

**THE INFLUENCE OF THE TYPE AND NUMBER OF BLOCKHOLDERS
ON R&D INVESTMENTS**

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The Influence of the Type and Number of Blockholders on R&D Investments

ABSTRACT

This article studies the relationship between the presence of large shareholders in the ownership structure of firms and R&D investment. Consistent with our theoretical contention, our results indicate that the impact of large shareholders on the R&D investment is (1) negative when blockholders are banks, (2) positive when blockholders are non-financial corporations, and (3) null when blockholders are individuals. In addition, we find a systematic negative relationship between the number of blockholders and R&D investment. Moreover, once we incorporate variables of ownership structure, the financial structure measures become irrelevant to explain a firm's R&D investment policy. Finally, we extend our analysis first by testing the impact of each blockholder type contingent to the life-cycle stage of firms and second by analyzing the influence that the combined effect between blockholder type and R&D investment has on the firm's economic performance. Results of these extensions provide relevant implications for policy makers and academic research.

Key words :

Ownership structure, banks, institutional blockholders, non-financial blockholders, individual blockholders, R&D investment.

The Influence of the Type and Number of Blockholders on R&D Investments

The ownership structure of firms is recognized as an important determinant of its general investment policy and, in particular, of its research and development (R&D) spending. However, there is no consensus regarding the effect of ownership concentration on a firm's R&D investment. To date, literature surrounding this relationship has only provided mixed results. For instance, Wahal and McConnell (2000) and Hosono et al. (2004) found that the stake of the largest shareholders was positively related with R&D investment. On the other hand, Yafeh and Yosha (2003) found a negative relationship. In addition, some authors (Francis & Smith, 1995; Holderness & Sheehan, 1988) found no significant differences in R&D per sales between diffusively-held and majority-held firms.

The aim of this paper is to reconcile these conflicting results by enriching the analysis of the firm's ownership structure. We move a step further from the simple characterization of the stake of the main blockholders as the main determinant of a firm's investment policy to incorporate two features: (1) the *type* of blockholders and (2) the *number* of blockholders necessary to control a firm. While the type of blockholder has recently received increasing attention (e.g., Kochhar & David, 1996; Lee, 2005; Tihanyi, Johnson, Hoskisson, & Hitt, 2003), the number of blockholders has been largely neglected in previous studies. Also, by introducing the characteristics of the ownership structure as explicative elements of a firm's R&D investment, we can evaluate the real impact other factors, like financial structure, have on this type of investment.

We identify three types of blockholders: banks, non-financial corporations, and individuals. Our conjecture is that the existence of different types of blockholders has a clear impact on the firm's R&D policy because their distinguishable pattern of characteristics and

preferences. Banks, which are more conservative investors and characterized by debt holdings in firms, are likely to influence negatively on R&D expenses. Moreover, these institutions are highly penalized in their solvency ratios if they hold stakes in risky firms (*i. e.* firms that invest heavily in risky strategies like R&D initiatives). Concerning non-financial blockholders, they may be more willing to promote innovative endeavors as there might be beneficial synergies for them. Finally, concerning individual blockholders, there are different countervailing effects that do not allow extracting a clear-cut conclusion of their impact in a firm's R&D investments. On the one hand, monitoring by a set of different types of blockholders with different points of view is expected to be better than the monitoring by a single specialist. This is expected to enrich vigilance and favor the investment in complex R&D activities. On the other hand, there is a bargaining effect that hinders the agreement on the decisions to be taken when there is a wide heterogeneity among blockholders. This bargaining effect is also at the basis of the differential effect on R&D investments once we compare a small number of blockholders with a large number of them. In general, we expect that as the number of blockholders increases, the aforementioned bargaining effect that hinders the agreement among them becomes larger. This, in turn, negatively affects R&D initiatives. Current literature does not consider the number of blockholders and just looks at the overall stake. Overall, our empirical results offer support to our theoretical contentions.

We contribute to current literature by extending our analysis in two novel and significant ways. First, we study the differential effect that each blockholder type has on the firms' R&D intensity considering their life-cycle stage. We find that individual blockholders have a significant and positive influence on fast-growing organizations' R&D investments, while mature firms benefit from the presence of non-financial organization and suffer the

conservationism of banks. Secondly, we examine how combinations between blockholder types and R&D intensity influence the economic performance of firms. This analysis offers remarkable implications for policy makers and exciting avenues for future research.

The rest of the article is structured as follows. In the next section we present relevant literature akin to the objectives of this work and our theoretical formulation. Next, we test our hypotheses on a sample of Spanish firms during the period 1996-2000. The article concludes with a discussion of the significance of the study.

THEORETICAL FRAMEWORK AND HYPOTHESES

The separation of ownership and control in modern corporations is the pivotal aspect under agency theory (Berle & Means, 1932; Jensen & Meckling, 1976). This separation is assumed to be efficient as it allows investors (*i.e.*, principal) to diversify their portfolios and executives (*i.e.*, agent) to specialize in management. Yet, assumptions about risk preferences and information asymmetries spawn the possibility of opportunistic actions by the risk averse agent who may have different objectives from a risk neutral principal and thus pursue self-serving priorities, giving birth to the so-called agency problems. These problems are severe in R&D investment decisions and, consequently, the impact of ownership structure on R&D intensity is often studied in the context of agency theory (Baysinger, Kosnik, & Turk, 1991; Lee, 2005; Tihanyi et al., 2003).

R&D investments imply the creation of intangible assets, which are expected to be valued in the market. Firms that have the capability to innovate are expected to generate greater profits than those that are noninnovators (Jelinek & Schoonhoven, 1993). However, R&D activities are characterized by three main traits. First, they are inherently risky as they provide greater

variability of outcomes and greater probability of failure despite the best effort of managers (Baysinger et al., 1991). As a result, risky R&D projects derive in greater employment risk for agents, which they cannot diversify away (Alchian & Demsetz, 1972). Second, R&D activities require long-term investments in projects that may have a negative impact on more immediate performance (Hoskisson, Johnson, & Hill, 1993). Consequently, managers may be reluctant to invest in risky long-term R&D projects. Third, R&D activities, often developed in high-discretion contexts (Hambrick & Finkelstein, 1987), require high managerial autonomy to be effective since managers face a wide range of complex strategic choices. But, at the same time, risk averse managers with great level of discretion may use their power to pursue low-risk strategies, avoiding R&D initiatives. Together, these characteristics can stimulate managerial opportunistic behavior and increase agency costs as it is easier to hide action in order to obtain private benefits. As a consequence, the ownership structure of the firm, which defines the mechanisms to control its actions, is likely to influence strategic decisions like R&D effort (Kochhar & David, 1996; Tihanyi et al., 2003). In particular, we expect that the number, characteristics, and preferences of large stakeholders will have an impact on innovative endeavors.

Ownership structure is widely recognized as a major driver of a firm's investment decisions (Porter, 1990) but its particular impact on R&D investment is much less studied (Lee & O'Neil, 2003). Moreover, empirical studies focused on the relationship between blockholders and R&D expenses are plagued by contradictory results, preventing from definitive conclusions. We argue that these equivocal results can be explained by incorporating two features of blockholders: the type and number of blockholders. The first feature has been exclusively studied in US or Japanese contexts, whereas the second one has been largely ignored in past research.

