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The impact of corporate governance practices on R&D intensities of firms: An econometric study on French largest companies*

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Abstract

Surveyed empirical studies on the influence of corporate governance on innovation tend to focus on specific dimensions of shareholders or boards. Their findings are mixed and inconclusive. We thus present a very recent number of papers that depart from board or shareholders' characteristics, to focus on governance practices.

Our empirical contribution uses a set of ratings given by experts and focuses on corporate governance practices with a sample of 6623 firms belonging to 110 large French groups. The relation between governance practices and R&D intensity, implementing different indexes and methods in order to improve the robustness of our results, is investigated in cross-section. We find that firms with governance practices that are shaped in order to defend shareholders' rights are more R&D intensive. The highest the shareholder is taken into consideration by managers, the highest the R&D intensity will be. A second result suggests more surprisingly that the effect is non linear: whether the firms take care of their shareholders seriously or moderately has no differentiated impact on R&D expenditure. However, firms with fewer democratic practices are more likely to be less R&D intensive. This paper also investigates so called deficiencies in shareholder protection in Continental European systems compared to Anglo-Saxon systems. A significant difference in R&D intensity is found between French group listed only in France and French groups listed in New-York or London. The last result suggests that the impact of national systems of corporate governance on R&D and innovation may be strong; reinforcing the impact on R&D of the different applied governance practices. Further investigations show, however, that it is very difficult to identify what the best governance practices are, regarding the R&D expenditures. Provisions implemented at the board level are however found positively related to R&D intensity. Finally, our results also suggest that sample selection matters in this kind of empirical literature.

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1. INTRODUCTION

For many years, the economics of innovation has tried to identify what the determinants of R&D investments are. The influence of corporate governance is, however, not usually considered by economists working on individual data despite repeated investigations made by the management literature. Recent empirical economic papers rather focus on incentive schemes that could be applied to researchers (Cockburn *et al.*, 2000) or to employees (Foss & Laursen, 2005) when theoretical models use a principal-agent theory (see Holmström, 1989). However, principal-agent conflicts, and the related incentive issues, can be considered at the corporate level. The researchers can have their own goals that do not fit the risk averse top managers' objectives; these top managers can get decisions at odds with their board when the last does not represent the stockholders strategy. Following the management literature, R&D incentives can thus be considered in a global view where the governance encompasses the different policies and provisions implemented in a firm including researcher but also managers, the board and even stockholders (Aghion, Dewatripont and Rey, 1997). The issue is not restricted to the agency theory since more collective views of governance can be found in the literature through the stewardship theory (Davis *et al.*, 1997) or even few papers dealing with the evolutionist theory of the firm trying to assimilate the motivational dimensions (for example, Cohendet & Llerena, 2003).

Beside the lack of a unified theory of governance, another problem is a lack of data and empirical verifications. For empirical economists working on innovation, the very recent raise of corporate governance as hot topics in economics facilitates however the availability of datasets that are publicly or privately managed.

The purpose of the present paper is to examine the influence of corporate governance practices on the R&D investments. In the surveyed corporate governance literature dealing or not with R&D or innovation, three main hampering factors are likely to be found. The first one is that corporate governance practices may be not applied. Secondly, in large differentiated groups, R&D investments or innovative processes, even collective, may happen at the corporate level but also in a decentralised manner at the firm level. Finally, thanks to data scarcity, claimed differences in national systems of governance are hardly considered even for globalized companies. This paper try to avoid several of these difficulties: we considered the influence of applied practices on R&D, at the firm level taking care for differentiated activities, sample selection, as well as national corporate governance systems.

Section II reviews the previous empirical works on the relation between corporate governance and R&D. It shows the variety and the volatility of the empirical literature in the field based on ownership or board characteristics. Section III deals with the more recent academic production that investigates the different practices implemented within a group in order to improve the alignment with shareholders. Section IV deals with the different data sources and describes the different available provisions. Our governance data are provided by a French rating agency. As in Gompers (2003) a governance index is computed but practices are here based on scores given by experts: we distinguish 19 distinct corporate governance practices for large firms belonging to 110 groups included in 2000 in the French SBF120 stock index. A general index is computed as a simple mean of scores whereas sub-indexes are also constructed, separating governance policy from governance implementation or results.

The econometric model is presented in section V. We list here several difficulties as well as the strategies to overcome the different problems. This paper applies governance to the different firms belonging to the French groups. Doing this, we can get a more realistic view of R&D expenditures that are not always decided at the top level. We try to control the rank of firms in groups in order to explore how the different governance practices impact R&D expenditures. Furthermore, since there is a lot of volatility in the results on governance, we try to investigate the robustness of the results introducing three different strategies: the use of discrete, rather than continuous, indexes to test the robustness of rates given by experts; the computation of clusters of governance practices that are often correlated; the introduction of a sample selection equation to deal with usual restricted sample.

Our results are presented in section VI. Descriptive statistics show the main differences between the different sets of firms and groups. The cross-section regressions suggest that governance practices induce different R&D investment decisions by managers. The higher the shareholder is taken into consideration by the managers, the highest the R&D investments will be. A second result is that the effect is non linear: firms may take care seriously or moderately of their shareholders, the differences in R&D expenditures will be null. Consequently, firms with few democratic practices are more likely to be less R&D intensive. A significant difference in R&D intensity is found also between French group listed in only in France and the groups that are listed in New-York or London. The result suggests that the impact of national systems of corporate governance on R&D and innovation may be strong. Further investigations show that it is very difficult to identify what are the best governance practices regarding the R&D expenditures. Provisions implemented at the board level (for example, the separation between the position of general manager and chairman of the board) are found to be the only one positively and robustly related to R&D intensity. The impact of governance practices is also found stronger for firms close to their headquarters. The hypothesis that compensation provisions for example could have an impact on decentralised managers is not supported. Finally, sample selection may be also a serious problem in this literature rather focused on large groups. A Section VII concludes the paper.

2. CORPORATE CONTROL AND R&D: EMPIRICAL BACKGROUND

2.1 Ownership structures and R&D

Thanks to Shleifer & Vishny (1997), large shareholders have strong incentives in profit maximization and enough control over the assets of the firm to put pressure on managers to have their interest respected and risky projects maintained. Two aspects are usually considered in the empirical literature: a first set of papers deals with the impact of ownership concentration on R&D and innovation; a second set focuses on the identity of the owners and the R&D differentiated strategies adopted.

Ownership concentration as an explanatory variable of R&D investment or R&D intensity is the simplest way to test empirically the idea that the higher the stockholding concentration is, the easier it is to reduce information asymmetries between insiders and outsiders. No robust results are however available : the relation is found either positive (Hosono *et al.*, 2004; Baysinger *et al.*, 1991; Hill and Snell, 1988; Berrone et al., 2005), either non significant (Czarnitzki & Kraft, 2003; Lee, 2005; Francis & Smith, 1995), or negative (see Ortega-Argilés *et al.,* 2003; Yafeh & Yosha, 2003) even if this last result seems to be weak (Holderness & Sheehan's, 1988; Francis & Smith, 1995; David *et al.*, 2001, Czarnitzki & Kraft, 2003).

