DIRECTORS' BOARD, R&D INVESTMENT AND FIRM'S PERFORMANCE: EVIDENCE FROM FRANCE

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Abstract

This research examines the relationship between the board of directors and firm's performance through the R&D investment-level in the French context from perspectives of corporate governance. Our model seeks to identify 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 board size, and secondly, the performance. The 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 relationship between boards composition linked variables and the firm performance are meditated by the firm R&D investment-level.

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

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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 firm performance by ignoring the indirect relationship between these two variables, excluding studies of Hutchinson and Gul (2004), Gani and Jermias (2006) and Le et al. (2006). These authors show the moderating role of governance mechanisms on the relationship between R&D investment and performance. According to them, the firm 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 realization of the performance. And given the shareholder delegates the investment decision rights to a manager, it creates agency relationships, sources of interest conflicts and agency costs (Jensen and Meckling, 1976). These agency problems are even more pronounced than the investment relates to activities in R&D (Baysinger et al 1991; Lee 2005; Tihanyi et al 2003), because they are risky (Baysinger et al 1991; Finkelstein and Boyd 1998; Barker and Mueller 2002), have a 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 behavior 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 stkeholders, 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)[1], the BD plays an important role in resolving conflicts of interest and orienting behavior of managers to investments in R&D. Most work on the relationship between corporate governance systems[2] and R&D investment are

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

[2] 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-nippen system). These two forms of financing are two alternative systems of corporate governance in which interest conflict between shareholders and managers is more or

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 confirm in part the role played by the BD in reducing conflicts of interests between stakeholders, and therefore adoption of R&D projects.

Based on the corporate governance theory, we intend to justify the theoretical associating 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 the performance turns out to be 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 such an internal governance mechanism and performance.

Thus, one might well wonder whether the corporate governance theories, using the R&D investment variable as a detecting assessment measurement of growth opportunities, can well explain the firm 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 performance. As for the second empirical section, it aims at testing the R&D investment-level's potential effect as a mediator between the BD and performance, in three separate models (one model for each BD component).

1 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 role 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[3]. It appears even more important that the degree of ownership and decision separation is emphasized[4]. 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 depends in part 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)[5] and outside directors (outsiders)[6]. As the legal representatives of shareholders, outside directors are supposed to be more independent and more competent than inside directors to exercise more effective control over managers.
It seems a priori that the nature of directors, through financial and/or strategic controls[7], the heap 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.

1.1 The dominance of inside directors, R&D investment and firm performance

As a proxy for corporate governance, the BD is composed of both insides and outsides directors. This heterogeneity may lead to different attitudes to accomplish the task of control. It seems a priori that its directors, through the implementation of performance evaluation systems and the type of control selected

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".
[3] Godard (1996) demonstrates that the relationship between BD, strategy and financial performance depend on the manager's entrenchment strategy, controlling shareholders and the environment nature.
[4] Ownership is more diffuse, less the wealth of each shareholder depends on the firm performance and more difficult it is to control effectively, individually and directly, the behavior of their managers. The control by the board thus appears determinant (Desbrières, 1997).
[5] These directors are firm executives or employees that depend hierarchically on the management.
[6] 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).
[7] 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.

(financial and / or strategic), influence corporate strategy, particularly R&D investment. The tendency of managers to increase performance by realization of R&D investments depends on the role played by the BD, organ charged with representing the interests of shareholders,

In France, 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 control role is reduced. In controlled firms, controlling shareholders sit on the board and appoint managers and directors. Compared to the family firm BD, there are more outside directors. In the managerial firms, the percentage of outside directors is more important than the other two 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, without dominant shareholder. The degree of control exercised by the board is inversely proportional to the degree of ownership and decision separation.

In firms with diffuse ownership, the BD can discipline the managers through the effects 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 are likely to be objective and independent, decided to evaluate and reward managers based on financial indicators. Assessments based on stock and / or accounting measurements of the performance transfer some risk to managers (Godard, 1996). The exercise of financial controls led managers to move towards diversification strategy and invest less in R&D activities.

French's BD, dominated by outside directors, take the initiative to dismiss managers who realize poor performance. In 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 the controls based on financial or budgetary indicators generally focus on short-term performance. The assessment framework therefore helps to shorten the horizon of decision-making managers. It encourages them to focus on projects with immediate results and making investments that will 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 in BD is associated with greater diversification and a lower concentration of R&D activities. The argument claims that outside directors less informed (low possession of specific knowledge) do not participate in the formulation of strategies and discourage, therefore, R&D investment. This leads to a short-term orientation of investment decisions and reduces the firm performance.