The type of blockholder

When we focus on the nature of blockholders, the literature shows different types of results. Some studies found that there exists a relationship between the type of blockholder and R&D investment policy (whether positive or negative), and others postulate the non-existence of such a linkage. Concerning the first strand, several scholars (e.g., Baysinger et al., 1991; Hill & Snell, 1988; Wahal & McConnell, 2000) found the existence of a positive relationship between the presence of institutional shareholders and R&D investment. Also, Haid and Weigand (1999), concluded that firms controlled by other firms (*i.e.*, institutional blockholders) showed lower sensitivity of internal funds to R&D investment than their owner-controlled counterparts. This feature is expected to affect less detrimentally R&D intensity of the former firms in comparison with owner-controlled ones, when there are some liquidity constraints (periods of recession). On the negative relationship, Graves (1988) found that, for a sample of computer firms, the presence of institutional blockholders damaged R&D investment. On the neutral strand of the literature, Chung, Wright and Kedia (2003) deduced that there is no effect on R&D investment due to the existence of institutional holdings. Also, Francis and Smith (1995) did not find significant differences in R&D-to-sales ratio when compared management-controlled firms with externally-controlled ones (with large and external blockholders).

A common characteristic of all these studies is that they do not differentiate between large equity holders. Only recently some studies have acknowledged the implications that the identity of such stakeholders can have for firms. Specific characteristics, goals, and preferences of blockholders are likely to have differential influence on the firm's strategy. A case in point is

the work of Tihany and colleagues (2003), who found significant differences between diverse types of institutional owners and firm's international diversification strategy.

Similarly, we argue that each type of institutional blockholders has distinguishable impact on the firm's R&D investment. Three types of blockholders have recognized particularities that deserve attention, namely banks, non-financial corporations, and individual blockholders.

We expect bank blockholders to have a negative impact on R&D investment for several reasons that we explain below:

First, banks and financial institutions are considered pressure-sensitive institutions (Kochhar & David, 1996). This type of institutions maintains business relationships with the firm in which they invest beyond simple ownership, often in the form of loans and credits (Kroszner & Strahan, 2001). As creditors, the power gained by these institutions from their ownership stake is somewhat mitigated by the increase in risk derived from their role as lenders. Banks are "retained" in their double role as shareholders and lenders and have less capacity to influence managers. These latter have a natural bias to elude investment in risky R&D projects with uncertain pay-offs (Boot, 2000). Furthermore, banks themselves may avoid R&D expenditures because they are exposed to uncertainty returns through two channels: credits and stakes. Apart from the risk considerations derived from the tendency of blockholder banks to be also lenders of their partially-owned firms, there is a second perverse effect that may damage R&D investments. When banks act as creditors, they have incentives to devote resources to create an information monopoly about the firm in which they invest (Yafeh & Yosha, 2003), which can adversely affect the access to resources (Rajan, 1992; Sharpe, 1990) in two ways. On one hand, the controlled firm may be threaten by being informationally captured by the bank and may be

reluctant to borrow from it. Consequently, potentially valuable investment opportunities, like R&D projects, may be lost (Boot, 2000). On the other hand, this hold-up problem can make it costly for a firm to reach additional lenders, as it may signal that the bank with the information monopoly is unwilling to lend to the firm. This issue clearly hinders innovation activities as they often require large amounts of funds. The lack of resources can be a fatal problem for R&D initiatives

Second, there is evidence regarding banks expropriating intentions as large shareholders (Boehmer, 2000). Then, R&D investments are natural candidates to be avoided if banks investments are driven by expropriating intentions, because these are capital-intensive investments.

Third, there is evidence (Berger, Miller, Petersen, Rajan, & Stein, 2005) suggesting that large banks avoid investment in complex projects like research and new product development because they do not produce high-quality information, a key feature required by large-scale banks. This is the case of the Spanish bank system which is characterized by the presence of large banks and financial institutions (Crespí & García-Cestona, 2001).

The above arguments lead to our first hypothesis:

Hypothesis 1: *There is a negative influence of a bank's ownership on firm's R&D investment intensity.*

The second type of institutional blockholder that we identify is the non-financial corporation. We expect a positive influence of the presence of this blockholder on R&D investment due to different reasons:

First, compared to banks, non-financial corporations have no-credit relationships and are less exposed to the uncertainty outcome of their investments. As a consequence, these corporations are more willing to give firms incentives in order to invest in R&D projects (Kochhar & David, 1996).

Second, non-financial corporations, in contrast with banks, are more likely to recognize the relevance of R&D investment as a pivotal input for their market success. The existence of potential synergies as well as spillover effects between the owner and the controlled firms should favor R&D investment (Jaffe, 1986). In fact, the reason why a corporation buys a significant stake in a firm is because it may find these kinds of synergies. By investing in R&D, owner firms can improve their absorptive capacity (Cohen & Levinthal, 1990), enhancing their ability to learn and take advantage of technological knowledge.

Third, blockholder firms may obtain an additional benefit if they buy significant stakes (larger than 50%) of R&D-intensive firms. In that case, blockholder firms can consolidate large investment accounts in their balance sheets. This may allow channeling accounting expenses to these investment accounts in order to raise profits artificially during hard times (and the inverse operation to adjust earnings downwards during good times). These income smoothing practices are larger in firms with cross-corporate shareholdings (Bae, Ho, & Kim, 2005) and are favored by the presence of institutional owners (Carlson & Bathala, 1997). Also, Yeo et al. (2002) have shown that the presence of external unrelated blockholders leads to close monitoring of management which decreases the level of earnings management. This suggests that blockholder firms, which are expected to be more related their partially-owned firms than banks, have a larger incentive to engage in earnings management practices by using R&D as an income-smoothing device (Nagy & Neal, 2001)

Last, if we assume that owner firms are larger than controlled firms (a reasonable assumption if R&D-intensive firms are in the early-stage of development), owner firms may be tempted to delegate in the controlled firms their own R&D activities in order to obtain larger returns. This is so considering the well-known difficulties that large established firms have to successfully compete and survive in technology-demanding markets (Henderson & Clark, 1990; Tripsas & Gavetti, 2000; Tushman & Anderson, 1986). Therefore, owner firms are expected to positively influence the R&D intensity of the controlled firm, leading to our second hypothesis.

Hypothesis 2: *There is a positive influence of non-financial corporation's ownership on firm's R&D investment intensity.*

The last type of blockholder that we identify is the individual or non-institutional blockholder. For this type of blockholder, we expect no relationship between its presence and the R&D investment intensity of the controlled firm. Baysinger and colleagues (1991) argued that the absence of systematic relationship between ownership concentration among individual shareholders and R&D investment is due to the heterogeneity of individual investor. There are large diversified individual stockholders who may prefer the higher returns of risky R&D strategies. But there are also undiversified individual investors, more risk averse, who will prefer low risk strategies with less volatile returns. This heterogeneity of individuals is translated into two opposite effects.