The volatility of results may rely first on sectorial differences (Yafeh & Yosha, 2003) and often small biased samples. It can also rely on national differences (See Lee and O'Neil, 2003; Lee, 2005) or even on a U shaped relation between the number of blockholders and the likelihood to invest into R&D (Smith *et al.*, 2003).

Further empirical works insist less on the concentration ratio of shareholders than on *the identity of owners*. Institutional investors are often here assumed to be activists and thus more influential on the management control. No robust results are available here: different works find either a positive and significant relation between institutional ownership and R&D spending (Jarrell et al. 1985; Baysinger et al. 1991; Hansen and Hill 1991; Bushee, 1998; Wahal *et al*., 2000), a insignificant influence (David *et al.,* 2001, or Chung *et al.*, 2003) or even a negative impact. (Graves,1988; Jones, 2003). Here, many works focus rather on shareholders that would be willing to pay dividends quickly even in firms with good growth prospects. Cescon (2002) shows indeed that in short term pressured Italian and U.K. firms, R&D is more likely to be considered as a fixed cost which has to be reduced during recessions. The short term view or shareholders' myopia found however little empirical support (See Woolridge, 1988; La Porta *et al*., 2000; Gugler, 2003) but led academics to deal with the heterogeneity of institutional shareholders.

Results from Berrone et al. (2005) or Munari et al. (2005) suggest that the impact of large shareholders on R&D intensity is negative when blockholders are banks (See also Zahra, 1996, or Kochhar and David,1996, here). Lee's results (2005) suggest also that banks but also affiliates ownership or crossholdings are negatively linked to patents. Last, Berrone et al. (2005) find it positive when blockholders are non financial institutions and non significantly different from null when blockholders are individuals.

2.2 The characteristics of the board and the managerial influence

The influence of the board or the management on R&D or innovation is mainly analysed through the board characteristics and the management ownership. The managerial literature is interested in a more precise picture of the characteristics of the board (See Hermalin & Weisbach, 2003, for a survey).

In the empirical literature, a first main interest is to known the share of inside and outside directors in the board. Outsiders would be more likely to get innovation from the management. Once again, little empirical support is found: Boone *et al.* (2005) or Chung et al. (2003) find that the fraction of independent board is found positively linked respectively with R&D intensity or market valuation. On the contrary, a study by Hill and Snell (1988) suggests that the share of insiders is positively correlated to R&D intensity whereas David *et al.* (2001) cannot get significant coefficient.

The managerial literature includes many other variables that are not often considered by economists. Usually, larger boards are better for corporate R&D investments because they are harder for a CEO to dominate and they have a range of expertise that helps them to take better decisions. Boone et al. (2005) suggest that a large board is correlated negatively with high R&D (a dummy variable here) whereas Zahra *et al.* (2000) report that medium size are better for innovation.

Lundstrum (2002) find that research and development expense is decreasing in the age of the Chief Executive Officer whereas Bantel & Jackson (1989) shows that old CEOs have less incentive to innovate than young ones. David *et al*. (2001) do not however find any significant effect here.

Last, the board variety is considered as a higher likely to get directors with specialized scientific knowledge that applies to new growth fields. Daellenbach *et al.* (1999) suggest that top management team's or CEO's openness to innovation is related to a higher level of R&D intensity. Along this issue, positive results are found by Barker & Mueller (2002) whereas Cockburn et *al.* (2000) rather find a non significant influence of scientist-CEO on the propensity of firms to publish.

Managerial ownership (usually the total ownership by directors including CEO and even management) becomes a problem if the manager-owners can compete with external shareholders and induce a loss of incentive benefits. This entrenchment argument, find poor empirical supports: no significant relations are found on small or restricted samples (Francis & al., 1995; Vafeas & Theodorou, 1998; David *et al*., 2001; Lacetera, 2003); whereas some scholars find a positive effect (Hill and Snell (1988), Zahra *et al.* (2000), Hoskisson *et al*. (2002), or Billings *et al.* (2004)) or a negative one on large samples (Czarnitzki & Kraft, 2003; Cui *et al*., 2002). Francis & Smith (1995) suggest here that management-owned firms are more likely to grow through external acquisition rather than internal R&D projects. Further works show that family owned firms or owner-managed firms seem to be positively related to R&D intensity or innovation (Kraft, 1989; Kurokawa, 2004) when Munari et al. (2005) offer a negative relationship. Zahra *et al.* (2000) suggest also that stocks owned by outside directors induce more innovation activities.

3. GOVERNANCE PRACTICES AND R&D

We can conclude that there is no convincing evidence that board composition or the ownership structure affects R&D or innovation. Many scholars have recently tried to address an alternative question with how governance is implemented, looking at internal governance practices (compensation schemes, charters…) rather than external ones. We first survey the empirical literature and then list few problems with this kind of econometric studies on corporate governance.

3.1 The governance provisions

Three main managerial or board practices can be found in the corporate governance literature dealing with R&D: accountancy, poison pills and incentive schemes.

A first set of works deals with the *accountancy strategies* implemented by managers to satisfy shareholders. These strategies are shaped by national practices. Canadian, Japanese or US firms may pursue different objectives through accountancy when they make the decision to capitalize or expense R&D spending. Some firms may want, through capitalization, to convey information that allows investors to assess the value of their R&D spending (See Bange et al., 1998; Landry, 2003). The CEO is thus able to signal or not their R&D investment even if it does not give a reliable image of what is done inside firms.

When the influence of the shareholders through takeovers is introduced, mitigated results are also available: Meulbroek *et al.* (1990) report a decrease in the ratio of R&D expenditures to sales following the adoption of *anti-takeover provisions*. Pugh et al. (1992) find here that R&D/sales ratio has a positive correlation when Johnson et Rao (1997) do not find significant effects.

Finally, The empirical literature on governance practices dedicated to innovation deals with the CEO or manager *compensation schemes* to be implemented to align CEO or managers' behaviour to the shareholders' views in favour of innovation projects rather than short-term financial measures (Hitt, Hoskisson, Johnson, & Moesel, 1996; Hoskisson, Hitt, & Hill, 1993). On this topic, Holthausen *et al.* (1995) find that the relation between innovation and long-term compensation is significantly negative. A strong relationship between firm performance and executive compensation can be found (See Hall & Liebman 1998) or a non significant one (Eng & Shackell, 2001). These two last results are however challenged by Foss & Laursen (2005) on a large set of Danish firms. They show that pay-for-performance increases with firms' ability to produce product innovation. When the incentive is analysed at the top hierarchical level, the results are aligned: In a Cho (1992) or Xue's paper (2003) where R&D activities are found positively dependent on stock-based pay or, on the value of CEO' stocks ownership as shown in Barker & Mueller (2002). Guay (1999) or Coles *et al.* (2004) papers suggest also that higher sensitivity of CEO wealth to stock volatility in the managerial compensation scheme induces more R&D investments. More precisely, the length of the use of stock options (Balkin *et al.*, 2000), the non-restricted stock options (Ryan et al, 2002) and, the stock option vesting period (Yanadori *et al.,* 2003), are all positively associated with innovation (the number of patents) or R&D intensity. The result seems robust and to even overcome the CEO position. Core and Guay (2001) show that R&D expenditure can also be positively linked to the level of non-executive equity incentives whereas Pugh *et alii* (1999) find that R&D increase when an Employee Stock Ownership Plan (ESOP) is adopted.

