretical corpus. It would also be interesting to extend the theoretical framework to the contributions of cognitive governance and empirically examine modeling for Tunisian firms.

References

1. Aboody D. and Lev B. (2000), Information Asymmetry, R&D and Insider Gains, *Journal of Finance*, Vol.55, pp:2747-2766.
2. Adams R.B. and Mehran H. (2005), Corporate performance, board structure and its determinants in banking industry, *Working papers of Federal Reserve Bank of New York*, p:1-42.
3. Barker V. L. and Mueller G.C. (2002), CEO Characteristics and Firm R&D Spending, *Management Science*, Vol.48, pp.782–801.
4. Baron R.M. and Kenny D.A. (1986), The moderator-mediator variable distinction in social psychological research: conceptual, strategic and statistical considerations, *Journal of Personality and Social Psychology* 51 (6), 1173-1182.
5. Başgoze P. and Cem Sayin H. (2013), The effect of R&D expenditure (investments) of firm value: case of Istanbul stock exchange, Journal of Business, Economics & Finance, Vol.2, N°3, pp:5-12.
6. Baysinger B.D. and Hoskisson R.E. (1990), The composition of boards of directors and strategic control: effects on corporate strategy, *Academy of Management Review*, Vol. 15, N°1, pp. 72-87.
7. Baysinger B.D., Kosnik R.D. and Turk T.A. (1991), Effects of Board and Ownership Structure on Corporate R&D Strategy, *Academy of Management Journal*, Vol. 34, N°1, pp: 205-214.
8. Belkhir M. (2009), Board of Directors' Size and Performance in the Banking Industry, *International Journal of Managerial Finance*, Vol. 5, N°2, pp:201-221.
9. Berrone P., Surroca J. and Tribo J.A. (2007), Do the type and number of blockholders influence R&D investments? New evidence from Spain, *Corporate Governance: An international Review*, Vol 15, n °5, pp. 828-842.

10. Bracker K. and Krishnan R. (2011), Examining the impact of research and development expenditures on Tobin's Q, Academy of Strategic Management Journal, Vol. 10, N°1.
11. Charreaux G. (1997a), Modes de contrôle des dirigeants et performance des firmes, *in Le gouvernement des entreprises, Théorie et Faits*, Charreaux, G. (éd.), Economica, pp: 17-54.
12. Charreaux G. (1997b), Vers une théorie du gouvernement des entreprises, *in Le gouvernement des entreprises, Théorie et Faits*, Charreaux, G. (éd.), Economica, pp: 421-469.
13. Charreaux G. et Pitol-Belin J-P. (1990), *Le conseil d'administration*, Vuibert Gestion.
14. Chen A., Kao L., Tsao M. and Wu C. (2007), Building a Corporate Governance Index from the Perspective of Ownership and Leadership for Firms in Taiwan, *Corporate Governance*, Vol.15, N°2, March, pp:251-261.
15. Conyon M.J. and Simon I.P. (1998), Board control, remuneration committees, and top management compensation, *Academy of Management Journal*, Vol.41, n°2, pp:146-157.
16. Desbrières P. (1997), La participation financière des salariés et ses incidences sur la performance et l'organisation interne de l'entreprise, *In* Charreaux, G. (éd.), *Le gouvernement d'entreprise*, Paris, Economica.
17. Deutsch Y. (2007), The Influence of Outside Directors' Stock- Option Compensation on Firms' R&D, *Corporate Governance*, Vol. 15, N°5, September, pp.816-827.
18. Di Vito J., Laurin C., and Bozec Y. (2008), Corporate ownership structure and innovation in Canada, *Actes du 29ème congrès de l'Association Francophone de Comptabilité, Cergy Mai.*
19. Ding Y., Stolowy H. and Tenenhaus M. (2007), R&D productivity: An international study, *Review of Accounting and Finance*, Vol. 6, n°1, pp. 86-101.
20. Doğan M. and Yildiz F. (2013), The Impact of the Board of Directors' Size on the Bank's Performance: Evidence from Turkey, *European Journal of Business and Management*, Vol.5, No.6, p:130-140.
21. Dundas K.N.M. and Richardson P.R. (1982), Implementing the Unrelated Product Strategy, *Strategic Management Journal*, Vol.3, pp.287-301.
22. Dutta S., Kumar U., Kumar D. and Zhu P. (2004), Determinants of corporate R&D intensity: Canadian evidence, *32nd Annual Administrative Sciences Association of Canada Conference*, ASAC Quebec, 2004.
23. Eisenberg T., Sundgren S. and Wells M.T. (1998), Larger board size and decreasing firm value in small firms, *Journal of Financial Economics*, Vol. 48, pp:35–54.
24. Ellstrand A., Tihanyi L. and Johnson, J. (2002), Board Structure and International Political Risk, *Academy of Management Journal*, Vol.45, N°4, pp:769–777.
25. Eng L.L. and Shackell M. (2001), The implications of long term performance plans and institutional ownership for firm's research and development expenses, *Journal of Accounting Auditing and Finance*, Vol. 16, n°2, pp. 117-139.
26. Fama E. F. (1980), Agency Problems and the Theory of the Firm, *Journal of Political Economy*, Vol.88, N°2, April, pp:288-307.
27. Fama E.F. and Jensen M.C. (1983a), Agency Problems and Residual Claims, *Journal of Law and Economics*, Vol. 26, June, pp: 327-350.
28. Fama, E.F. and Jensen M.C. (1983b), Separation of Ownership and Control, *Journal of Law and Economics*, vol. 26, June, pp: 301-326.
29. Finkelstein S. and Boyd B. (1998), How Much Does the CEO Matter? The role of managerial discretion in the setting of CEO compensation, *Academy of Management Journal*, Vol.41, pp.179–199.
30. Gani L. and Jermias J. (2006), Investigating the effect of board independence on performance across different strategies, *The International Journal of Accounting*, Vol. 41, pp:295–314.
31. Ginglinger E. (2002), L'actionnaire contrôleur, *Revue Française de Gestion*, Vol.28, n°141, pp:37-56.
32. Godard L. (1996), *Conseil d'Administration, Stratégie et Performance Financière*, Thèse de Doctorat en Sciences de Gestion (finance), IAE Dijon, Université de Bourgogne.
33. Godard L. et Schatt A. (2005), Caractéristiques et fonctionnement des conseils d'administration français : Un état des lieux, *Revue Française de Gestion*, Vol 31, pp:69-87.
34. Goel R.K. and Ram R. (2001), Irreversibility of R&D Investment and The Adverse Effect of Uncertainty: Evidence from the OECD Countries, *Economics Letters*, Vol.71, pp.287-291.
35. Goold M. and Quinn J.J. (1990), The Paradox of Strategic Controls, *Strategic Management Journal*, vol. 11, n°1, Janvier, p:43-57.
36. Graves S.B. (1988), Institutional ownership and corporate R&D in the computer industry, *Academy of Management Journal*, Vol. 31, n°2, pp. 417-428.

