INSTITUTIONAL INVESTORS AND R & D INVESTMENT: AN INTERNATIONAL COMPARISON

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Abstract

This article examines the involvement of institutional investors, as a heterogeneous entity in the management of the firm. Knowing the identity of these institutions (banks, pension funds and mutual funds) may be useful because of its different influences on the behavior of managers in R & D investment. In conducting a comparative study between different national systems of governance, we seek to identify the type of institution that can foster R & D investment. The empirical study is based on a sample of 531 U.S., Japanese and French firms for the period 2003-2007. The results of canonical analysis conducted show that investors have different effects on R & D investment according to the institutional context.

Keywords: R&D investment, institutional investors, banks, pension funds, mutual funds

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1. Introduction

In recent decades, ownership of large firms is increasingly dominated by institutions. The importance of investors shows the volume of their equity in the firm capital. In 2008, institutional ownership is very unequally distributed between countries: it is 53% for the United States, against only 14% and 7% for Japan and France, respectively (OECD, 2008).

An abundant literature, mainly Anglo-Saxon, was interested in the effects of the rise of institutional shareholders on firm activities. The theoretical contributions concerning the role of institutional investors and their impact on the general policy of firms have led to many controversies. The theory of "short termism" shows that institutional investors are short term oriented (Drucker 1986, Graves 1988, Hill et al. 1988). In responding to a desire for advancement and job security, they are trying to encourage managers to forego the increase in risky and long term investments, especially for R & D investment, in order to increase the short-term financial profitability. As for the theory of "efficiency", it postulates that institutional shareholders opt for rational strategic choices that increase future profits of the firm (Jarrell et al. 1985, Jensen 1988). Therefore, no relationship should exist between the proportion of institutional shareholding in the firms' capital and R & D investment. A third stream, "the theory of activism," shows that institutional investors are long term oriented, which incites managers to make investment decisions that increase the long-term value of the firm, as the R & D investment (Heiner 1983, Aoki 1984).

Empirically, there is no consensus on the impact of institutional ownership on R & D investment. While some works lead to a positive relationship (Jarrell et al. 1985, Hill and Hansen 1989, Hansen and Hill 1991, Baysinger et al. 1991, Kochlar and David 1996, Wahal and McConnell 2000, Eng and Shackell 2001, Aghion et al. 2008), others reinforce a negative relationship (Graves 1988, Samuel 1996) or mixed (Graves 1990, Bushee 1998, 2001) or even neutral (Majamda and Nagarajan 1997, Chung et al. 2003).

Despite their differences, these works consider the institutional investors as a homogeneous entity. However, the term "institutional investor" includes a variety of organizations such as pension funds, banks and mutual funds (Roe, 1990). This variety may explain differences in their voting behavior and their relationship with the firm (Brickley et al. 1988) (Brickley et al. (1988) have divided the institutional investors into three categories according to their sensitivity to the influence of managers: institutions sensitive to the pressures of managers, institutions resistant to pressure from managers and institutions whose attitudes towards the pressures of managers are indeterminate), in their preferences for investment horizons in their trading behavior (Bushee 1998, 2001) (Bushee (1998, 2001) has classified the institutional investors into three groups, based on past behaviour, on investment given the nature of portfolio diversification and trading behavior: dedicated investors, transient investors and quasi-indexer investors) and therefore, in their attitudes towards R & D investment.

The organization of the functioning of these institutions and their control practices is different from one country to another, hence the interest to study and compare the impact of the nature of these international institutions on R & D investment.

Under this section, our research will be organized around two fundamental questions: to what extent is R & D investment explained by the nature of institutional who control managers' opportunism to create value? And according to what systems of governance?

These questions are part of a theoretical debate on corporate governance. An international comparison of governance, especially institutional investors and their impact on R & D investment may be interesting. Interest in American, Japanese and French contexts is justified by the observation that each experimental field has a different tradition. The choice of the United States is marked by its economy of financial market. In contrast, the Japanese economy appears much like intermediation. Furthermore, analysis of the French situation is relevant because it represents a hybrid economy between the intermediation and the financial market.

This article is organized as follows: In the first section on theoretical exposure, we present the hypotheses underlying the impact of the nature of institutional on the R & D investment in different financial systems. The second section relates to the presentation of methodological aspects and interpretation of empirical results.