First, there is a positive *monitoring effect* that favors the scrutiny of those complex R&D-intensive projects as a wide set of heterogeneous shareholders are able to understand better the complexities derived from those projects and prevent eventual managers' opportunistic behavior. Moreover, this scrutiny eagerness is likely to be stronger for individual blockholders

because the stake in the controlled firm compromises a large proportion of their wealth. Unlike institutional blockholders, whose portfolios are typically diversified, individual blockholders have more concentrated investments.

Second, on the negative side, the agreement on long-term R&D-intensive projects is more difficult to achieve when there is great heterogeneity among blockholders that have to take the decision. Moreover, we expect a larger number of blockholders when owners are not institutions¹. In this case, we also expect a superior *bargaining effect* (see upcoming discussion). Hence, the combination of both effects leads to our third hypothesis.

Hypothesis 3: *There is a null influence of individual ownership on firm's R&D investment intensity.*

Number of blockholders

Very recently some theoretical papers have started studying the effects of the composition of the controlling group (the coalition of blockholders with a stake larger than 50%) on firm returns. This is made by inspecting, both, the monitoring role of the controlling group (Bolton & Von Thaden, 1998; Pagano & Röell, 1998) and the expropriation problem of the minority by the controlling group (Bennedsen & Wolfenzon, 2000; Gomes & Novaes, 2005). The outcome of both agency problems (owner-manager and blockholder-minority shareholder) determines, among other things, firm's R&D investment decisions (Haid & Weigand, 1999). We argue that firms with the same stake in their control group but different number of blockholders

¹ It is remarkable that the average number of blockholders is 1.9 if they are individuals, while it is only 1.7 when they are banks and 1.4 when they are non-financial corporations.

within that control group define a quite different investment policy, in general, and R&D investment policy, in particular. This is so because the existence of a set of large shareholders with different individual objectives makes more difficult to reach consensus on firm decisions, especially in those decisions that involve a long-term agreements like those to undertake R&D-intensive projects. This is the so-called *bargaining effect*.

Moreover, the existence of a large number of blockholder weakens the degree of monitoring of manager's actions since vigilant responsibilities are diluted among a greater number of dominant shareholders. This, in turn, enhances managerial discretion and consequently managers have greater leeway to pursue low-risk strategies and show self-serving behavior (Finkelstein & Boyd, 1998; Tosi, Katz, & Gomez-Mejia, 1997), evading risky R&D projects.

Thus, we hypothesize the existence of a negative relationship between the number of blockholders and firm R&D investment policy.

Hypothesis 4: *The number of blockholders has a negative influence on firm's R&D investment intensity.*

Additional analysis:

1) On the firm's growth

In the above paragraphs we exposed the expected differential effects that each blockholder type as well as their number would have on the controlled firm's R&D intensity. These effects are likely to be more evident under certain circumstances. In particular, we argue that the growth rate of firms in which blockholders invest can help to confirm our arguments. Firms with high growth rates are often young firms that perform in attractive but turbulent

contexts, which provide risky business opportunities. Institutional investors, in particular banks, are likely to avoid investment in such firms. Rather, individual investors, like venture capitalists, participate in these firms. Venture or angel investors are well-known for their risk taking behavior and consequently we expect them to promote risky R&D projects.

On the other hand, firms with low growth rate are incumbent firms that face more stable environments. Institutions like banks can be more attracted by these firms that have proven their ability to survive. Consequently, we expect that individual blockholders exert more of their influence in firms with large growth rates, while bank and non-financial blockholders to be more influential in mature firms (*i.e.*, firms with low growth rates). As argued in the above paragraphs, we expect a negative influence from banks and a positive one from non-financial corporations. This further analysis allows us to test the robustness of our contentions.

2) On the financial structure

There is a second aspect that may aid in the evaluation of the connection between ownership structure and R&D investment: a firm's financial structure. The literature on the financing of R&D has found that leverage has a negative impact on R&D investments (Bah & Dumortier, 2001; Long & Ravenscraft, 1993). This is so due to different reasons. First, debt is a controlling mechanism that hinder the development of capital-intensive projects like R&D ones. Second, R&D investments are volatile long-term projects. This is at odds with the stickiness of the debt contract. Our conjecture is that the importance of these aspects is fully conditioned by the characteristics of the ownership structure of the firm. This is the case because the possibility to renegotiate the debt contract –that affects the controlling, length, and the “real” rigidity nature of debt contracts- is influenced by the type of blockholder –institutional or not- that owns the leveraged firm. This means that the ownership structure determines at a last stage a firm's

financial structure. But also, in this paper we have argued about the strong connection between ownership structure and R&D investment. Then, we expect that the connection between financial structure and R&D will vanish once we introduce a firm's ownership structure as determinant of R&D investments. This is an indirect test of the real strength of the impact of ownership structure on a firm's R&D investments.

METHODS

Sample and Data

To test the empirical predictions, we use the SABE databases for the years 1996 through 2000. These databases, available from Bureau Van Dijk, provide the ownership structure, balance sheets, and income statements for over 190,000 Spanish firms (95% of all Spanish companies) that deposit their financial statements in the Central Mercantile Register (Registro Mercantil Central). All Spanish firms are forced by law to deposit their annual financial statements in this public register. However, the law does not establish a penalty for not doing it unless the company goes bankrupt. This implies that not all firms, especially the smaller ones, comply with this obligation and that the quality of the information provided varies very much from firm to firm. We restrict the sample using three criteria: we eliminate firms that do not report the ownership structure, those that do not present detailed financial statements and those that are not corporations (cooperatives, partnerships, and proprietorship). Moreover, these three criteria have to be satisfied for at least three of the five available years. We are left with an unbalance panel of 3,638 different firms and 12,685 firm-year observations.

This database has two main advantages. First, it contains a very complete description of the ownership structure of the firms. We have the names and ownership stakes of the

shareholders that account for at least 50% of the shares for 90% of the observations. This allows us to characterize the type of *blockholders* as well as the number of it required to control the firm and carefully study its effect on a firm's R&D investment policy. Second, the sample is representative of the total population of firms in the economy: only 0.49% of the firms are open and public (listed), 10.86% are close and the remaining 88.65% are open and private.

Measures

Dependent variables

R&D intensity. The variable to characterize a firm's R&D policy is its *R&D intensity* that is defined in terms of the ratio of R&D expenditures to total sales.

Financial performance. We measure the differential effects on performance due to R&D investment contingent on the type of ownership structure. We approach to firm performance through the Return on Assets (*ROA*) defined as the ratio earnings before interests and taxes to the total value of assets.

Independent variables

Variables of ownership structure.

The first dimension of the ownership structure we focus on is the type of blockholders. We distinguish between banks, non-financial corporations, and individuals. In particular, we define as *Bank ownership* the stake in the hands of banks; *Corporate ownership* the stake in the hands of other firms; and *Individual ownership* the stake in the hands of individuals (non-institutional blockholders). Two comments are in order. First, we have aggregated the stake in the hands of the individuals with the same surname in the understanding that they belong to the

same family. Second, following La Porta, Lopez-de-Silanes and Shleifer (1999), we consider a blockholder as a shareholder who has at least 10% of the shares.