In sum, BD dominated by outsides directors reduces the performance of French firms through the realization of a diversification strategy and discourage 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. This relationship is mediated by the R&D investment-level.

1.2 The dual functions, R&D investment and firm 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 France, the dual structure is relatively more frequent (Godard and Schatt, 2005) awarding the CEO a greater power of decision and control in the firm. For French shareholders, the combination of the two functions can be risky, since it offers the opportunity for managers 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[8], managers have an incentive to reduce R&D investment (Kor 2006; Hadiji-Zouari and Zouari 2010a), negatively affecting the firm performance.

In summary, a dual structure in which the CEO is also chairman of the BD negatively affects the performance based on low concentration of R&D activities. Therefore, the 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. This relationship is mediated by the R&D investment-level.

1.3 The board of directors' size, R&D investment and firm performance

The board of directors' size can support or oppose the strategic decisions made by managers, as it is enlarged or reduced. An essential element of corporate governance, the BD' size acts on managerial latitude to encourage R&D investments, create value.

Researchers in the corporate governance theory have generally argued that the greatest BD can offer diverse opinions, skills, expert advice and more qualified managers reducing uncertainty surrounding the firm development, and therefore, improving the firm performance. Whereas the BD is larger and have greater diversity, to better fulfill their institutional and control functions, they can become unsuitable, not to take timely strategic decisions in response to fundamental environmental changes. This contradiction is reflected in the differences of the results examining the relationship between the Board of directors' size and the firm performance (Jensen 1993; Yermack 1996; Adams et Mehran 2005; Belkhir 2009; Dogan and Yildiz 2013).

In France, Zahra and Stanton (1988) and Conyon and Simon (1998) show that the BD' size has a negative effect on financial performance (performance measurement oriented shareholders: Earnings per share and dividend per share). Similarly, Jensen (1993) states that the disciplinary function is better performed by a BD' smaller. It has a more efficient internal control by reducing agency conflicts between shareholders and managers. Whereas a BD enlarged size may hinder its operation. Larger the size increases, the problems of coordination and communication of its members amplify inducing conflicts of interest more pronounced. In this framework, Ginglinger (2002) considers a large board multiplies the frequency of expertise but also increases the problem of stowaways and potential conflicts reducing the effectiveness of decision making. Thus, managers can pursue their own interests at the expense of shareholder 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 board size on firm performance.

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

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

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

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

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

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

2 Empirical analysis

This section aims to test the indirect effect of BD on firm 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 results of this study will make up a second section.

2.1 Presentation of data and variables measurements

The study data come from two databases (Osiris and Thomson One Banker) and 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). Financial institutions were excluded because of their atypical behaviour in financial policy. Firms whose number of employees was less than 500 were also removed to make the most interesting theoretical plausibility[9]. We selected all firms for which we have data on the composition of BD, R&D investment (risk and horizon) and the performance, that is, 178 French firms for statistical analysis.

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 for the 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 fallout R&D strategies for firm performance[10]. Thus, and as in previous studies (Kothari et al 2002; Yang et al 2007; Karjalainen 2008; Pandit et al 2011), we define the firm performance by two measures, 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) [11] 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.).

To measure the "R&D investment-level" ("R&D")[12], we use the indicators found in the literature. It can be defined as the total expenditure on R & D divided by either asset's total (Hosono et al 2004; Hung et al 2006; Kor 2006; Di Vito et al 2008), or 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 latter measure of the intensity of R & D that has been widely used in previous studies. This measurement allows standardizing the R&D investment-level in with respect to the firm size.

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

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

[11] This measurement of 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.

[12] 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 of these expenditures (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 the part of these expensed as capitalized expenditures. 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.

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. This measurement has been used by several previous researches, we cite as an example Kor (2006), Chen et al. (2007) and Zouari-Hadiji and Zouari (2010a).

The board of directors' size is measured by the number of directors who sit. This measurement was also used by Yermack (1996), Godard (1996) and Godard Schatt (2005).

For more reliable results, we introduced two control variables corresponding to the firm size and activity sector. The firm size is measured by the natural logarithm of total assets of the firm. This measure has been used in several studies such as Nekhili et al. (2012), Zouari and Zouari-Hadiji (2013) and Liano (2013).

The activity sector is a dummy variable taking the value 1 if firms belong to a high-technology industry and 0 otherwise. This measurement has been used by several studies such as Kor (2006), Chen et al. (2007), Zouari-Hadiji and Zouari (2010a) and 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 Table 2, a low and/or not significant correlation between them.