2. Theoretical Foundations and Hypotheses

The investment decision is separated from the value creation and realization of performance. And since the shareholder delegates investment decision rights to manager, it creates agency relationships, sources of interest conflicts and agency costs (Jensen and Meckling, 1976). These agency problems are more pronounced than the investment concerns of activities in R & D (Baysinger et al. 1991, Lee 2005, Tihanyi et al. 2003) because they are riskier (Baysinger et al. 1991, Finkelstein and Boyd 1998, Barker and Mueller 2002), have a long horizon performance (Laverty 1996, Ryan and Wiggins 2002), and are highly specific to the firm (Goel and Ram, 2001). These characteristics are all factors that allow managers to have behaviors that maximize their wealth at the expense of stakeholders. To control managerial opportunism and encourage R & D investment, creator of value, it is necessary to create levers for aligning the behavior of managers, represented mainly by institutional investors.

Demonstrating a capacity of processing information and special skills, investors are able to make rational decisions and to constrain the strategic conduct of managers, including R & D investment. Knowing the identity of these institutions is useful because of the different implications for the management of the firm. The functioning of these institutions and their control practices are different from one country to another. The policy of R & D investment via the appropriate mode of governance will be explained as an efficient organizational solution to maximize firm value. This maximization occurs through the establishment of governance mechanisms, represented by the nature of the institutional order to reduce agency problems.

2.1. The impact of banks on R & D investment

The legal and regulatory environment has important implications on the role played by banks in financing systems and corporate governance of a country.

In the U.S., banks are subject to the most stringent fiduciary standards. The restrictions imposed on their mode of operation make it difficult to establish close and lasting relations with firms. Indeed, the Bank Holding Act of 1956 prohibits U.S. banks from holding more than 5% of the same firm and the shares they hold do not allow them to control the client firm (Morck and Nakamura, 1999). The practice of rigid rules that hinder their development clearly explains the existence of dispersed ownership in this country. Banks do not have significant shareholdings in the capital of American firms. They have a diversified portfolio of small holdings and a high turnover ratio of the portfolio because they regularly trade securities. These institutions are considered as dedicated institutional owners (Porter, 1992). They choose the outflow of capital rather than intervene to restructure and correct management practices of firms in difficulty. These institutional feel their duty, towards their own corporate customers, is to meet their demands by providing continuous liquidity. For this, they do not have enough power to control the firm management.

In these circumstances, the manager is freed of all constraints and promotes the achievement of personal investments. He/she is therefore encouraged to undertake low levels of R & D investment. Hill et al. (1991) suggest that a dispersed ownership structure implies low control on the part of shareholders, which allows managers to implement their diversification strategies. Bushee (1998) also finds that the predominant ownership by dedicated' institutions (banks) significantly increases the probability of reduced R & D investment. Similarly, Berger et al. (2005) find a negative relationship between the participation of banks in capital and the intensity of R & D investment.

In contrast, in Japan, banks play a crucial role, especially for growing firms[7]. They are both shareholders and creditors. They benefit from a bigger

[7] Once the large Japanese firms have reached maturity, they try to disengage from the grip of banks or their main banks, reduce their debt and use the capital markets (Abegglen and Stalk, 1985, Hoshi et al. 1990).

liberty of involvement in the firms' capital (Prowse, 1990). Despite the fact that antitrust law limits the participation of banks in firms to 5%, this regulation is not enforced by the authorities due to the cooperative banking practices leading to a real capacity to intervene. Most Japanese banks delegate their decision-making power to the principal bank which holds the majority shares and / or credits. With a vantage point as the principal lender, the principal bank shareholder and cash manager, the principal bank has a controlling power over the managers.

The means of pressure available to major banks[8] and their informational advantages lead the Japanese manager away from conduct destructive of value. Indeed, Hoshi et al. (1990, 1991) and Morck et al. (2000) show that the most efficient Japanese firms are those whose capital share held by banks is high. Therefore, the significant weight of banks in corporate capital and their privileged position in terms of gathering information to enable them to encourage the managers to increase R & D investment create value. By studying the link between institutional ownership and the behavior of managers towards expenditure on R & D, Bushee (1998) found a negative relationship between the transient owners (banks) and reducing expenditure on R & D. Lee and O'Neill (2003) and Hosono et al. (2004) also show that participation of banks in the capital of Japanese firms increased the R & D intensity.

In France, the participation of banks in corporate capital does not exceed an average limit of 5%. The strong relationship between the bank and the firm is not as strong as in Japan. This can be explained by the long separation between investment banks and deposit banks, which has limited the development of banks, industries, and by the willingness of governments to develop financial markets and thus reduce the influence of banks. Even if we should not neglect the role of banks in corporate control, particularly through the shares they hold in their name or their customers', their principal preoccupation is to safeguard their financial interests.

The low participation of French banks in the capital, compared to the amounts they lend to the firm, encourages them to behave primarily as creditors. Gains on capital loans are more than sufficient to offset capital losses caused by a policy of non-maximizing stock price. The debt requires the manager of the firm to pay periodic interests. To cope, they are forced to adopt a policy of diversification to have stable cash flows. They prefer, in this context, the safest investment strategies to reduce fluctuations in their profits. This argument shows a negative relationship was established between the banks' participation in capital and R & D investment.