37. Hill C.W.L. and Snell S.A. (1988), External control, Corporate strategy and Firm performance in research intensive industries, *Strategic Management Journal*, Vol.9, pp:577-590.
38. Hoskisson R.E., Hitt, M.A. and Hill, C.W.L. (1989), *Managerial incentives and investment in R&D in large multiproducts firms*, Unpublished manuscript, Texas A&M University, Department of Management.
39. Hosono K., Tomiyama M. and Miyagawa T. (2004), Corporate Governance and Research and Development: Evidence from Japan, *Economic of Innovation and New Technology*, Vol.13, N°2, March, pp:141-164.
40. Hung S.C., Lee Y. and Lin B.W. (2006), R&D intensity and commercialization orientation effects on financial performance, *Journal of Business Research*, Vol. 59, n°6, pp. 679-685.
41. Hutchinson M. and Gul F.A. (2004), Investment opportunity set, corporate governance practices and firm performance, *Journal of Corporate Finance*, Vol.10, pp:595-614.
42. Jensen M.C. (1993), The Modern Industrial Revolution, Exit and the Failure of Internal Control Systems, *The Journal of Finance*, Vol. XLVIII, N°3, pp:831-880.
43. Jensen M.C. and Meckling W.H. (1976), Theory of the Firm: Managerial Behavior, Agency Costs, and Ownership Structure, *Journal of Financial Economics*, Vol. 3, N°4, Octobre, pp:. 305-360.
44. Kaplan S. and Minton B. (1994), Outside Intervention in Japanese Companies: its Determinants and its Implications for Managers, *Journal of Financial Economics*, Vol. 36, N°2, pp: 225-258.
45. Karjalainen P. (2008), R&D investments: The effects of different financial environments on firm profitability, *Journal of Multinational Financial Management*, Vol. 18, n°2, pp. 79-93.
46. Kor Y.Y. (2006), Direct and Interaction Effects of Top Management Team and Boards Compositions on R&D Investment Strategy, *Strategic Management Journal*, Vol.27, N°5, pp:1081-1099.
47. Kothari S. P., Laguerre T.E. and Leone A.J. (2002), Capitalization versus expensing: Evidence on the uncertainty of future earnings from capital expenditure versus R&D outlays, *Review of Accounting Studies*, Vol. 7, n°4, pp. 355-382.
48. Laverty K. J. (1996), Economic Short-Termism: The Debate, the Unresolved Issues, and the Implications for Management Practice and Research, *Academy of Management Review*, Vol.21, July, pp.825–860.
49. Le S.A., Walters B. and Kroll M. (2006), The moderating effects of external monitors on the relationship between R&D spending and firm performance, *Journal of Business Research* vol. 59, pp:278-287.
50. Lee P.M. (2005), A Comparison of Ownership Structures and Innovations of US and Japanese Firms, *Managerial and Decision Economics*, Vol.26, pp:39–50.
51. Lee P.M. and O'Neill H.M. (2003), Ownership Structures and R&D Investments of US and Japanese Firms: Agency and Stewardship Perspectives, *Academy of Management Journal*, Vol.46, N°2, pp:212–225.
52. Lev B. and Sougiannis T. (1996), The capitalization, amortization, and value-relevance of R&D, *Journal of Accounting and Economics*, Vol. 21, n°1, pp.107-138.
53. Lev B. and Zarowin P. (1998), The market valuation of R&D expenditures, *Working paper, New York Stern University*.
54. Liano, C.H. (2013), R&D Performance and Credit ratings, *Journal of Accounting, Finance and Economics*, Vol. 3. No. 2, pp. 53 -71
55. Lin B. W.and Chen J.S. (2005), Corporate Technology Portfolios and R&D Performance Measures: A Study of Technology Intensive Firms, *R&D Management*, Vol. 35, n°2, pp. 157-170.
56. Lipton M. and Lorsh J. (1992), A Modest Proposal for Improved Corporate Governance, *Business Lawyer*, Vol. 48, pp:59-77.
57. Lorsch J.W. and MacIver E. (1989), *Pawns or Potentates: the Reality of America's Corporate Boards*. Harvard Bubiness School, Boston.
58. Nekhili M., Boubaker S and Lakhal F. (2012), Ownership Structure, Voluntary R&D Disclosure and Market Value of Firms: The French Case, International Journal of Business, Vol. 17, N°2, pp:126-140.
59. Pandit S., Wasley C.E and Zach T. (2011), The effect of R&D inputs and outputs on the relation between the uncertainty of future operating performance and R&D expenditures, *Journal of Accounting, Auditing and Finance*, Vol. 26, pp:121-144.
60. Pramod K.N., Narayanan K. and Padhi P. (2013), R&D intensity and market valuation of firm: a study of R&D incurring manufacturing firms in India, MPRA Paper No. 37299.
61. Rao P.S and Lee-Sing C.R. (1995), Les structures de régie, la prise de décision et le rendement des firmes en Amérique de nord, *Finance, Economie et Comptabilité*, Vol. 5, pp:27-45.