The number of blockholders that form the controlling coalition (*Number controlling blockholders*) is the second element of the ownership structure that we consider as determinant of a firm's R&D policy. Following Bennedsen and Wofelzon (2002), we take as control group the coalition with the minimum number of blockholders. The way we compute the number of members of the controlling coalition is as follows. When the largest shareholder owns more than 50% of the shares, we assume that it is the only member of the coalition. When the largest shareholder owns less than 50%, for a given ownership structure many different controlling coalitions may be formed. In a rough simplification we assume that in this case the two largest shareholders will always be in the coalition. If the joint stake of the two largest shareholders is lower than 50% then the coalition will also include the third largest shareholder and so on and so forth. Obviously this is not the necessary or most likely outcome of a coalition formation game. But it gives us a measure of the minimum possible number of members of any controlling coalition.

To study crossed effects between the aforementioned dimensions, we consider variables *Bank ownership*×*Number* that is the product of *Bank ownership* times the *Number controlling blockholders*. Following the same logic, we define *Corporate ownership*×*Number* and *Individual ownership*×*Number*.

In some specifications we identify those firms with a value of R&D intensity larger than the mean for the sector in the corresponding year with a dummy variable *dummy R&D*. Also, in some cases, we consider the interactive effect of the ownership structure and R&D investment on a firm performance. This leads to define the following variables *Bank ownership*×*R&D* that is

the product of *Bank ownership* times the *Dummy R&D* variable. Following the same logic, we define *Corporate ownership*×*R&D*, *Individual ownership*×*R&D*, and *Number controlling blockholders*×*R&D*. These moderator variables allow us study when the impact of some of our independent variables has a reduced or enhanced influence on our dependent variables.

Control variables

We control for size effects with the *Sales* variable that is the amount of sales on a log scale. The effects of financial structure are captured with two variables. First, *Debt-to-equity*, which is the ratio of book value of debt to the book value of equity. Second, *Internal funds-to-assets*, which is the ratio of a firm's internal funds to the overall value of a firm's assets. In order to avoid potential endogeneity problems, we also control for previous performance. We lagged the *ROA* variable one period and named it *ROA{t-1}*. Finally, we introduce as an additional control a variable *family* that is a dummy that is equal to 1 when there are blockholders that belong to the same family.

Data Analysis and Model specification

Our main specification is aimed to test the effect of the presence of different types of blockholders as well as its number on a firm's R&D investment intensity. We accompany the variables that characterize the ownership structure mentioned before, with a set of controls for size, financial structure and profitability. In particular, we focus on the following specification:

$$\begin{aligned}
 R \& D \text{ intensity}_{it} = & \mathbf{a} + \mathbf{b}_1 (\text{Bank ownership}_{it}) + \mathbf{b}_2 (\text{Corporate ownership}_{it}) \\
 & + \mathbf{b}_3 (\text{Individual ownership}_{it}) + \mathbf{b}_4 (\text{Number controlling blockholders}_{it}) + \mathbf{b}_5 (\text{Sales}_{it}) \\
 & + \mathbf{b}_6 (\text{Debt-to-equity}_{it}) + \mathbf{b}_7 (\text{Internal funds-to-assets}_{it}) + \mathbf{b}_8 (\text{ROA}\{t-1\}_{it}) \\
 & + \mathbf{b}_9 (\text{Family}_{it}) + \mathbf{y}_t + u_i + \mathbf{e}_{it}
 \end{aligned} \tag{1}$$

Additionally, as an extension, we test the performance effects of different combinations of blockholders and a firm's R&D investment. This is a way to inspect whether the presence of those blockholders that trigger R&D investments translates into a positive impact of those investments on performance. In particular, the specification we consider is as follows:

$$\begin{aligned}
ROA_{it} = & \mathbf{a} + \mathbf{b}_1 (\text{Bank ownership} \times \text{Dummy R \& D}_{it}) \\
& + \mathbf{b}_2 (\text{Corporate ownership} \times \text{Dummy R \& D}_{it}) \\
& + \mathbf{b}_3 (\text{Individual ownership} \times \text{Dummy R \& D}_{it}) \\
& + \mathbf{b}_4 (\text{Number controlling blockholders}_{it}) + \mathbf{b}_5 (\text{Dummy R \& D}_{it}) \\
& + \mathbf{b}_6 (\text{Sales}_{it}) + \mathbf{b}_7 (\text{Debt-to-equity}_{it}) + \mathbf{b}_8 (\text{Internal funds-to-assets}_{it}) \\
& + \mathbf{b}_9 (\text{Family}_{it}) + \mathbf{y}'_t + \mathbf{u}'_i + \mathbf{e}'_{it}
\end{aligned} \tag{2}$$

It is important to emphasize that under both types of estimations, we recognize the possible existence of unobservable heterogeneity \mathbf{y}_t potentially correlated with a firm's ownership structure and/or a firm's performance. We consider that the reasons that may explain the presence of a particular type of blockholder may be perfectly related with a firm's R&D policy and/or its performance. That is, there may be some unobservable firm's characteristics that trigger a particular type of R&D policy as well as a firm's performance and the same characteristics also may attract a particular type of blockholder. Thus, the unobservable heterogeneity that explains a firm's R&D policy or its performance may perfectly be the driving mechanism that explains the presence of a particular type of investor on a firm's ownership. This may generate a correlation between a firm's intrinsic and unobservable characteristics $\mathbf{y}_t, \mathbf{y}'_t$

and its type of blockholder. We deal with this problem by making use of *fixed-effect* techniques (within group estimators)².

RESULTS

We provide in Table 1 a description of the main variables that we use in order to test our hypotheses. We have to note the large ownership concentration of Spanish firms as the stake of the largest *blockholder* is almost 70% (68.97%). Also, the stake in the hands of banks is, on average, 30.79%; in the hands of other corporations is 77.47%; and of individuals 67.14%. It is remarkable that we obtain a positive impact on R&D investment only for the presence of corporations and individuals. Hence, only when blockholders have a large stake (they are particularly committed with the firm), they support this kind of long-term risky investment. This is also consistent with our argument concerning the possible beneficial effect of R&D investments in accounting practices when blockholder firms can translate these investments to their balance sheet –when their stake in their controlled firm is larger than 50%. In this case, blockholder firms have a wider scope for managing efficiently expenses and investments accounts in order to implement a profit smoothing policy.

Finally, we observe that the number of blockholders in the controlling coalition is significantly lower for those firms that invest significantly in R&D (dummy R&D=1) in

² If the unobservable heterogeneity is correlated with explanatory variables, we have to perform fixed-effects estimation. But, if it is not correlated with the explanatory variables, unconditional inference like that of the composed error method (random effects) is the most efficient alternative (Arellano & Bover, 1990). The way to inspect whether there is correlation or not is through the Hausman test that studies whether systematic differences exist between those coefficients of the fixed-effect estimation and those of the random-effects estimations. If this null hypothesis is rejected, the only consistent estimator is the fixed-effects one. If not, the best alternative is to use the random-effect estimation.

comparison with those that do not, suggesting initial support for Hypothesis 4. Finally, those firms that invest intensively on R&D are more profitable, larger and less leveraged.