In conclusion, the restrictions on modes of operation of banks that characterized the American and French firms create conditions that are less conducive to the achievement of R & D investment than their Japanese counterparts. We deduce the following hypothesis:

H1: Participation of banks in the capital of French and American firms (Japanese) was negatively (positively) associated with the R & D investment.

2.2. The impact of pension fund on R & D investment

In the U.S., the increase in institutional ownership over Japan and France is largely due to the increased presence of pension funds in the capital market. These institutions, whose responsibility is to raise funds on behalf of investors[9], are subject to strict fiduciary constraints. The adoption in 1974 of ERISA (Employees Retirement Income Security Act) sensitizes managers to exercise their fiduciary duties. These include the obligation to exercise the voting rights attached to shares held by these institutions.

Attention to the exercise of voting rights by these fund managers varies from one fund to another. In the literature, we note that pension funds are not a homogeneous whole. Some are public sector including regime under public management, others are private sector administered for employees by corporations or other nongovernmental entities.

The public pension funds, in the United States, have substantial assets and have a large number of shares of listed firms. The importance of assets to be managed confers significant economic importance. This presence constraint has caused them to get involved and influence the strategies of firms to meet their interests. These institutions are resistant to pressure managers (Brickley et al. 1988). They do not engage in business relationships with firms and therefore have no conflict of interest. In case of dissatisfaction with managers, public pension funds tend to exercise their voice through their activism (Davis and Thompson, 1994). In a context of declining firm performance, Bushee (1998) shows that when institutions are present significantly in the capital of the firm, managers are less likely to decrease spending on R & D. These institutions have a strong motivation to exercise explicit control and ensure that the leader does not reduce R & D investment.

On the contrary, pension funds of private regime are far less active than their public counterparts (Gillan and Starks, 2001). The main reason is fear that their activism could lead to trade retaliation. Because of business relationships with corporate customers, private pension funds may

[8] Kang and Shivdasani (1999, 1995) found that firms affiliated with main banks are more encouraged to replace their managers for poor performance than independent firms.

[9] These entrust pension funds a significant portion of their savings and want to finance their retirement benefits from their investment.

refrain from criticizing the management of their firms for fear of becoming suspicious of their own management or offending firms that depend on their business (Bies 2003; Ingley and Van der Walt 2004). The desire to preserve their business relationships places them in conflict of interest in the monitoring of the corporate management (Brickley et al. 1988). This encourages them to act in a spirit of collaboration with firms and intervene discreetly. To exercise their voting rights[10] and avoid the pressures of the firm management, private pension funds prefer to remain anonymous and contact the intermediary organisms (mutual fund managers or independent managers) if they deem it appropriate to interfere with firms. These organisms have a more aggressive behavior than public funds and seek high returns in order to "perform on the index" (Baudru and Kechidi, 1999). Their mode of control encourages managers to adopt strategies for investments in R&D to achieve high profitability.

Although the use of their vote power differs, pension funds (public or private) are involved in the management of the firm and are able to reduce agency costs. They influence the American managers to undertake more R & D investment to improve the level of future performance of the firm and stop sub-optimal investment. In this context, Hoskisson et al. (2002) and Hall (2002) find that pension funds which have long-term investment policies encourage strategic investments and innovations more.

In France, pension funds are not subject to the same fiduciary constraints as their U.S. counterparts. The low participation of these institutions in the capital of client firms does not allow them to exert direct influence on corporate governance (Blesson and Clerwall, 2003). They are regarded as passive shareholders because they can sell their shares at any time they need cash. These institutions simply seek to maximally exploit their portfolio. Portfolio diversification, which is a strategic investment of pension funds, aims to improve performance against risk. They prefer to take profits from elusive portfolios through valuation or devaluation of stock prices, although these changes are temporary (Loescher, 1984). Such a view causes institutions to attach disproportionate importance to success in investment and neglect long-term commitment to innovation and growth. An important consequence of this behavior is that managers of firms focus less on R & D investment.

In Japan, pension funds have no legal restrictions (Xu and Wang 1997), which favors holding a large equity position in firms and encourages them to actively vote shares they hold (Prowse, 1990). These institutions have direct control over the management of their firm by occupying seats on the Board of Directors and investing in research and information treatment to protect their investments. This control cannot theoretically be against their interests. According to Opler and Sokobin (1998), when pension funds organize their activism in the firm by engaging in relationships characterized by an exchange of information, the result may only be the improvement of the performance of the firm. Therefore, a positive relationship is established between the participation of pension funds in capital and R & D investment. In this context, Hosono et al. (2004) found that the share of capital held by large shareholders is positively related to R & D investment.