The literature deals also with the choice to source knowledge outside the firm. In the context of choosing between "make" and "buy" R&D, risk-averse managers or short term oriented shareholders may prefer "buy" over "make" since outsourcing provides immediate innovation. Xue (2003) confirms that acquisition and R&D are substitutes and find that "CEOs receiving relatively more accounting-based compensation tend to acquire technology externally instead of growing it internally through R&D; in contrast, when CEO compensation contracts are skewed toward stock-based pay, firms pursue innovation through both approaches".

Multi-provisions are of course the main objective of this recent empirical literature that is usually bounded with data. A solution with multiple governance provisions may be to reduce multiple indicators. Following Gompers et al. (2003), index building to sum up the governance activity of firms is the more popular implemented methodology even if a lot of information is lost into the construction process. Using different innovation output indicators on a large US panel, Sugheir *et al.* (2005) shows that management dominated firms are negatively associated with the quantity or the quality of patents.

According to the academic literature, there are still very few evidences on the impact of governance provisions on R&D or innovation. This paper tries to bring new results into this recent set of works. We present few boundaries in the field before our own data and method.

3.2 Few boundaries in the econometrics of governance practices

Even if practices are considered, measurement problems occur. We point out here three aspects that can be found in the empirical literature.

First, as mentioned by Tirole (2001, p 17) “the theory of corporate finance should establish a clearer distinction between formal and real control”. In organizations, thanks to the board, shareholders have formal control over many issues when managers own the real control thanks to their superior information. A consequence for the empirical analysis on corporate governance is that a mismatch can occur between the observed formal governance devices and its real practice and impact. To rely on the real part of the governance requires either very detailed variables (e.g. the share of stock options given to the middle management) or a qualitative evaluation through experts who give a rate relatively to defined criteria (For example, an evaluation of the real independence induced by a formal separation between CEO and chairman of the board position). From an empirical point of view, the story is even more complex when the governance of firms can be considered as symbolic. Thanks to Westphal & Zajac (1998), managers can strategically behave to satisfy the shareholders demand. Thus, the real control can rely on an ability to resist to shareholders’ wants thanks to better information but also on their capacity to manipulate shareholders by shaping fake governances structures, practices and communications. For empirical studies, this kind of symbolic practice of governance guidelines is also critical since it is really hard to know if a governance practice is part of a symbolic strategy or not, even with detailed variables. This view is not inconsistent with a heterodox view of leadership defined as “the ability to resolve coordination problems by influencing beliefs” (Foss, 2001, p.358-359).

A second useful advance is to consider that large corporations are a heterogeneous assembly of firms and divisions. Governance practices thus have to deal with vertical and horizontal structures organizing heterogeneous firms working in a group. The range of corporate governance devices thus goes beyond the top level of corporate management. First, alignment of managers does not hold here when a subsidiary has no risky investments. Secondly, governance practices do not apply equally between differentiated activities where strategic trade-offs are to be considered. Governance practices vary among industries thanks to demand, technology or concentration (See Kor et alii, 2004). Within a multi-activity firm, the R&D investments can therefore decline in several lines of business and rise in others that are considered with higher ROI rates. The net effect, measured at the aggregated level, may hardly reflect the influences of governance practices. Thirdly, a further problem occurs at a vertical level. As is well known in statistical offices, top corporate managers of large firms often ignore many small R&D investments made on a particular technology by operating subsidiaries. They cannot control without prohibitive costs if these decentralised affiliates strictly follow the governance values. Thus, even if R&D investments or governance can be considered at the division level (See, Hoskisson *et al.,* 1993), corporate policies, structures and impacts are to be considered at the firm level, taking care of its rank in the company, to be evaluated.

Third, many large companies are global and owned by foreign shareholders. Some national systems of corporate governance do exist (See La Porta et al., 2000) and may influence the propensity to invest in R&D or innovation (see Tylecote and Conesa, 1999 ; O’Sullivan, 2001; Miozzo, 2002 ; Casper and Matraves, 2003; Tylecote & Ramirez, 2005). Liberal market systems as the US or UK are strong in radical innovation in newly emerging technologies, sophisticated internationally competitive services, and large complex systems with rapidly changing technology (Soskice, 1997, 1999) even if the influences can maybe more restricted to high tech sectors (Tylecote & Ramirez, 2005). However, even suggested, it is still very hard to get international data that would allow a comparison between corporate governance systems. To our knowledge, there is thus no available direct econometric evidences showing that the Anglo-Saxon governance system is more likely to induce, either at the corporate or firm level, higher R&D investments or innovation. Differences in R&D sources of financing between Israel and United States are underlined in Blass and Yosha (2003). The authors suggest that the choice of where to list the share is induced by the rate of return of R&D investments: investors in countries with equity-based sources of financing as the United-States should be more careful in their screening process.

4. DATA AND VARIABLES

4.1 Sample

Our sample matches five separate data sets. First, data on corporate governance are provided by Vigéo agency. Vigéo is an independent corporate social responsibility (CSR) rating agency. Thanks to the review by Vigéo, corporate governance is associated with a set of indicators that categorize the company's performance on the basis of precise questioning, available documents, and information gathered regarding the policies, implementation and results of the management system in place. The Vigéo data are available at the corporate level. Available Vigéo ratings are restricted to SBF-120" companies. The SBF-120 Index is a capitalization-weighted index of the 120 most highly capitalized and most liquid French stocks traded on the Paris Stock Exchange. Since the young rating agency did not crop systematically annual ratings in 2000, our sample is restricted to 116 French groups.

A second set of data gathers the R&D data coming from three different surveys. The first one is the 2000 R&D survey from the French ministry of research and higher education (DPD C3). Small firms even in services and utilities sectors are considered providing at least one full time equivalent researcher is occupied. The survey however is weak when insurance and bank are considered: the firms are either not questioned or give inconsistent answers. This shortcoming is important since several insurance companies or banking companies are included in the SBF 120 and is an important boundary. In order to get a more accurate evaluation of R&D investments, we complement the R&D data by the CIS3 dataset where R&D is asked more qualitatively. A third set of data is the French R&D tax credit fiscal file where there is a direct incentive to declare R&D budgets and a threat to declare false amounts.