Table 2. Correlations matrix (French Firms) [13]

	Percentage of inside directors	Duality	Firm size	Activity sector
Percentage of inside directors	1,00			
Duality	0,023	1,00		
Firm size	0,102	0,123	1,00	
Activity sector	0,094	0,023	0,272	1,00

2.2 Hypotheses modeling

We undertake to test the existence of a mediating effect by means of the hierarchical regressions method[14] for the purpose of comparing the overall effect of the variables blocks. As far the check of this effect, it is achieved by constructing three models in which each BD constituent variable is treated through a specifically-pertinent model.

Baron and Kenny (1986) have proposed four conditions relevant 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.

[13] 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).

[14] In this work, the treatment of mediating variables should follow the approach as 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's 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 into the regression-equation certain independent variables: 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's effect on the relationship between the predictor and the criterion.

• Condition (3): The mediator-supposed variable M must significantly influence variable Y, when 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 influences significantly and positively the R&D investment-level, (2) the R&D investment-level influences significantly and positively the firm performance, (3) when the influence of R&D investment on firm performance is taken into account, the BD will have no significant effect on the 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 dominance of inside directors on the BD and firm performance. These models would enable to validate the hypothesis H_1 ($H_{1.1}$, $H_{1.2}$, $H_{1.3}$ and $H_{1.4}$), and their formulations are:

$$PERF_i = \beta_0 + \beta_1 ADMINT_i + \beta_2 LOGTA_i + \beta_3 SECT_i + \varepsilon_i \quad (1)$$

$$R\&D_i = \beta_0 + \beta_1 ADMINT_i + \beta_2 LOGTA_i + \beta_3 SECT_i + \varepsilon_i \quad (2)$$

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

As for the equations four to six, they would test the indirect relationship between dual structure and firm performance through the R&D investment effect. These equations would enable to validate the hypothesis H_2 ($H_{2.1}$, $H_{2.2}$, $H_{2.3}$ and $H_{2.4}$) and are formulated as follows:

$$PERF_i = \beta_0 + \beta_1 DUAL_i + \beta_2 LOGTA_i + \beta_3 SECT_i + \varepsilon_i \quad (4)$$

$$R\&D_i = \beta_0 + \beta_1 DUAL_i + \beta_2 LOGTA_i + \beta_3 SECT_i + \varepsilon_i \quad (5)$$

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

Regarding the equations seven to nine, they should test the indirect relationship prevailing between the board size and firm performance through R&D investment. These equations would enable to validate the hypothesis H_3 ($H_{3.1}$, $H_{3.2}$, $H_{3.3}$ and $H_{3.4}$), whose formulations are:

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

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

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

with,
PERFi: firm i performance measured by ROA and MTB ratios,
$ADMINT_i$: Number of inside directors / total number of directors of the company i,
$R\&D_i$: Total expenditure on R & D / total sales of firm 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.

2.3 Results' presentation and interpretation

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

2.3.1 Assessing the model hypotheses "dominance of insides directors / R&D investment / firm 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 insides directors ("ADMINT") and firm performance ("ROA" and "MTB"). To expose 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 firm 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 englobes all the variables: the independent variable (ADMINT), the mediating variable (R&D) together with the control variables (size and sector) in a bid to explain the firm 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 haven't 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 that the variable "ADMINT" is positively and significantly associated with the "R&D" pertinent to 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 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 reveals a positive and significant relationship between the R&D investment-level ("R&D") and one of the indicators both of the firm-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) checks to verify the third R&D condition mediating between the variable "ADMINT" and firm 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 firm 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 = 0.124, p < 10%). Based on these achieved 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 indicates that on monitoring the "R&D", that 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 performance". This result leads to support the mediating-effect partial hypothesis. Thus, hypothesis (H_{1-4}) can be accepted and, consequently, the hypothesis H1 turns out to be valid 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 performance				Outcome: Firm 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 R²		0,084		0,009		0,182		0,084	
F value		6,602***		1,557 n.s		11,198***		5,198***	
Adjusted R² 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 enable to increase the percentage of explained variance compared to Model 1. In the case where performance is measured via "ROA", adjusted R² 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 R² passes from 0.000 to 0.084 and the F statistic testifies that model 3 turns out to be significant as to model 1 (a non significant model). This increase in adjusted R² is naturally related to the consideration of the R&D investment-level's mediating effect. Thus, the variation in adjusted R² for both 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. firm performance.

2.3.2 Assessing the model hypotheses "dual structure / R&D investment / firm performance"

For the sake of identifying the mediating role of 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") along with the control variables while predicting the successive dependent variables, namely: firm 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. firm performance.