[INSERT TABLE 1 ABOUT HERE]

Table 2 shows the results of the presence of different types of blockholders on a firm's R&D intensity. In row 1 there is the result of specification (1), while in rows (2), (3), (4), we incorporate additional variables to study the moderator effect of the number of blockholders on the connection between blockholders' types and R&D investment. For the full models as well as that of row (2), Hausman tests reveal the existence of correlation between unobservable heterogeneity and explanatory variables. Hence, we conduct fixed-effect estimations. For the remaining models we perform random-effect estimations.

[INSERT TABLE 2 ABOUT HERE]

Once we focus on the type of blockholder, we find that banks' ownership has a significant negative impact on R&D investment. This confirms our Hypothesis 1. However, the presence of non-financial blockholders stimulates this kind of investments. This conforms to Hypothesis 2 and sheds some light on the wide dispersion of results concerning the final effect of the presence of institutions in the R&D policy followed by firms. Our results indicate that the effect depends on the type of institution: Banks has a negative impact while non-financial corporations a positive one. Finally, and according to Hypothesis 3, the presence of non-institutional blockholders (individuals) does not have a significant impact on the R&D investment carry out by firms.

Concerning the number of blockholders, all specifications show a negative impact on a firm's R&D intensity. It seems that a bargaining effect exists, which hinders R&D investments as predicted by Hypothesis 4.

The interaction between the types of blockholders and their number reveals that the existence of a large number of blockholder has a negative moderating effect when other corporations have a controlling role in a firm. Nevertheless, it is important to stress that even when there is a large number of blockholders, the overall effect on a firm's R&D investment of the presence of other corporations is still positive.

Finally, we observe that those variables related to the financial structure (debt-to-equity and Internal funds-to-assets) do not have a significant impact on R&D investment. Their effect is fully explained by the firm's ownership structure.

The type of blockholder in growth firms

As a first extension, we study whether the results found change when we focus on growth firms and non-growth ones. To do so, we estimate specification (1) separating the sample between these two types of firms. We define growth firms as those such that the rate of increase of their sales is larger than the mean for the sector and year. Table 3 shows the results of these estimations.

[INSERT TABLE 3 ABOUT HERE]

The results found indicate that non-institutional ownership has a positive effect on R&D investment in growth firms in comparison with non-growth firms. Among these individual owners we may expect to find "*angel*" investors investing in growth firms (start-ups). In contrast, the effect of institutional owners mostly concentrates on non-growth (mature) firms. These types of firms are the natural objectives of institutional owners, whether banks or other corporations. The effects of these latter types of investors are like those for the overall sample: positive for other corporations and negative for banks.

Performance analysis

As a second extension, we estimate the effect of R&D investment on a firm's returns (proxied by ROA) moderated by the type of ownership structure. Table 4 shows the results.

[INSERT TABLE 4 ABOUT HERE]

The inspection of the previous table reveals that the effect of significant investments on R&D (superior to that of the mean for the sector and year) is positive on performance when the blockholders are individuals or other corporations. Note that these are the types of blockholders that stimulate R&D investments according to the results obtained in the estimation of specification (1) (individuals in growth firms and corporations in non-growth ones). Hence, the types of owners that promote R&D investments seem to provide the adequate mechanisms (*e.g.* monitoring, advising), to transform these investment in a performance enhancement.

DISCUSSION AND CONCLUSION

In this paper we have investigated the relationship between ownership structure and corporate R&D investment in Spain. Previous studies have examined this relationship in US and Japan (Lee, 2005; Lee & O'Neil, 2003; Porter, 1992), but studies about the effects of ownership structure in European settings are inexistent. This is the first one of this kind and we intended to identify idiosyncratic ownership structures that favour R&D investment in an European country.

The conclusions derived from this study are important for both investors and public authorities, as decisions regarding the magnitude and allocation of R&D expenditures are extremely important for corporations, particularly in some sectors. Consequently, it is imperative to identify the structures favoring innovation activities. Moreover, the importance of R&D for a firm in order to outperform its competitors requires avoiding information diffusion among

shareholders. However, providing information about firm's R&D projects would help shareholders to understand the benefits they can enjoy in the future. This tension between managers and shareholders can be resolved, or at least lessened, with the adoption of the adequate corporate control system. In particular, large shareholders can play a decisive role in critical corporate decisions (Tirole, 2001). These blockholders have the incentives and the power to influence management's discretion to choose R&D strategies. Previous literature has suggested that ownership concentration is positively related to R&D investments (Lee, 2005; Lee & O'Neil, 2003). However, other studies like Yafeh and Yosha (2003) find a negative result. We can reconcile these different results by focusing on the differences in blockholders' preferences regarding the strategic orientation of the firm. Thus, the effect on R&D by each large shareholder type is expected to be different depending on their risk aversion and time-horizon orientation (Baysinger et al., 1991). If large shareholders possess distinctive preferences, the correct understanding of the effect of ownership structure on R&D investment requires distinguishing shareholder types.

In this study we have examined the effect of three blockholders, namely banks, non-financial corporations, and individuals, on R&D investment. Unlike previous literature, our study advances understanding of the relationship between corporate governance and innovation activities in five newly fronts. First, we have argued that among institutional blockholders it is important to distinguish between banks and blockholder firms because they have opposite effects concerning R&D investments. Second, we have stressed that not only the identity and the amount of stakes of large shareholders influence the R&D policy, but also the number of blockholders. The existence of a set of large shareholders with different preferences makes more difficult their agreements on firm decisions, and this is expected to influence negatively R&D.

Third, we have suggested that the effect of large shareholder is contingent to the life-cycle stage of the firm: Fast-growing organizations require the development of learning abilities, changes in their organizational structure, and the introduction of new technologies, which they can achieve by improving organization flexibility (Barney, Wright, & Ketchen, 2001). In this context, it is expected that control structures that work in mature firms do not work for stimulating R&D investments in growth-firms. Fourth, we have shown the relevance of taking into account a firm's ownership structure in explaining R&D investments because once variables of ownership structure are incorporated in the estimations, there is no direct effect of the financial structure (leverage) on R&D investments. This is remarkable given that the literature on R&D financing has described a negative relationship between leverage and R&D (Bah & Dumontier, 2001). And fifth, we have examined the combined effect of ownership structure and R&D expenditure on financial performance. In this case, our interest has been to understand whether those blockholder that stimulates R&D investments also favor the transformation of these investments into productive outcomes; in other words, when large shareholders influence managers to invest in R&D, do the decision adopted always lead to a performance improvement? Or, if large shareholders induce managers to choose lower levels of R&D, do those shareholders try to prevent managerial opportunism and then enhance financial performance?

The type of blockholder

Our findings indicated that R&D investment is related negatively with bank ownership and positively with non-financial corporation ownership, whereas individual ownership has a neutral effect.

The observed negative effect of bank equity concentration on R&D investment is somewhat related to the result obtained by Lee (2005) on the negative connection between bank's ownership and innovation for large values of R&D investments. Although traditionally Spanish banks have played an important role in financing the industry, they rarely have participated in the active management of firms. In the late nineties, Spanish banks have followed a disintermediation policy that has led them to reduce significantly their stakes in other firms. However, they have not sold all the stakes due to different reasons: to diversify their portfolio and obtain share premiums, to obtain a privileged position in the financing of the firm, and to participate in future bond and stock emissions of the firm (Crespí & García-Cestona, 2001). All these reasons suggest that banks follow a conservative investment policy that is at odds with the investment in risky long-term projects that not yield short-term returns (*i.e.*, R&D-intensive projects).