The link between rated corporate and individual firms is made thanks to the LIFI data set from INSEE. The annual files provide information on the different affiliates within a group and insist on the identification of controlled firms. A firm in LIFI is controlled when the owner holds more than 50% of shares. The threshold is very high and many firms are controlled with much lower levels. The LIFI instrument is nonetheless powerful since it gathers all firms belonging to a group, even small firms or service firms.

In 2000, 83 126 firms located in France are listed belonging to 10 438 groups. A SBF-120 group is thus observed either at the aggregated level, or at the individual level. Compared to other works in the literature, a single corporate in our data set can thus gather firms involved in diverse industries where the R&D intensities may be very different. Missing values on employment are however frequently observed in this sample, especially in services or among SMEs. Many firms are also involved in services to individuals or non-commercial tasks (administration, education…); they are not kept in the final sample. Deleting firms with unknown employment, we risk introducing a sample selection bias into our data. However, missing values occurs as on SBF-120 affiliates as on other controlled firms. 9926 groups remains. Especially, 3928 individuals are deleted among the 110 groups (thus 39%) whereas 15 731 on 53 817 are deleted among the non SBF-120 firms (29%). Several SBF-120 groups as Wanadoo, Dior, Rexel, Lapeyre, Equant are controlled by larger rated groups; all individual firms are here deleted from our data set as well as M6 Television that belongs to a group that is not delimited in a satisfactory way. We thus get a final set of 44 289 firms controlled by 10 053 groups. Among theses firms, a selected sample of 6223 firms belonging to 110 SBF-120 groups constitutes our departure data set (see the appendix for a list of the 110 groups).

4.2 Variables

4.2.1 Explained variables

At the firm level or at the group level, we are able to compute the R&D intensity computed as the R&D budget over the number of employees (sales are not always available or positive). Out of the three sources for R&D budgets the highest are sustained in order to cope with the difficulty to get a convenient view of R&D investments especially in services or SMEs. At the individual level, aligned with many previous papers dealing with corporate governance and coping with restricted samples (e.g. Baker & Mueller, 2003), we compute R&D intensities, for each firms, centered at the industry level (we use a 114 classes level of the French NACE). The mean is taken here since the median is always zero in the different sectors where many firms are with a null R&D budget. The R&D Zscore, $ZR\&D_i$ are computed on the base of the entire sample of firms belonging to groups. This kind of explained variable is justified by sample selection problems where corporate governance is known for a subset of firms only (see the section on econometric issues).

4.2.2 Explanatory variables

Our main variables on governance are available at the group level. They are provided by Vigéo. Vigéo tracks 19 aspects of corporate governances. Vigéo gave us only aggregated 9 ratings. Compared to Gompers et al. (2003), several differences occur: each provision is rated along its ability to raise Shareholders rights. A rate, on a 100 point scale, is given if each governance practice raises the alignment of managers on shareholders. Ratings are given but relatively to the governances practices implemented in the same sector (defined at the 2 digit level). Finally, Vigéo investigates practices separating the values from the implementation and results.

A G governance index is thus simply computed as the mean of the 9 basic sub-indexes available from Vigéo. However, the different given ratings may be noisy and lead to a loose index. In order to check for the robustness of the results, G is also transformed into a dummy G^{bin} that is 1 when its value is higher than 50. Finally, in order to mitigate any problem due to the construction of the different indexes, a hierarchical agglomerative using a Ward's linkage cluster analysis choosing a Euclidean distance as a dissimilarity measure is proceeded. 3 clusters are then defined gathering highly democratic firms (G^{clust1} is thus 1) governed for and by the shareholders, from loosely governed firms

(G^{clust3} is the 1) where the shareholders rights are weak, and from intermediately governed firms (G^{clust2} =1).

Moreover, three intermediate indexes (as the average of sub-indexes) are also computed measuring the sustained Values (G_1 is $\frac{1}{3}$ $[G_{11}+G_{12}+G_{13}]$); Implementation (G_2 is $\frac{1}{2}$ $[G_{21}+G_{22}]$) covers the programmes and actions undertaken by the company to put policy and strategy into real practice. Results (G_3 is $\frac{1}{4}$ $[G_{31}+G_{32}+G_{33}+G_{34}]$) are the degree, level and consistency of realisation of policy and strategy and stakeholder satisfaction for corporate governance supported by quantified performance data.

Table 1: The rated practices and induces governance sub-indexes, for the 110 available SBF-120 groups

19 aspects Rated by Vigéo		9 available Sub-indexes		3 intermediate Indexes	
G_{111}	How does the executive committee express its conception on shareholders and corporate governance in the global corporate strategy?	G_{11}	Policy	G_1	VALUES
G_{112}	Is there any charter dealing with rules on corporate government?				
G_{113}	A chapter dedicated to corporate governance in the annual report				
G_{120}	A dedicated structure in charge of relations with shareholders	G_{12}	Structure		
G_{130}	Tools of communication offered	G_{13}	Communication tools		
G_{211}	Structure of the board of directors / supervisory board	G_{21}	The Board	G_2	IMPLEMENTATION
G_{212}	Separation between the position of general manager and the one of chairman of the board				
G_{213}	Existence of a director's charter				
G_{214}	Staggering of the directors' mandates				
G_{215}	Dedicated committees				
G_{220}	What does the group do to incite and to facilitate the involvement of the shareholders in the Annual general meeting? (Use of new technologies…)	G_{22}	Annual meeting		
G_{311}	Is there any double-voting share?	G_{31}	Voting	G_3	RESULTS
G_{312}	Is their any limitation to vote?[a]				
G_{313}	Is there any shareholder pact?				
G_{321}	Executive committee	G_{32}	Compensation		
G_{322}	Stock options				
G_{323}	Director's fees				
G_{330}	Litigation or lawsuit taken by shareholder within the year	G_{33}	Litigations		
G_{340}	Self-evaluation on the communication	G_{34}	Communication quality		

[a] In France, the proportion of non voting stocks is capped. Non voting (and limited voting) capital may not exceed 25% of stock capital.

Following Blass and Yosha (2001), an additional dichotomous variable NY&LSE is also proposed here. NY&LSE is one when the French firms are registered at the Stock exchange of New York or London Stock Exchange in 2000. All these firms belong to the French SBF120. Only 22 French groups are in this situation and therefore more likely to complied to U.S. or UK rules of governances either implied by state laws or even by governance habits from firms or shareholders.

Following previous studies dealing with R&D investments or intensity, we use several control variables, available at the firm level: the number of employees taken in log ($SIZE_i$). The variable is also computed at the second order ($SIZE^2{}_i$). At the firm level, the LIFI data base on groups gives also the rank of control for each affiliate. If an affiliate is directly controlled (the control rate is 50 or more here) by the head, the $RANK_i$ variable is set to one. If the firm is indirectly controlled by a direct affiliate, the rank is set to 2 and so on. The maximum circle in our sample is 15. This variable approximates the degree of link with the shareholders and is available at the individual level.