In summary, the presence of pension funds in the capital of American and Japanese firms, as opposed to their French counterparts, encourages R & D investment, hence the following hypothesis:

H2: A significant participation of pension funds in the capital of American and Japanese firms (French) is positively (negatively) associated with the R & D investment.

2.3. The impact of mutual funds on R & D investment

While pension funds are committed to finance the long-term retirement, mutual funds manage securities and attract others to increase their fees. Blesson and Clerwall (2003) find that one of the most important functions of investment funds is to be providers of management services to pension funds and insurance through mandates.

In France, the first place is for OCPSV institutional investors (Organisms for the Collective Placement in Stock Value) and more specifically for variable capital funds called ISVC (Investment Societies with Variable Capital) or mutual funds. These managers manage one (or several) portfolio (s) of stock on behalf of their customers[11]. They sell and redeem shares on investor demand. They are financial intermediaries that sell shares to the public and invest the funds they receive. They offer their customers the shares of several mutual funds.

To the extent that these investors manage the assets of investors, it is difficult for them to oppose the decisions of the firms delegating the management of their funds to them. The desire to preserve their business relations places them in a situation of interest conflicts (Davis, 1996). Mutual funds do not want to take initiatives that give them a bad image among firm managers. The latter are, after all, potential customers and any activist attitude from these institutions encourages corporate management to deprive them of their investment assets. These institutions therefore tend to vote for firm directors or sell their shares. As managers prefer to protect their personal capital against risk and maximize their personal interests, they have an interest in

[10] The Ministry of Labor has imposed guidelines for the exercise of voting rights that is part of the fiduciary duties of private pension funds.

[11] Pension funds or insurers.

implementing diversification strategies, and thereby avoid R & D investment (Tosi and al. 1997). Taking into account the interests of beneficiaries for whom they manage the assets, mutual funds favor less activities in R & D.

In the United States, the closed-end funds or mutual funds are predominant. They sell the shares, but unlike mutual funds, do not buy. These managers are organized by a sponsor. Unlike in France, the organization of funds in the United States is not controlled by banks[12], but split into several trades. In other words, it is not often the same firms that manage funds, distribution, administration and conservation. These fund managers must meet the thresholds established by regulation. Indeed, they should not have more than 5% of their assets invested in stock issued by the same entity. This constraint related maximum percentage of stock of one issuer has its basis in the 1988 Act which requires the exercise of fiduciary duties. Fund managers are advised to take necessary measures to exercise voting rights with special attention to increasing shareholder value.

Borokhovich et al. (2000) found that when shareholders are not affiliated institutions, abnormal income and percentage of shares held by these institutions are positively related. Their results show that, given their share in the capital, fund managers are encouraged to carefully monitor the decisions of managers in order to promote long-term performance of the firm and pursue strategies of R & D investment. Similarly, Wahal and McConnell (2000) found a positive relationship between participation of mutual funds and the level of expenditure on R & D. The authors show that these institutions act as intermediaries between the impatient individual investors and firms. As these fund managers have inside information on firms, they can be more patient with firms and allow, in this regard, for increase in the level of expenditure on R & D.

In Japan, the legislation does not impose any restriction on mutual funds. While often associated with major financial institutions, these funds are totally unregulated. They hold a large stock position in the firm capital. Given the high level of participation, mutual funds have a strong motivation to control and influence managers to promote long-term performance of the firm (Alchian and Demsetz, 1972). Brickley et al. (1988) argue that mutual funds are better able to effectively monitor managers than other shareholders. The managers cannot take advantage of the presence of these institutions in the capital of the firm to maintain or increase their managerial discretion. Duggal and Millar (1998) also found that it is more difficult for managers to adopt anti-takeover mechanisms that are harmful to the interests of shareholders who are active investors such as mutual funds. By using their voting power, these institutions encourage managers to undertake investments in R & D that create value. So the generally important activism of mutual fund managers, characteristic of American and Japanese firms, creates more favorable conditions for investment in R & D, than the passivity of these institutions with French firms. We deduce the following hypothesis:

H3: A significant participation of mutual funds in the capital of American and Japanese firms (French) is positively (negatively) associated with the R & D investment.

As in the foregoing, we consider in the context of this study three variables that determine R&D investment: shareholding banks, shareholding pension funds and shareholding mutual funds. The theoretical predictions are presented in table 1.

3. Empirical analysis

This section aims to test the effect of institutional investors on R & D investment. Initially, we present our sample, the explained and explanatory variables and the method of multivariate analysis (canonical analysis). The presentation and interpretation of results of this study will be a second section.