The relationship test between the variable "DUAL" and firm performance (measured by "ROA") shows a weak explanatory power (adjusted $R^2 = 0.046$) and significantly acceptable ($F = 3.012$, $p < 10\%$, 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 haven't a 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_{1-1}).

Model 5 is statistically significant at a threshold of 1% and that the variable "DUAL" is negatively and significantly associated with the "R&D" pertinent to 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_{1-2}).

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 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) is check to verify the third R&D condition mediating between the variable "DUAL" and firm 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 both forms of firm 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 $= 0.201$, $p < 1\%$). Based on these achieved results, the third condition proves to be, in turn, partially fulfilled. This achievement allows supporting the sub-hypothesis (H_{1-3}).

The results in Table 4.2 indicates that on monitoring the "R&D", that 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 performance". This result leads to support the mediating-effect partial hypothesis. Thus, hypothesis (H_{1-4}) can be accepted and, consequently, the hypothesis H1 turns out to be valid by French firms.

The introduction of the mediating effect in the full model enables 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 [(15)]. This result indicates that the weak

[15] 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%).

explanatory power of the governance-traditional 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 firm performance.

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 performance				Outcome: Firm 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

2.3.3 Assessing the model hypotheses "board size / R&D investment / firm performance"

For the purpose of highlighting the R&D investment's mediating role in the relationship between the board size ("TAILCA") and firm 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 turns out to have 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 ($H_{1\text{-}1}$).

Model 8 is statistically significant at a threshold of 1% and that the variable "TAILCA" is positively and significantly associated with the "R&D" pertinent to 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 ($H_{1\text{-}2}$).

The Tests Model 3 (full model) indicate that R&D investment (as a potential mediating variable) remains significant in explaining the dependent variable (both forms of firm 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 $= 0.122$, $p <$ à 10%). Based on these achieved results, the third condition proves to be, in turn, entirely fulfilled. This achievement allows supporting the sub-hypothesis ($H_{1\text{-}3}$).

Table 5.2 depicted results highlight that the variable "TAILCA" -associated coefficients are by no means statistically significant whatever the performance measure applied, though they have been 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 board size and firm performance. These results allow us to accept the sub-hypothesis ($H_{1\text{-}4}$), and consequently, hypothesis H1 is validated by French firms.

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 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 R²		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

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

Variables		Step 3				Step 3 & Step 4 Model 9			
		Outcome: Firm performance				Outcome: Firm 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 R²		0,084		0,009		0,115		0,079	
F value		6,602***		1,557 n.s		7,176***		4,930***	
Adjusted R² 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) enable to increase the percentage of explained variance compared to Model 7. The variation in adjusted R² for both models associated with the addition of the mediating variable proves to be significant (7% and 7.6%). This shows that this variable appears to be an affective predictor of the dependent variable i.e. firm performance.

In general, the present study achieved results prove to have important implications regarding both the theoretical as well as practical levels. On the one hand, our research provides a further contribution to the 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 corporate-governance related research has not been developed, yet. Nevertheless, this study provides an initial early-stage response to both conceptual and methodological levels.

In addition, our results demonstrate that French firms prove to have interesting motives and benefits leading them to invest in R&D activities, enhanced 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 in attaching great importance to the internal administrator, the non-dual structure and the board size. In fact, three variables seem to be positively and significantly associated with firm performance through the R&D investment-level. The R&D mediating effect, though partial, has been demonstrated and proven 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 exclusively been considered, overlooking its cognitive contribution.

3 Conclusion

The study of the role of BD in the choice of R&D-investments in seems interesting to better understand 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 hind of research can improve decision making for R&D-investment in a hybrid mode of governance.

Globally speaking, we have defined our approach to investment based from complementary angles:

- A conceptual approach to model the relationship between the three concepts, namely "BD, R&D investment and performance". Given the fact that R&D investment that could act as a mediating variable for a particular BD characteristics pertinent variable and not for another, the assessing such a mediating effect has been achieved by 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 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, hierarchical regressions indicate that the variables "dominance of inside directors", "dual structure" and "board size" turns out to be exclusively relevant in determining the mediating effect on the basis of the Baron and Kenney (1986) devised methodology. Indeed, taking into account the mediating variable, R&D investment-level proves to significantly improve the explanatory power of three models pertaining to the "dominance of inside directors / R&D / performance", "dual structure / R&D / performance" and to "board size / R&D / performance". It follows that the impact of variables related of the BD characteristics on U.S, Japanese and French firms' performance appears to be simultaneously direct and indirect. Actually, 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 organizational architecture, 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 for the contributions of cognitive governance and examine empirically modeling with 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.