The group commitment in R&D does influence the affiliate's own R&D investments. To take the interaction into account, we calculate $GRR\&D^{others}{}_{gi}$ that is the intensity done by the other affiliated firms j than firm i within the same group g (j≠i). Finally, an additional individual variable is computed that measure for a firm i the size of the rest of the group. $GRSIZE^{others}_{gi}$ is thus the number of employees (taken in log) of the same group g that are working in other affiliates j (j≠i).

5. ECONOMETRIC MODELING

5.1 The empirical model and expected signs

At the firm level, thanks to the available data we can thus estimate the following main model including individual variables (i) and group variables (g):

$$\begin{aligned} ZR\&D_i = \sum \underset{>0}{\varphi}\ G_g + \underset{>0}{\beta_1}\ NY\&LSE_g + \underset{<0}{\beta_2}\ RANK_i \\ + \underset{<0}{\lambda_1}\ SIZE_i + \underset{>0}{\lambda_2}\ SIZE_i^2 + \underset{>0}{\kappa}\ GRSIZE_{gi}^{Others} + \underset{>0}{\mu}\ GRR\&D_{gi}^{Others} + e_i \end{aligned} \qquad [1]$$

All the different indexes are expected to be positively correlated with the R&D intensity (All $\varphi > 0$). Among the different practices we can expect particularly the compensation policy to be positive and significant as suggested by the surveyed empirical literature. There is however no means to sort the different parameters here. May be the coefficient of the Value (G_1), Implementation (G_2) and Results (G_3) could be expected in a ascending way but a coherent policy would lead to a complementary investment into the three aspects of governance.

Robustness of the governance index is tackle in two different ways. First tested through the substitution of discrete indexes at the place of the continuous ones: governance variables (G, G_1, G_2, G_3, G_{11} to G_{34}) are thus replaced with discrete variables (G^{bin}, G_1^{bin}, G_2^{bin}, G_3^{bin}, G_{11}^{bin} to G_{34}^{bin}). The same step by step procedure is followed in order to deals with potential collinear regressors and the same positive sign are expected here. A second measure for an alternative G continuous regressor is to introduce the different clusters G^{clust1}, G^{clust2} and G^{clust3} into the specification. It is made in order to mitigate colinearity problems that could weaken the reliability of a simple average as G indexe. A ascending hierarchy between the positive expected coefficients is likely here following the ascending level of scores among clusters.

The NY&LSE variable is introduced to check if the Anglo-Saxon governance system is superior for innovation to the continental governance systems (the French system being a agent of the other European (German, or Nordic) national systems). We thus consider here that there the US and UK systems are close (See Tylecote & Ramirez, 2005 on these differences). A positive sign is thus expected ($\beta_1 > 0$) even if a reliable identification may be a problem with only 22 listed groups.

When control variables are considered, RANK is expected to have a negative effect on R&D intensity ($\beta_2 < 0$): managers in low rank affiliates are less aligned with shareholders and therefore, thanks to a risk avers assumption are less likely to invest in R&D. At the same time R&D centres are usually low ranked to monitor more directly the risky R&D investments. An additional investigation would separate low rank firms from highly ranked firms in order to check if the influence of governance variables is weaker in the last class of firms.

A positive influence of size is expected. This effect is expected either at the individual point of view or at the group level: a large affiliate is able to spread R&D costs more easily and an affiliate is also more likely to spread the cost on the market of the whole group. We also consider that the use required important absorptive capacities à la Cohen and Levinthal (1989) to acquire and adapt knowledge toward productive purposes. The R&D intensity of firms within the same group is expected to have a positive influence on R&D intensity. The complementary effect is thus here considered as dominant compared to the substitution effect that should occur when a specialized R&D centre or firm does exist.

5.2 Econometric issues

Thanks to the introduction of variables at the group level in our model, not all repressors vary along all dimensions. Disturbances may be correlated within groups. While the coefficients would still be unbiased, they are inefficient and standard errors could be downward biased. The bias of standard errors can result in spurious findings of statistical significance for the aggregate governance variables. Moulton (1986) has shown that the magnitude of the downward bias for the standard errors increases with the group size, the intraclass correlations of the disturbances and the intraclass correlations of the regressors. To overcome the problem, we cluster the residuals on the identity of groups. It takes into consideration the clustering of individuals in group units, thereby producing correct standard errors (in the measurement sense) even if the observations are correlated[1].

A second usual problem here is colinearity between governance regressors (Gompers, 2003). It is thus expected to be difficult to be able to identify the coefficient of the different governance practices. The intermediate indexes (G^1 to G^3) and sub-indexes (G^{11} to G^{34}) are thus introduced separately and afterward gathered into the same specification. We also systematically compute a Wald test to know if the introduction of the set of variable improves the basic model. Finally we clustered the governance scores.

Last in the empirical literature on corporate governance, results heavily rely on the sample size and biased that would be introduced through the sampling procedures. Many works are sample biased since they include rather large firms, multi-firms ones or public listed companies. In our case, focusing on the 120 largest French companies, a serious bias may occur. We thus try to overcome partially the problem introducing a selection equation that explains roughly the probability to be listed within the SBF-120 French index (SBF120=1 instead of 0):

$$Selection_i = \underset{<0}{\gamma_1} GRSIZE_g + \underset{>0}{\gamma_2} GRR\&D_g + \underset{<0}{\alpha} RANK_i + \sum_{m=1}^{36} \delta_m ID_{im} + \nu_i \qquad [2]$$

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[1] The estimator variance becomes: $V_{Cluster} = (X'X)^{-1} \sum_{g=1}^{Ng} u_g^{'} u_g \ (X'X)^{-1}$ with $u_g = \sum_g e_i x_i$ where N_g is the group number, the clusters are the g groups.

The probability to belong to the SBF-120 relies on the size of the group g ($GRSIZE_g$ that is larger than $GRSIZE^{others}_{gi}$), on the intensity of the R&D in this group (defined as $GRR\&D_g$.that is thus different from previously defined $GRR\&D^{others}_{gi}$). We also want to control for possible bias induced by the rank of firms and sector of activity. The final selected sample may be indeed twisted toward firms with high rank (since larger or more diversified) and toward some high value added activities. Last, industry dummies, INDUST, are also available at the individual level. We fit our regression model (equation [1]) with selection equation [2] using a full maximum likelihood estimator.

6. RESULTS

6.1 Descriptive statistics

6223 firms are belonging to 110 groups from the SBF120 French Stock exchange index. They represent 14% of our general set of firms belonging to groups. On average, firms from SBF120 groups are higher ranked firms than non SBF firms. Similarly, they are naturally larger and contribute to build larger groups. Table 2 suggests also that the R&D intensity is also higher in SBF120 groups than in non SBF120 ones.