3.1. Presentation of data and variables measurements

Although many studies have addressed the impact of institutional investors as a homogeneous group on R & D investment (measured by the intensity of R & D), only a few have studied the influence of different types of institutional investors on R & D investment (Kochlar and David 1996, Bushee 1998, 2001). The majority of existing works in literature analyze a sample by the administration of questionnaires or gathering information from databases. And since a lot of information needed to test our hypotheses is public, including that relating to institutional investors and R & D investment, we chose the second empirical approach with a sample of U.S., Japanese and French firms. This will allow us to test our hypotheses in a theoretical context of international comparison of corporate behavior in R & D investment.

[12] This is a consequence of legislation of the 30s (especially the Glass Steagall Act).

Table 1. Summary of main explanatory variables of R&D investment and the signs predicted by theories of reference

Hypotheses	Explained variables	Explanatory variables	Expected signs		
			U.S.	JP	FR
H1	R&D Investment	Ownership of Banks	-	+	-
H2	R&D Investment	Ownership of pension funds	+	+	-
H3	R&D Investment	Ownership of mutual funds	+	+	-

The study data from two databases (Worldscope and Osiris) and annual reports of publicly traded U.S. (NYSE), Japanese (Nikkei 225) and French (CAC40) firms over the period 2003-2007. These firms belong to the industrial, commercial, tourism, technology and service sectors. The sectional heterogeneity can establish the external validity and generality of results (Lee, 2005). Financial institutions were excluded because of their atypical behavior in financial policy. Firms whose number of employees was less than 500 were also removed to make the most interesting theoretical plausibility. We selected all firms for which we have data on resident institutional investors and the determinants of R & D investment (risk, horizon), that is 531 firms (178 French, 174 American and 179 Japanese) for comparative statistical analysis.

To find the indicators for measuring study variables, we relied on key indicators encountered in the literature to identify the most frequently used and widely available. These measurements are contained in Table No. 2 of the Appendix. Only the variable "R & D investment" has resulted in purification work done during an iterative process. We will recall here the retained measurements for the explained and explanatory variables.

The indicators often used in literature to measure R&D investment are R&D intensity, amount not communicable by firms. In the setting of our survey, R&D investment is considered like a risky and long term investment. Firms engaged in R&D have a high level of risk and a long-term return.

We use three measurements to assess the risk of R&D investment. Similar to Jensen et al. (1992), Bah and Dumontier (1996, 1998), the first measurement is the standard deviation ratio of return to total assets σ (ROA). The second is the standard deviation ratio of return to sales σ (ROS). The last measurement is the standard deviation ratio of return to equity σ (ROE).

As for the long-horizon R&D investments, Balakrishnan and Fox (1993), Gaver and Gaver (1993) and Bah and Dumontier (1996, 1998) found that firms engaged in R&D activities have a strong growth opportunity. As for these studies, we use three measurements specified by the growth opportunities to assess the investment horizon. The first measurement is the ratio of tangible assets expenditure to profit before interest, depreciation and tax (Balakrishnan and Fox 1993). The second and third are, respectively, the PER and the ratio of the market to book value of equity (MBVE) (Bah and Dumontier 1996; Gaver and Gaver 1993).

These measurements have made for us, alongside the theoretical literature, a framework to create our own measure of R&D investment. We have thus developed a set of 6 items. After iterations made on the basis of Principal Components Analysis (PCA and Varimax rotation, See table 3 in Appendix) and reliability testing, these 6 items were reduced to 4 items and summarized in 2 factors measuring R&D investment: 1) Risk of R & D investment and 2) Horizon of R&D investment.

Regarding the nature of institutional investors, we used the following indicators:

- Ownership of banks: the percentage of equity held by resident banks;
- Ownership of pension funds: the percentage of equity held by public and private residents' pension funds;
- Ownership of mutual funds: the percentage of equity held by resident mutual funds;

The explanatory and control variables influence the realization of R&D investment and verify its multidimensionality. They are also distinct from each other and present, as shown in Tables 4, 4.1 and 4.2 in appendix, a low and/or not significant correlation between them.

To test the model, we use STATISTICA 1994-2000, which is the most common program among the known methods of multivariate analysis. Every relationship has been tested independently by using a canonical analysis (when the relationship is composed of several variables to explain, see Zouari 2008). This "second generation approach" enables us to determine whether there was a significant relationship between R&D investment and the nature of institutional investors.

3.2. Presentation and interpretation of results

This section aims to present the test results of the three assumptions underlying the explanatory model of R&D investment. The model will estimate the total sample which includes 178 French, 174 American and 179 Japanese firms. This distinction helps to disclose further explanation of the determinants of R&D investment.

The values of Table 5 are indicators of the overall link between R&D investment and independent variables (determinants). Calculations for specific cases in the United States, Japan and France have given only one significant canonical pair at 5% and 10%.