62. Ryan H.E. and Wiggins R.A. (2002), The Interactions Between R&D: Investment decisions and Compensation Policy, *Financial Management*, Vol.31, pp.5–30.
63. Scherer F.M. (1984), Innovation and Growth: Schumpeterian Perspectives. MIT Press, Cambridge, MA.
64. Sougiannis T. (1994), The accounting based valuation of corporate R&D, *The Accounting Review*, Vol. 69, n° 1, pp. 44-68.
65. Tihanyi L., Johnson R.A., Hoskisson R.E. and Hitt M.A. (2003), Institutional Ownership Differences and International Diversification: The Effect of Board Directors and Technological Opportunity, *Academy of Management Journal*, Vol.46, pp.195–211.
66. Xie X., O'Neill H. and Cardinal L. (2003), Boards as Agents of Innovation: How Board Characteristics Affect R&D Intensity and R&D Performance in Research Intensive Firms, *Paper Presented at Academy of Management Annual Meeting*, Seattle, WA.
67. Xu M. and Zhang C. (2004), The Explanatory Power of R&D for the Cross-Section of Stock Returns: Japan 1985–2000, *Pacific-Basin Finance Journal*, Vol. 12, pp: 245– 269.
68. Yang Y.W., Searcy D.W.L. and Tatum K.W. (2007), The role of corporate governance on long-term financial performance and market valuation of R&D investments in the biotechnology industry, *Working paper, Proceedings of the Midyear Conference of the, Auditing Section of the American Accounting Association , January, 11-13, 2007*.
69. Yermack D. (1996), Higher market valuation of companies with a small board of directors, *Journal of Financial Economics*, Vol.40, pp:185–212.
70. Zahra S.A. and Stanton W.W. (1988), The implications of Board of Directors' Composition for Corporate Strategy and performance, *International Journal of Management*, Vol.5, N°2, pp:229-236.
71. Zouari G. and Zouari-Hadiji R. (2013), Ownership Structure, Innovation and Firm Performance: Evidence From Tunisia, *International Journal of Governance*, Vol.3, N°2, September, pp:79-107.
72. Zouari-Hadiji R. and Zouari G. (2010a), Internal Governance Systems and R&D Investment: An International Comparison, *Corporate Board: Role, Duties & Composition*, Vol. 6, N°1, p:39-56.
73. Zouari-Hadiji R. and Zouari G. (2010b), Institutional Investors and R&D Investment: an International Comparison, *Corporate Ownership & Control*, Vol. 7, N°3, p: 43-55, Spring.