Computed on SBF 120 groups, the different sub-indexes do not discriminate a lot between the different groups: the average rates are all very close to 52. A majority of groups (56%) from the SBF120 are considered as being above their competitors in governances practices. However not all the different practices are well diffused among the SBF120 groups. The "Values" (G_1) are put forward when the results are not that satisfactory. The rights and duties of shareholders do not seem to be well preserved whereas conflicts and litigations may not be so well avoided and managed by firms. The board practices are however much better considered than other type of implementation practices (Table 3).

Table 2: Descriptive statistics of non governance variables

Variables	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
SBF120	0.14	0.35	0	1	1	0	1	1
Ng	9 996				110			
N	44 289				6 223			
ZR&D					0.12	1.70	-0.71	63.55
RANK	1.79	1.51	0	15	3.33	2.30	0	15
SIZE	3.32	1.74	0	12.59	3.91	1.85	0	11.79
$SIZE^2$ (squared)	14.08	12.87	0	158.63	18.73	15.83	0	138.99
$GRR\&D^{others}$	1.66	13.65	0	1108.73	4.02	8.71	0	96.45
$GRSIZE^{others}$	6.09	3.06	0	12.62	10.37	1.31	0.10	12.15
GRR&D	1.76	12.91	0	771.90	4.11	9.93	0	376.14
GRSIZE	6.60	2.52	0	12.62	10.39	1.26	3.401	12.15

The three different clusters are well sorted (Table 4). The largest cluster (Cluster3) gathers groups with high corporate governance standards. Following Gompers (2003) this "Democratic" cluster is at odds with the smallest cluster of "Dictatorial" groups (Cluster1) where corporate governance schemes are loosely considered. An "Intermediate" set of groups (Cluster2) complete the two.

However, if the clustering procedure seems to be superior to a simple sum of sub-indexes (as in Gompers, 2003), puzzling issues may arise. The weakness of groups belonging to the dictatorial cluster is thus not that obvious when rights and duties are considered. However the small size of our sample and the skewed distribution of the "Right and duties" score may explain it. Groups listed in Wall Street or London are more likely to be belong to democratic groups.

Table 3: Description of the governance variables (N=110)

		Label	Variables	Mean	Std. Dev.	Min	Max
Discrete Variable		NY&LSE	Listed in NY or London	0.19	0.37	0	1
Continuous indexes	Index	G	Governance Practices	53.5	12.5	24.59	89.58
	Intermediate Indexes	G_1	Values	53.6	15.6	8	100
		G_2	Implementation	55.2	15.7	0	100
		G_3	Results	51.8	12.3	21.87	100
	Sub-indexes	G_{11}	Policy	54.0	19.5	12	100
		G_{12}	Structure	53.6	15.2	12	100
		G_{13}	Communication tools	53.1	20.3	0	100
		G_{21}	The Board	57.2	21.6	0	100
		G_{22}	Annual meetings	53.2	14.8	0	100
		G_{31}	Voting	50.2	15.5	0	100
		G_{32}	Compensation	52.7	20.4	0	100
		G_{33}	Litigations	51.4	11.6	12.5	100
		G_{34}	Communication quality	53.0	17.9	0	100
Discretised indexes	Index	G^{bin}	Governance Practices	0.56	0.50	0	1
	Intermediate Indexes	G_1^{bin}	Values	0.55	0.50	0	1
		G_2^{bin}	Implementation	0.54	0.50	0	1
		G_3^{bin}	Results	0.47	0.50	0	1
	Sub-indexes	G_{11}^{bin}	Policy	0.39	0.49	0	1
		G_{12}^{bin}	Structure	0.32	0.47	0	1
		G_{13}^{bin}	Communication tools	0.38	0.49	0	1
		G_{21}^{bin}	The Board	0.54	0.50	0	1
		G_{22}^{bin}	Annual meetings	0.30	0.46	0	1
		G_{31}^{bin}	Voting	0.25	0.43	0	1
		G_{32}^{bin}	Compensation	0.35	0.48	0	1
		G_{33}^{bin}	Litigations	0.22	0.41	0	1
		G_{34}^{bin}	Communication quality	0.38	0.49	0	1

Table 4: Description of clusters

Variables	Ng Labels	Cluster1 21 Dictatorial	Cluster2 35 Intermediate	Cluster3 54 Democratic
Governance Practices	G^{bin}	37.15	47.83	63.91
Values	G_1^{bin}	31.40	49.89	64.81
Implementation	G_2^{bin}	41.07	46.79	66.39
Results	G_3^{bin}	38.98	46.82	60.53
Policy	G_{11}^{bin}	31.92	47.74	67.48
Structure	G_{12}^{bin}	36.88	50.71	62.50
Communication tools	G_{13}^{bin}	24.60	52.26	64.66
The Board	G_{21}^{bin}	39.88	45.83	71.98
Annual meetings	G_{22}^{bin}	42.26	47.74	60.80
Voting	G_{31}^{bin}	44.84	41.56	58.02
Compensation	G_{32}^{bin}	36.51	43.81	65.51
Litigations	G_{33}^{bin}	43.55	50.83	55.09
Communication quality	G_{34}^{bin}	31.03	51.07	63.48
Listed in New York city or London	NY&LSE	0	0.17	0.24

6.2 Econometric results

First regression results are reported in Table 5. Every column use ZR&D as dependant variable whereas column (a), (b) and (c) use continuous indexes as right hand side variables and column (d) (e) and (f) use discretised indexes as explanatory variables. The impact of governance is not always significant and varies among the specifications. The different F-test do not reject for column (a), (b), (c) or (d) the null hypotheses for corporate governance practices to be null. The governance indexes are more likely to be significantly different from 0 when they are discretised. The G^{bin} index is therefore positively linked to the intensity of R&D expenditures. The same result is obtained when intermediate governance indexes are substituted to the general index. Two parameters out of three estimated in column (b) becomes significant in column (e) specification. The robustness of the results is thus not very strong. One interpretation may rely on the noise those ratings given by different experts introduce and that the discretisation process tries to mitigate. More surprising is the negative sign obtained for the Results' parameters. When the expected positive sign is found for the implementation side of governance practices, it suggests the influence of the board practices and annual meetings introduce a better influence of shareholders. A negative sign obtained for the "Results" index suggests that the role of democratic voting rules, incentive provisions and a lack of litigations do not improve risk taking but exactly the contrary: it lowers the intensity of R&D of firms. The interpretation is however far to be straightforward since the disaggregation of intermediate indexes lead us to mixed results (as in Gompers, 2003) where neither the negative impact of democratic voting rules not the negative influence of compensation schemes are robust. The impact of a lack of litigation procedure or problems is also questionable. The introduction one by one of these variables (not reported) does not give any significant coefficient.

Despite the general lack of power in the sub-index regressions, the different results suggest that governance practices are indeed positively related to the R&D intensity when they help the shareholder for controlling the firm. An additional result is that the attention paid to provisions ruling the board is indeed important for a higher R&D investment. Firms that are listed in London or New York Stock Exchange are more likely to be R&D intensive. The magnitude of the estimated parameter shows that this variable is rather robust and has a important influence on R&D intensity (overs 20%) whereas the impact of governance practices are similar of lower (from 12% to 27% compared to 20% to 33%).