We have provided different reasons to justify the positive effect on R&D investment of the presence of non-financial corporations in a firm's stakes. First, these corporations are stable owners with clear incentives, due to their large stakes, to monitor managers. Second, these corporations are investors with a long-term perspective, thereby allowing managers to take long-term view of investments. Third, corporations in control take advantage of their knowledge, accumulated through its own R&D investment track, to influence current managerial decisions in the direction to take advantage of eventual future spillovers that emerge from the R&D projects developed within their controlled firms. Last, blockholder corporations with a controlling stake (this is the case in our sample) may give incentives to their controlled firms to invest in R&D because this facilitates earnings management practices in the consolidated balance sheet between expenses and investments accounts.

The neutral effect of individual ownership is consistent with the evidence found by Baysinger et al. (1991). The absence of relationship between the presence of individual blockholders and the innovation expenditure is explained by the characteristics of this group. They have more powerful incentives to scrutiny managerial decisions than institutional blockholders (*i.e.*, banks and corporations), but at the same time, these incentives are lessened as the number of individual blockholders increases, due to the fact that large number of individual blockholders stimulates free-rider behaviors. Additionally, the high heterogeneity and the relatively large number of these blockholders complicate the agreement on what investments should be made (bargaining effect). This damages a firm's R&D investments. Precisely, the identification of these free-rider and bargaining problems is behind the examination of the relationship between the number of blockholders and innovation expenditures. As expected, we have proved that the number of large shareholders has a negative impact on a firm's R&D intensity.

The type of blockholder in growth firms

In addition, we have found that the aforementioned effects depend on the life-cycle stage of the firm. In particular, the results reported in this study showed that, in firms with high growth rates, the impact on the R&D investment is neutral when blockholders are banks or corporations, and positive when blockholders are individual investors. These results suggested that such firms choose particularly risky R&D project and, consequently, institutional investors avoid this kind of investment. However, individual investors, such as venture capitalists, who participate in these firms, favor investment in such risky projects with long-term returns. Accordingly, they cause a positive effect on R&D investments.

On the connection to the financial structure

Firm's ownership structure is closely connected with its financial structure. This is relevant for our research question because if ownership structure shapes both financial structure and R&D investments, there should not be a direct effect of financial structure on R&D investment once variables of ownership structure are incorporated in the estimations. Our work provides evidence supporting this rationale and calls into question previous results found in the literature (Bah & Dumontier, 2001; Long & Ravenscraft, 1993) over the negative linkage between leverage and R&D investments. Our findings indicate that this relationship is spurious and financial structure and R&D investments have only an indirect connection through the firm's ownership structure. Thus, the debate should not be about whether debt is good or bad to finance R&D but what should be the type of blockholder most appropriate to finance R&D projects.

Performance analysis

The previous discussion raises an obvious question: Does the control device of large shareholders lead to select appropriate investment decisions? In response to this question, we should keep two important points in mind: First, some blockholders can opportunistically use their power to obtain private benefits – favoring those R&D projects that might facilitate minority expropriation. Hence, a large amount of this investment does not guarantee an improvement in financial performance. And second, a lower R&D investment intensity due to a stringent monitoring by conservative blockholder may not necessarily lead to a reduction in the financial performance. In fact, this can lead to a better selection of projects and, consequently, increase the efficiency of R&D expenditures.

Our results suggested that when firms engage in conspicuous R&D projects (*i.e.*, R&D investments higher than the mean of the sector), the presence of large shareholders, particularly corporations and individuals, has a positive impact on financial performance. This result is an illustration of the positive influence of corporations and individuals on management's discretion: managers are encouraged to choose those projects that improve the financial performance. Alternatively, the R&D projects that get through the intense scrutiny of banks do not cause ROA improvements. This evidence is consistent with the conservative attitude of banks towards innovation: this type of blockholder shows a strong preference for projects with low levels of risk.

Policy implications

The results reported in this paper have important policy implications. In 1985, Spanish government engaged in a comprehensive privatization process. Over the last twenty years, the public sector has been largely restructured and its weight in the GDP has experienced a progressive reduction. In this context, Spanish government favored the creation of the so-called "núcleos duros" – a stable control group. There were at least two reasons for justifying this policy: First, Spanish government was fearful of the possibility that important domestic firms were acquired by foreign multinational. And second, it was expected that the presence of stable control groups would avoid potential service quality reductions. These groups were formed around large commercial or savings banks and they have been very common in sectors such as oil, utilities and airlines.

As a result, the governance structure of former public enterprises is characterized by two main features: (1) the presence of a large number of small shareholders and a stable control group, which follows the policy designed by the government (Crespí & García-Cestona, 2001),

and (2) the pivotal role played by banks in these “núcleos duros”. The main concern for the presence of banks was the need for an improvement in the corporate governance of Spanish firms. Banks were considered to be beneficial to evaluating and monitoring long-term investments.

The results showed in this study help to understand the effects of both features on corporate strategy and performance. On the one hand, we have found that increases in the number of blockholders in the controlling group drive R&D investment down. This is an important issue for public authorities, as one of their main preoccupations is the quality of the services provided by recently privatized firms, which is closely related to R&D investments. Consequently, our evidence suggests that, when designing “núcleos duros”, public authorities have to take into account the negative effect of the presence of a control group with a large number of blockholders on the innovative strategy. On the other hand, according to our evidence, the participation of banks as control owners, instead of improving long-term investments, reduces the amount assigned to R&D activities.

A last comment applies to the beneficial effects of compensating through share buy-backs by growth firms. This is in fact the usual mechanism this firms use for compensating their shareholders (TheEconomist, 1999). This feature may be used to diminish the presence of institutional blockholders and increase that of individual blockholders. A natural way to achieve this objective is to buy shares from controlling banks and distribute them to other types of blockholders (preferably individuals), or float them on the stock market. According to our results, this should stimulate R&D investment in these growth firms.

Future research

Our study can be extended in different ways. First, future research could address an aspect that has been barely mentioned in the paper: To what extent R&D investments may be used as a mechanism of earnings management by controlling blockholders? It could be argued that by investing in R&D, firms may channel more easily accounting expenses to investment ones and smooth income. Given that, institutional blockholder with a controlling stake in R&D-intensive firms may stimulate these practices in order to consolidate this income smoothing in their own balance sheet.

As a second possible avenue is to incorporate alternative measures of corporate governance, financial performance, and innovation, which would allow a more finely grained analysis connecting specific governance mechanisms to the specific dimensions of a firm's R&D indicators as well as its financial performance. Ownership structure is only one mechanism that may influence R&D investment; others may be the composition of the board or the duality of the CEO. Then, it may be of interest to examine the relationship between governance mechanisms and innovation. Third and also related to the measurement issue, a potential extension of our paper could be to study the effect of corporate governance mechanisms on different indicators of innovation. We have used the level of R&D expenses, but there are other measures such as the number of: patents, technological collaborations, product/process innovations, radical versus incremental innovations, and so on.