Information on the correlation coefficients of significant canonical axis pairs appears in Table 6. This table replicates the factor structure of significant canonical pairs, that is to say, the correlations between synthetic variables from PCA and canonical axes. We indicated in bold weights with a value significantly greater than 0.5 (generally accepted threshold, Evrard et al. 2003), and we highlighted those with a value between 0.2 and 0.5 for further interpretation (see Fahmi 1999; Zouari 2008).

3.2.1. Interpretation of results for U.S. firms

For the relationship between R & D investments and its determinants, the calculations have revealed one significant canonical pair at 5% (see Table 5). The first canonical correlation coefficient (R Canonical) is about 0.36. It expresses the maximum correlation between the two groups of variables (measurements of R & D investment and the nature of institutional investors) and reflects the existence of a linear relationship between them. This correlation significantly, expresses by itself more than 13% of common variance (R^2), that is to say of the variance of R & D investment explained by its determinants.

Moreover, the index of total redundancy[13] in all measurements of R & D investment is 6.82%. Fornell and Larcker (1980) considers that redundancy is important when it exceeds 10%, average when it is located between 5 and 10%, and weak when its value is less than 5%. We can therefore conclude that the two sets of variables share a middle portion of the total variance (Fornell and Larcker, 1980) and therefore our explanation of R & D investment determinants is moderately reliable (Thompson, 1990).

The factor structure of the significant canonical axis can retain one significant variable measuring R & D investment ("Horizon" where the canonical coefficient, that is to say, **r = 0.98**) and two institutional variables ("Ownership of Pension Funds" **r = 0.93** and "Ownership of Mutual Funds" r = 0.42, see Table 6). The sign of these correlation coefficients allows us to confirm two of the three hypotheses tested. Indeed, when managers invest in R & D (long term), we are witnessing an ownership structure characterized by:

- A strong participation of pension funds (hypothesis **H2 is validated**), which is consistent with studies by Bushee (1998), Hoskisson et al. (2002) and Hall (2002);
- A strong ownership of mutual funds (hypothesis **H3 is validated**), in accordance with the work of Wahal and McConnell (2000).

[13] The indicator of redundancy enables us to appreciate the part of the variance of each set of variables explained by canonical axes.

We therefore conclude that the ownership structure of American firms characterized by a high share of pension funds and mutual funds influences managerial discretion and encourages R & D investment.

These results show the existence of interrelationships between R & D investment and the variables related to the nature of institutional investors. It is likely that the model underlying these relationships is accepted in Americans firms.

3.2.2. Interpretation of results for Japanese firms

The calculations have revealed one significant canonical pair at 10% (see Table 5). The first canonical correlation coefficient is about 0.86 and reflects the existence of a linear relationship between the two groups of variables. This correlation significantly expressed 74% of the common variance, which is to say of the variance of R & D investment explained by the nature of institutional investors.

Moreover, the total redundancy index is 53.79%. We can therefore conclude that the two sets of variables share a portion of the total variance described as high (above 10% criterion Fornell and Larcker 1980), and that the explanatory power of institutional variables is strong and appropriate (Thompson, 1990).

As summarized in Table 6, the two variables relating to R & D investment ("Risk" and "Horizon") (**r = -0.99** and r = -0.26, respectively), and those measuring the nature of Institutional investors ("Ownership of Banks," "Ownership of pension funds" and "Ownership of Mutual Funds") are negatively related to the canonical axis (**r = -0.88**, **r = -0.82** and r = -0.31, respectively).

Examination of these correlation coefficients allows us to **validate hypothesis H1**. Indeed, when the participation of banks in the capital is high, managers of Japanese firms choose risky investments (high canonical coefficient in absolute value of about 0.99), and to a lesser extent, long-term ones (r = 0.26). Studies by Bushee (1998), Lee and O'Neill (2003) and Hosono et al. (2004) also found a positive relationship between the transient owners (banks) and the intensity of expenditure on R & D. Similarly, Chevallier-Farat (1993) found that the ability of banks to diversify internally enables them to withstand the volatility of corporate profits.

Moreover, when the share of pension funds and mutual funds is high, Japanese managers are motivated to invest in R & D (**hypotheses H2 and H3 are validated**). This result is consistent with the findings of Brickley et al. (1988), Duggal and Millar (1994), Opler and Sokobin (1998) and Hosono et al. (2004). Indeed, managers cannot take advantage of the presence of these institutions in capital to maintain or increase their managerial discretion. The fear of being dismissed is an incentive to satisfy the interests

of pension funds and mutual funds by adopting risky projects.

In conclusion, the canonical results prove the existence of interdependence between the R & D investment and institutional variables. It seems, therefore, that the Japanese model can be rejected.