Table 6 gathers results obtained with discretised thus clusterised indexes. The results confirm that democratic governance practices are positively linked to R&D intensive investments. A further results however is that high R&D expenditures can accommodate intermediate corporate governance that has no different impact than a democratic governance scheme (F-stat value is only 0.40 here); on the contrary of dictatorial firms that match significantly lower R&D intensity. Finally, Table 6 shows that the magnitude of the governance practices is similar but rather higher than the NY&LSE coefficient.

It shows that firms with "democratic" governance practices that are listed abroad are much more high tech than their national and "dictatorial" counterparts.

The influence of the rank of firms is found negative as expected. The different specification give however a poor robustness of this results. Several explanations may be put forward here (Noise, R&D centrality…). However, this result does not mean that the corporate governance becomes weaker when firms are highly ranked. In order to test this hypothesis without the possibility to introduce crossing variables, we divide the sample into two sets of firms thanks to their rank in their group (rank ≤ 2 and rank >2). Column (h) and column (i) in Table 6 reports that the influence of governance practices is positive and high for firms near to the headquarter (column (i)) whereas a positive but diminished influence is found for firms owned by democratic companies (column (g)). These results are aligned with our conjecture restricting the influence of corporate governance to the core firms of a company.

Table 5: Impact of governances practices on R&D expenditures

		With continuous indexes				With dichotomic indexes		
Explanatory variables	Labels	(a)	(b)	(c)	Labels	(d)	(e)	(f)
Governance Practices	G	0,002			G^{bin}	0,124*		
		(0,003)				(0,064)		
Values	G_1		-0.003		G_1^{bin}		-0,041	
			(0.002)				(0,069)	
Implementation	G_2		0.005		G_2^{bin}		0,246***	
			(0.003)				(0,090)	
Results	G_3		-0.001		G_3^{bin}		-0,106*	
			(0.004)				(0,064)	
Policy	G_{11}			0,005	G_{11}^{bin}			0,041
				(0,004)				(0,094)
Structure	G_{12}			0,000	G_{12}^{bin}			-0,040
				(0,006)				(0,157)
Communication tools	G_{13}			0,000	G_{13}^{bin}			0,125
				(0,004)				(0,146)
The Board	G_{21}			0,007*	G_{21}^{bin}			0,274***
				(0,004)				(0,098)
Annual meetings	G_{22}			-0,001	G_{22}^{bin}			-0,177
				(0,004)				(0,137)
Voting	G_{31}			-0,013**	G_{31}^{bin}			-0,073
				(0,006)				(0,236)
Compensation	G_{32}			0,001	G_{32}^{bin}			-0,161*
				(0,003)				(0,088)
Litigations	G_{33}			0,016**	G_{33}^{bin}			0,300
				(0,006)				(0,238)
Communication quality	G_{34}			-0,005	G_{34}^{bin}			-0,059
				(0,003)				(0,147)
Listed in NYC or London	NY&LSE	0,200*	0.230*	0,280**	NY&LSE	0,197*	0,271**	0,329**
		(0,112)	(0.118)	(0,139)		(0,113)	(0,120)	(0,125)
Firm's rank in the group	RANK	-0,017	-0.017	-0,017	RANK	-0,019	-0,023*	-0,022*
		(0,014)	(0.013)	(0,013)		(0,014)	(0,012)	(0,013)
Size	SIZE	-0,149***	-0.147***	-0,145***	SIZE	-0,155***	-0,148***	-0,153***
		(0,052)	(0.053)	(0,052)		(0,053)	(0,053)	(0,052)
Size squared	$SIZE^2$	0,020***	0.020***	0,019***	$SIZE^2$	0,020***	0,020***	0,019***
		(0,006)	(0.006)	(0,006)		(0,006)	(0,006)	(0,006)
Group size	$GRSIZE^{others}$	-0,061**	-0.064**	-0,070***	$GRSIZE^{others}$	-0,067**	-0,092***	-0,070**
		(0,026)	(0.026)	(0,026)		(0,027)	(0,031)	(0,027)
Group R&D intensity	$GRR\&D^{others}$	0,015***	0.016***	0,018***	$GRR\&D^{others}$	0,015***	0,015***	0,016***
		(0,003)	(0.003)	(0,003)		(0,003)	(0,002)	(0,003)
Constant	Intercept	0,802**	0.803***	0,373	Intercept	0,890***	1,113***	0,876***
		(0,311)	(0.303)	(0,284)		(0,324)	(0,360)	(0,283)
Number of firms	N	6223	6223	6223	N	6223	6223	6223
Selection equation		No	No	No		No	No	No
	R^2	0,016	0.017	0,026	R^2	0,016	0,019	0,024
All coef. on gov. are null	$F(3,109)$		1.05		$F(3,109)$		2.98**	
All coef. on gov. are null	$F(9,109)$			1.42	$F(9,109)$			1.18
All coef. are null	$F(. ,109)$	10.65***	9.16***	8,07***	$F(. ,109)$	10,65***	10.26***	6,76***

Explained variable: ZR&D,
*** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.
Years: 2000; Hubber and White standard errors (in parentheses); Residuals are clustered.

On control variables, tables 5 and 6 shows that the signs is found as expected. The U shape of size is common especially when very small firms are included in the sample (NACE = 731 or NACE = 741 or even start-ups). The largest your sister firms are, the less is your own R&D intensity. Thus, small affiliates are less likely to invest in R&D than large firms. However, the R&D intensity of sister and mother firms is stimulating positively the R&D investments of a firm underlying the complementarity between R&D activities in a group.

Table 6: Impact of governances practices on R&D expenditures: regression with clusterised ratings

Variables	Population Label	All (g)	Rank > 2 (h)	Rank ≤ 2 (i)
Intermediate cluster	Clust2	0.229**	-0.026	0.459***
		(0.098)	0.076	0.155
Democratic cluster	Clust3	0.284***	0.146*	0.384***
		(0.095)	0.083	0.139
Listed in NYC or London	NY&LSE	0.187*	0.113	0.360**
		(0.110)	0.108	0.170
Firm’s rank in the group	RANK	-0.015		
		(0.014)		
Size	SIZE	-0.160***	-0.128**	-0.202**
		(0.052)	0.062	0.084
Size squared	$SIZE^2$	0.021***	0.016**	0.025***
		(0.006)	0.007	0.008
Group size	$GRSIZE^{others}$	-0.075**	0.004	-0.108***
		(0.030)	0.038	0.035
Group R&D intensity	$GRR\&D^{others}$	0.015***	0.019***	0.014***
		(0.003)	0.006	0.003
Constant	Intercept	0.824***	0.060	1.051***
		(0.299)	0.380	0.352
	N	6223	3838	2385
All coef. are null	$F(7,109)$	11.61***	4.11***	13.78***
All coef. on gov. are null	$F(2,109)$	4.67**	1.72	4.74**
Coef. on gov. are different	$F(1,109)$	0.40	2.70	0.48
	R^2	0.018	0.010	0.029

*** significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.
Years: 2000; Hubber and White standard errors (in parentheses); Residuals are clustered; Clust1=1 (“dictatorial” governance) is taken as a reference. Explained variable: ZR&D

7. CONCLUSION

Corporate governance has been neglected in the economics of innovation literature. Managing innovation properly need however to take care of this aspect that cannot be restricted to the governance of R&D collaborations or the inventive schemes dedicated to researchers. Furthermore, governance problems cannot be reduced to the usual ownership structure or the board characteristics. Governance practices are a better approach to deal with governance issues for economists.