Finally, it would be of great interest to explore the relationships between corporate governance structures, R&D decisions and financial performance in different institutional financial systems, making use of accounting as well as market measures of financial performance. This is a relevant feature, given the differences that exist across different countries.

REFERENCES

- Alchian, A. A. & Demsetz, H. 1972. Production, information costs, and economic organization. *American Economic Review*, 62: 777-795.
- Bae, K. H., Ho, S., & Kim, J. B. 2005. *Income smoothing, external monitoring, and managerial entrenchment: Japanese evidence*. Mimeo (available at <http://aaahq.org/midwest/Meeting%20Info/2005/Abstracts/3C-Income%20Smoothing%20External%20Monitoring.rtf>).
- Bah, R. & Dumontier, P. 2001. R&d intensity and corporate financial policy: Some international evidence. *Journal of Business Finance & Accounting*, 28(5-6): 671-692.
- Barney, J., Wright, M., & Ketchen, D. J. 2001. The resource-based view of the firm: Ten years after 1991. *Journal of Management*, 27: 625-641.
- Baysinger, B. D., Kosnik, R. D., & Turk, T. A. 1991. Effects of board and ownership structure on corporate r&d strategy. *Academy of Management Journal*, 34(1): 205-214.
- Bennedsen, M. & Wolfenzon, D. 2000. The balance of power in closely held corporations. *Journal of Financial Economics*, 58(1-2): 113-139.
- Berger, N. A., Miller, H. N., Petersen, M. A., Rajan, R. G., & Stein, J. C. 2005. Does function follow organizational form? Evidence from the lending practices of large and small banks. *Journal of Financial Economics*, 76(2): 237-269.
- Berle, A. A. & Means, G. C. 1932. *The modern corporation and private property*. New York: Macmillan.
- Boehmer, E. 2000. Business group, bank control and large shareholders, an analysis for german takeover. *Journal of Financial Intermediation*, 9: 117-148.

- Bolton, P. & Von Thaden, E. L. 1998. Blocks, liquidity and corporate control. *Journal of Finance*, 53: 1-25.
- Boot, A. W. A. 2000. Relationship banking: What do we know? *Journal of Financial Intermediation*, 9: 7-25.
- Carlson, S. J. & Bathala, C. T. 1997. Ownership differences and firms' income smoothing behavior. *Journal of Business Finance & Accounting*, 24(2): 179-196.
- Cohen, W. M. & Levinthal, D. A. 1990. Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly*, 35(1): 128-152.
- Crespí, R. & García-Cestona, M. A. 2001. Ownership and control of spanish listed firms. In F. Barca & M. Becht (Eds.), *The control of corporate europe*: 207-227. Oxford: Oxford University Press.
- Finkelstein, S. & Boyd, B. 1998. How much does the ceo matter? The role of managerial discretion in the setting of ceo compensation. *Academy of Management Journal*, 41(2): 179-199.
- Francis, J. & Smith, A. 1995. Agency costs and innovation. Some empirical evidence. *Journal of Accounting and Economics*, 19: 383-409.
- Gomes, A. R. & Novaes, W. 2005. Sharing of control as a corporate governance mechanism, *PIER Working Paper*: 1-12.
- Haid, A. & Weigand, J. 1999. R&d, financial restraints, and corporate governance structures, *Mimeo*.
- Hambrick, D. C. & Finkelstein, S. 1987. Managerial discretion: A bridge between polar views of organizational outcomes. In L. L. Cummings & B. M. Staw (Eds.), *Research in organizational behavior*, Vol. 9: 369-406. Greenwich, CT: JAI press.

Henderson, R. & Clark, K. 1990. Architectural innovations: The reconfiguration of existing product technologies and the failure of established firms. *Administrative Science Quarterly*, 35(1): 9-30.

Hill, C. W. & Snell, S. 1988. External control, corporate strategy, and firm performance in research-intensive industries. *Strategic Management Journal*, 9: 577-590.

Holderness, C. G. & Sheehan, D. P. 1988. The role of majority shareholders in publicly held corporations. *Journal of Financial Economics*, 20: 317-346.

Hoskisson, R. E., Johnson, R. A., & Hill, C. A. 1993. Managerial incentives and investment in r&d in large multiproduct firms. *Organization Science*, 4: 325-341.

Jaffe, A. B. 1986. Technological opportunity and spillovers of r&d: Evidence from firm's patents, profits and market value. *American Economic Review*, 76: 984-1001.

Jelinek, M. & Schoonhoven, C. B. 1993. *The innovation marathon: Lessons from high technology firms*. San Francisco: Jossey-Bass.

Jensen, M. C. & Meckling, W. 1976. Theory of the firm: Managerial behavior, agency costs, and ownership structure. *Journal of Financial Economics*, 3: 305-360.

Kochhar, R. & David, P. 1996. Institutional investors and firm innovation: A test of competing hypothesis. *Strategic Management Journal*, 17(1): 73-84.

Kroszner, R. & Strahan, A. 2001. Bankers on boards: Monitoring, conflicts of interests, and lender liability. *Journal of Financial Economics*, 62: 415-452.

Lee, P. G. & O'Neil, H. M. 2003. Ownership structures and r&d investments of u.S. And japanese firms: Agency and stewardship perspectives. *Academy of Management Journal*, 46(2): 212-225.

- Lee, P. G. 2005. A comparison of ownership structures and innovations of us and japanese firms. *Managerial and Decision Economics*, 26: 39-50.
- Long, W. & Ravenscraft, D. J. 1993. Lbos, debt and r&d intensity. *Strategic Management Journal*, 14: 119-135.
- Nagy, A. L. & Neal, T. L. 2001. An empirical examination of corporate myopic behavior: A comparison of japanese and us companies. *The International Journal of Accounting*, 36: 91-113.
- Pagano, M. & Röell, A. 1998. The choice of stock ownership structure, agency costs, monitoring and the decision to go public'. *Quarterly Journal of Economics*, 113: 187-225.
- Porter, M. E. 1990. *The competitive advantage of nations*. New York: Free Press.
- Porter, M. E. 1992. Capital disadvantage: America's failing capital investment system. *Harvard Business Review*, 70: 65-82.
- Rajan, R. 1992. Insiders and outsiders: The choice between informed and arm's length debt. *Journal of Finance*, 47(4): 1367–1400.
- Sharpe, S. A. 1990. Asymmetric information, bank lending, and implicit contracts: A stylized model of customer relationship. *Journal of Finance*, 45(4): 1069-1087.
- TheEconomist. 1999. Shares without the other bit: In corporate america, paying dividends has gone out of fashion, *The Economist*, Vol. 353:111.
- Tihanyi, L., Johnson, R. A., Hoskisson, R. E., & Hitt, M. A. 2003. Institutional ownership differences and international diversification: The effect of board directors and technological opportunity. *Academy of Management Journal*, 46(2): 195-211.
- Tirole, J. 2001. Corporate governance. *Econometrica*, 69: 1-35.