3.2.3. Interpretation of the results for French firms

The calculations gave a single canonical significant pair at 10% (see Table 5). The canonical correlation coefficient is about 0.23 and represents almost 6% of the common variance. And, as the total redundancy index is about 2% (less than 5%, test of Fornell and Larcker 1980), our explanation of R & D investment by institutional variables is weakly adequate (Thompson, 1990).

The analysis of canonical coefficients can retain two significant measurements of R & D investment ("Horizon" and "Risk"). They are negatively related to the canonical axis (**r = -0.98** and **r = -0.97**, respectively). The variables explaining the R & D investment ("Ownership of pension funds", "Ownership of banks" and "Ownership of Mutual Funds") is negatively and positively related (**r = -0.75**, **r = -0.68** and r = 0.46, respectively, see Table 6).

The signs of these correlation coefficients allow us to confirm two hypotheses and disprove one among the three tested. Thus, a comprehensive overview of these results is presented as follows: strong ownership of banks and pension funds and low participation of mutual funds in the capital of French firms promote the achievement of long-term and risky investment.

We can deduce that the more French managers invest in R & D:

- The higher the percentage of capital held by French banks (hypothesis **H1 is invalidated**). This result leads to questioning the reflection produced by Bushee (1998). The author notes that the predominant ownership by banks significantly increased the likelihood of reducing R&D investment. So we see that the means of pressure available to major banks and their informational advantages prevent managers from deviating toward a behavior destructive of value:
- The lower the involvement of pension funds (hypothesis **H2 is validated**), according to findings of Loescher (1984) and Blesson and Clerwall (2003);
- The lower the participation of mutual funds (hypothesis **H3 is validated**), which joins the results of Davis (1996) and Tosi et al. (1997).

These results show the existence of linear relationships between R & D investment and institutional variables. It seems, therefore, that the model specific to the French case, which underlies these relationships, cannot be entirely dismissed.

In summary, the tests results of theoretical models allowed us to explain the managers' behavior in American, Japanese and French firms in the case of R & D investment (risky and long-term approach) through the nature of institutional investors.

Conclusion and future research

The aim of this paper is to investigate the power exercised by the different types of institutional investors (banks, pension funds and mutual funds) on the behavior of managers to encourage R & D investment. This study seems interesting because it allows us to better understand the mechanisms of value creation. Taking into account the characteristics of this investment (long-term return and high risk) and the agency and transaction costs that result, enables us to explain the behavior of firms for R & D investment.

On the theoretical level, we constructed a model explaining the adoption and effectiveness of R & D investment through national systems of governance (Anglo-Saxon, Germano-Nippon and hybrid), construed mainly by the nature of institutional investors (bank ownership, pension funds ownership and mutual funds ownership). The choice of the United States is justified by the financial market economy. In contrast, the Japanese economy appears much like intermediation. Furthermore, analysis of the French situation is relevant because it represents a hybrid economy between intermediation and financial markets.

Empirically, the canonical analysis conducted on samples of firms proves the existence of a linear association between R & D investments, which create value, and ownership of institutional investors.

In the U.S., we found that low bank ownership and a strong participation of pension funds and mutual funds in corporate capital are accompanied by a realization of R & D investment. These results clearly confirm the assumptions of the theory of corporate governance and are in line with those obtained by Hill et al. (1991), Bushee (1998), Wahal and McConnell (2000), Hoskisson et al. (2002), Hall (2002) and Berger et al. (2005).

In Japan, R & D investment is positively related to the participation of banks, pension funds and mutual funds in corporate capital. These institutions mitigate pressures on myopic behavior because of their large and long term portfolios (Porter, 1992). They have a power of strict control of the managers to make the best investment decision for the proper conduct of firms. These results then confirm those found by Brickley et al. (1988), Duggal and Millar (1994), Bushee (1998), Opler and Sokobin (1998), Lee and O'Neill (2003) and Hosono et al. (2004). In France, we found a strong ownership of banks and a low participation of pension funds and mutual funds in firm capital promote investment in R & D. The bank is considered an active shareholder which influences the management and control of the firm. It causes managers to favor this type of investment to increase the firm value. On the contrary, pension funds and mutual funds are short-term oriented

institutions. Subject to performance and prudence constraints, they certainly result in restriction of investment in R & D.

If this research provides contributions to the understanding of the determinants of investment in R & D, it has, however, as all confirmative studies, limits and still leaves many questions open about the issue of investment. In addition to the ownership of institutional investors, the model should incorporate other internal and external control mechanisms to represent a more complete reality. These mechanisms include managerial ownership, the Board of Directors and the financial market, etc, which have an impact on managerial discretion, and therefore on the choice of investment in R & D.