Thanks to a new dataset crossed with usual French R&D data, we provide an empirical framework where individual firms belong to large groups with different activities. Taking care for selectivity, we examine the influence of governance practices scored by experts on R&D intensities. Doing this we hope to be able to grasp real governance practices rather than the formal ones. Furthermore, we propose to identify national governance differences through cross-border listed French companies.

Our main findings are the following: First, governance practices do increase the R&D investment decisions by managers. The higher the shareholder is taken into consideration by the managers, the highest the R&D investments will be. A second result is that the effect is non-linear: firms may take care seriously or moderately of their shareholders, the differences in R&D expenditures will be null.

Only firms with few “democratic” practices are more likely to be less R&D intensive. Third, a significant difference in R&D intensity is found also between French group listed in only in France and the groups that are listed in New-York or London. The result suggests that the differences between national systems of corporate governance may have a strong impact on local R&D and innovation strategies that have to cope with other countries requirements. Fourth, it is very difficult to identify what are the best governance practices regarding the R&D expenditures. The board level is found the place where practices are to be implemented to boost R&D intensity. This result suggests that governance practices are critical at the top level. This result is corroborated by the impact of governance practices that is also found stronger for firms close to their headquarters. Finally, sample selection may be also a serious problem in this literature rather focused on large groups.

Some methodological choices done in this paper are debatable although consistent with previous works.

First, the use of Z-scores is usual in corporate governance literature. However, when R&D intensity is considered, non-R&D firms are assigned with the same R&D intensity level within an industry. This could be a problem if one considers this explained variable as (softly) censored.

Second, a selection problem is taken into consideration in this paper whereas another strategy is possible. Here, scored listed groups are selected among French groups. An alternative would be to restrict the selection among the sub-sample of listed French companies. The burden is however much higher since it requires the matching between all companies listed in France and each surveyed individual firms.

Third, the number of scored groups is limited. The extension of the scoring procedure is done by the rating agency. Following Gompers *et alii,* (2003), further works should be able to use more companies gathering several years.

Finally, the R&D intensity is one possible measurement of firms’ commitment into innovative activities. A broader scope would consider the external R&D expenditures to tackle the idea that governance practices also induce more internal R&D activities than external R&D activities.

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9. APPENDIX: AVAILABLE RATED FRENCH GROUPS

The used 110 French groups from the Paris SBF120 index, in 2000

ISIN Code	*Name*	*ISIN Code*	*Name*	*ISIN Code*	*Name*
FR0000120404	Accor	FR0000125874	Euro Disney SCA	FR0000130577	Publicis
FR0000125924	AGF	NL0000241511	Euronext	FR0000130395	Remy Cointreau
FR0000031122	Air France	FR0000125379	Eurotunnel	FR0000131906	Renault
FR0000120073	Air Liquide	FR0000121147	Faurecia	FR0000120131	Rhodia
FR0004126027	Algeco	FR0000133308	France Telecom	FR0000062994	Rodriguez
FR0000120198	Alstom	FR0000121246	Galeries Lafayette	FR0000073272	Sagem
ES0177040013	ALTADIS	FR0000131518	Gecina	FR0000125007	Saint-Gobain
FR0000071946	Alten	LU0121706294	Gemplus	FR0000120578	Sanofi-Synthelabo
FR0000034639	Altran Technologies	FR0004038099	GFI Informatique	FR0000121972	Schneider Electric
FR0000051732	Atos	FR0000052979	GrandVision	FR0000130304	Scor
FR0000130460	Aventis	FR0000120289	Guyenne & Gascogne	FR0000121709	Seb
FR0000120628	Axa	FR0000121881	Havas Advertising	FR0000039109	Seche Environnement
FR0000120180	Bail Investissement	FR0000052292	Hermes Intl	FR0000130809	Societe Generale
FR0000035164	Beneteau	FR0000120859	Imerys	FR0000121220	Sodexho
FR0000120966	Bic	FR0000052573	Infogrames Entertainm	FR0000120776	Sophia
FR0000131104	BNP Paribas	FR0000125346	Ingenico	FR0000050809	Sopra
FR0000061129	Boiron	FR0000120537	Lafarge	FR0000131732	Spir Communication
FR0000125858	Bollore	FR0000130213	Lagardere SCA	FR0000051807	SR Teleperformance
FR0000120503	Bouygues	FR0000125908	Legris Industries	NL0000226223	STMicroelectronics
FR0000052607	Bull	FR0000121352	Locindus	FR0000120529	Suez Lyonnaise des Eaux
FR0004026250	Business Objects	FR0000120321	L'Oreal	FR0000131708	Technip
FR0000125460	Canal+	FR0000121014	LVMH	FR0000054900	TF1
FR0000125338	Cap Gemini	FR0000038606	Manitou B.F.	FR0000121329	Thales
FR0000039620	Carbone Lorraine	FR0000121261	Michelin	FR0000184533	Thomson MultiMedia
FR0000120172	Carrefour	FR0000120685	Natexis Banques Popul	FR0000120271	TotalFina-Elf
FR0000125585	Casino Guichard	FR0000120560	Neopost	FR0000062713	Transiciel
FR0000120982	Ciments Francais	FR0000037392	Nergeco	FR0000054470	Ubi Soft Entertainment
FR0000130296	Clarins	FR0000044448	Nexans	FR0000124711	Unibail
FR0000121568	Club Mediterranee	FR0000052870	Norbert Dentressangle	FR0000034662	Unilog
FR0000120222	CNP Assurances	FR0000121691	NRJ	FR0000130338	Valeo
FR0000184202	Credit Lyonnais	FR0000124133	Oberthur Card Systems	FR0000120354	Vallourec
FR0000120644	Danone	FR0000132904	Pechiney	FR0004155885	Valtech
FR0000130650	Dassault Systemes	FR0000053381	Penauille Poly Servic	FR0000125486	Vinci
NL0000235190	EADS	FR0000120693	Pernod Ricard	FR0000127771	Vivendi Universal
FR0000130452	Eiffage	FR0000066755	Pinguely Haulotte	FR0000054603	Walter
FR0000131757	Eramet	FR0000124570	Plastic Omnium	FR0000125684	Zodiac
FR0000121667	Essilor International	FR0000121485	Printemps Pinault Redoute		