Tosi, H. L., Katz, J. P., & Gomez-Mejia, L. R. 1997. Disaggregating the agency contract: The effects of monitoring, incentive alignment, and term in office on agent decision making.

Academy of Management Journal, 40(3): 584-602.

Tripsas, M. & Gavetti, G. 2000. Capabilities, cognition, and inertia: Evidence from digital imaging. *Strategic Management Journal*, 21(10): 1147-1161.

Tushman, M. I. & Anderson, P. 1986. Technological discontinuities and organizational environments. *Administrative Science Quarterly*, 31(3): 439-465.

Wahal, S. & McConnell, J. J. 2000. Do institutional investors exacerbate managerial myopia?

Journal of Corporate Finance, 6: 307-329.

Yafeh, Y. & Yosha, O. 2003. Large shareholders and banks: Who monitors and how? *The Economic Journal*, 113(484): 128-146.

Yeo, G. H. H., Tan, P. M. S., Ho, K. W., & Chen, S. 2002. Corporate ownership structure and the informativeness of earnings. *Journal of Business Finance & Accounting*, 29(7-8): 1023-1046.

TABLE 1
Means and Standard Deviations

	Mean	St. Dev.	R&D=1 ^a	R&D=0 ^a	T-test
R&D intensity	0.006	0.058	0.046	0.000	0.000***
ROA	0.090	0.189	0.102	0.088	0.008***
Bank ownership	30.787	33.559	27.062	31.657	0.261
Corporate ownership	77.469	29.741	74.653	81.403	0.000***
Individual ownership	67.143	37.868	72.516	57.523	0.000***
Stake of the largest blockholder	68.969	31.359	69.945	68.839	0.199
Number controlling blockholders	1.279	0.723	1.229	1.285	0.004***
Family	0.148	0.356	0.068	0.150	0.000***
Sales	14.774	1.391	14.871	14.761	0.004***
Debt-to-equity	6.979	549.091	1.364	7.686	0.686
Internal funds-to-assets	0.377	0.317	0.364	0.379	0.077*

^a We define R&D=1 (0), when R&D intensity is larger or equal (lower) than the mean for the sector and year. The rest of the variables are defined in the text.

* $p = 0.10$; ** $p = 0.05$; *** $p = 0.01$

TABLE 2
Determinants of R&D investment intensity: Full Sample^a

Independent variables:	Dependent variable: R&D / Total sales ^b				
	Full model	Joint effect of blockholder & number of blockholders			Full model
		Banks	Corporations	Individuals	
Bank ownership	-0.0377***	-0.0438***			-0.0421***
Bank ownership×Number		0.0066			0.0041
Corporate ownership	0.0226**		0.0778***		0.0852***
Corporate ownership×Number			-0.0538***		-0.0644***
Individual ownership	0.0193			0.0352	-0.0082
Individual ownership×Number				-0.0120	0.0331
Number controlling blockholders	-0.0274***	-0.0307***	-0.0173**	-0.0200**	-0.0261***
Sales	-0.0056	-0.0029	-0.0067	-0.0054	-0.0050
Debt-to-equity	0.0001	0.0001	0.0001	0.0001	0.0001
Internal funds-to-assets	0.0085	0.0087	0.0047	0.0053	0.0074
ROA {t-1} ^c	-0.0105*	-0.0101	-0.0136**	-0.0125**	-0.0113*
Family	0.0041	0.0029	-0.0040	-0.0041	0.0035
Intercept	0.0005	-0.0071**	-0.0054	-0.0083	0.0014
<i>Hausman Test</i>	25.61 (0.002)	26.70 (0.001)	12.39 (0.135)	11.19 (0.191)	28.63 (0.000)
<i>Effects</i>	Fixed-effects	Fixed-effects	Random-effects	Random-effects	Fixed-effects
<i>F Test</i>	3.53***	2.96***			3.68***
<i>Chi-squared</i>			29.47***	13.94*	
<i>N</i>	8,221	8,221	8,221	8,221	8,221

^a Standardized regression coefficients are shown in the table.

^b The dependent variable is corrected by sector and year. All the variables are defined in the text.

^c ROA(t-1) means ROA lagged by one period. We have lagged this variable to avoid potential endogeneity problems.

* $p = 0.10$ ** $p = 0.05$ *** $p = 0.01$

TABLE 3
Determinants of R&D investment intensity: Growth Firms vs. Non-Growth Firms^a

Independent variables:	Dependent variable: R&D / Total sales ^b		
	Full model	Growth firms ^c	Non-growth firms ^c
Bank ownership	-0.0377***	0.0244	-0.0491***
Corporate ownership	0.0226**	-0.0078	0.0355***
Individual ownership	0.0193	0.0361**	0.0136
Number controlling blockholders	-0.0274***	-0.0126	-0.0493***
Sales	-0.0056	-0.0014	-0.0293**
Debt-to-equity	0.0001	0.2932	-0.0003
Internal funds-to-assets	0.0085	0.0397*	0.0050
ROA {t-1} ^d	-0.0105*	-0.0075	-0.0111
Family	0.0041	-0.0319*	0.0104
Intercept	0.0005	0.0159	-0.0102*
Hausman Test	25.61 (0.002)	2.29 (0.986)	29.00 (0.001)
Effects	Fixed-effects	Random-effects	Fixed-effects
F Test	3.53***		40.11***
Chi-squared		140.83*	
N	8,221	2,015	6,206

^a Standardized coefficients are shown in the table.

^b The dependent variable is corrected by sector and year. All the variables are defined in the text.

^c We define growth firms as those such that the rate of increase of their sales is larger than the mean for the sector and year.

^d ROA(t-1) means ROA lagged by one period. We have lagged this variable to avoid potential endogeneity problems.

* $p = 0.10$; ** $p = 0.05$; *** $p = 0.01$

TABLE 4
Performance Analyses by the Type of Blockholder^a

Independent variables:	Dependent variable: ROA			
	Full model	Banks	Corporations	Individuals
Bank ownership × R&D	-0.0065	-0.0114		
Corporate ownership × R&D	0.0662***		0.0444***	
Individual ownership × R&D	0.0483***			0.0264**
Number controlling blockholders × R&D.	-0.0137	-0.0189	-0.0171	-0.0204
Dummy R&D	-0.0109	0.0124	0.0009	0.0098
Sales	0.0582***	0.0576***	0.0569***	0.0581***
Debt-to-equity	0.0009	0.0008	0.0008	0.0008
Internal funds -to-assets	0.4340***	0.4329***	0.4333***	0.4333
Family	0.0056	0.0058	0.0058	0.0058
Intercept	0.0020	0.0045	0.0037	0.0038***
Hausman Test	15.81 (0.863)	11.75 (0.946)	10.29 (0.975)	12.98 (0.909)
Effects	Random-effects	Random-effects	Random-effects	Random-effects
Chi-squared	1372.72***	1347.45***	1356.97***	1351.68***
N	12,444	12,444	12,444	12,444

^a Standardized regression coefficients are shown in the table. The estimations include temporal and sectorial dummy variables.

All the variables are defined in the text.

* $p = 0.10$; ** $p = 0.05$; *** $p = 0.01$