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Appendices

Table 2. Measurements of Explanatory Variables in the Model of Investment in R & D

Initial variable	Measurements or Factors extracted
- R&D Investment	Six items; after PCA with Varimax rotation: Two factors: - Risk of Investment in R & D - Horizon Investment in R & D
- Ownership of Banks	One measure: the percentage of equity held by resident banks
- Ownership of pension funds	One measure: the percentage of equity held by public and private residents' pension funds
- Ownership of mutual funds	One measure: the percentage of equity held by resident mutual funds

Table 3. Summary: Results of PCA

PCA N°	Initial variable	Factors extracted	r	σ^2 (en %)	p value	α	Items deleted
1.1	R&D investment (USA)	Factor 1 : Risk of R&D investment Item 1 : Standard deviation ROA Item 2 : Standard deviation ROS Factor 2 : Horizon of R&D investment Item 1 : Tangible Assets /NOPBT Item 2 : PER *Total*	 0,898 0,894 0,801 0,792 	40,610 32,322 72,932	1,624 1,293	0,737 0,631	- "Standard deviation ROE" (r < 0,5 in factors extracted). - "MBVE" to increase the reliability of the 2nd factor.
1.2	R&D investment (Japan)	Factor 1 : Risk of R&D investment Item 1 : Standard deviation ROE Item 2 : Standard deviation ROA Factor 2 : Horizon of R&D investment Item 1 : Tangible Assets / NOPBT Item 2 : PER *Total*	 0,951 0,938 0,797 0,757 	44,754 31,064 75,817	1,790 1,243	0,871 0,555	- "Standard deviation ROS" (r < 0,5 in factors extracted). - "MBVE" to facilitate the interpretation of Factor 1.
1.3	R&D investment (French)	Factor 1 : Risk of R&D investment Item 1 : Standard deviation ROE Item 2 : Standard deviation ROA Factor 2 : Horizon of R&D investment Item 1 : PER Item 2 : Tangible Assets / NOPBT *Total*	 0,852 0,847 0,856 0,773 	40,354 26,665 67,020	1,614 1,067	0,695 0,637	- "MBVE" (r < 0,5 in factors extracted). - "Standard deviation ROS" to facilitate the interpretation of Factor 2.

Table 4. Correlations matrix (U.S. Firms)[1]

	Activity sector	Ownership of Banks	Ownership of pension funds	Ownership of mutual funds
Activity sector	1,000			
Ownership of Banks	0,136	1,000		
Ownership of pension funds	0,006	0,165	1,000	
Ownership of mutual funds	0,035	0,283	0,293	1,000

Table 4.1. Correlations matrix (Japanese Firms)[1]

	Activity sector	Ownership of Banks	Ownership of pension funds	Ownership of mutual funds
Activity sector	1,000			
Ownership of Banks	-0,058	1,000		
Ownership of pension funds	0,001	0,263	1,000	
Ownership of mutual funds	0,196	0,070	-0,061	1,000

Table 4.2. Correlations matrix (French Firms)[(1)]

	Activity sector	Ownership of Banks	Ownership of pension funds	Ownership of mutual funds
Activity sector	1,000			
Ownership of Banks	-0,117	1,000		
Ownership of pension funds	-0,052	-0,070	1,000	
Ownership of mutual funds	-0,105	0,065	-0,007	1,000

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

Table 5. Canonical Correlations for heterogeneous samples

Hypotheses	Pairs of canonical axes	R canonical	R^2	Chi^2	Threshold significance	Index of redundancy
U.S.	1	0,3650	0,1332	18,690**	0,0166	0,0670
	2	0,0491	0,0024	0,310	0,9579	0,0012
						0,0682
JAPAN	1	0,8627	0,7444	13,862*	0 ,0958	0,3953
	2	0,5516	0,3042	2,176	0,3367	0,1426
						0,5379
FRENCH	1	0,2378	0,0565	13,353*	0,0998	0,0182
	2	0,1378	0,0190	3,311	0,3460	0,0021
						0,0203

(Thresholds: *** significant at 1 %, ** significant at 5 %, * significant at 10 %)

Table 6. Factor structure of significant canonical pairs

Hypotheses	**Variables**		**Axis 1**
U.S.	Explained variables	- Risk of R&D investment	-0,1985
		- Horizon of R&D investment	**0,9831**
	Explanatory variables	- Ownership of banks	-0,1026
		- Ownership of pension funds	**0,9398**
		- Ownership of mutual funds	0,4287
JAPAN	Explained variables	- Risk of R&D investment	**-0,9964**
		- Horizon of R&D investment	-0,2630
	Explanatory variables	- Ownership of banks	**-0,8850**
		- Ownership of pension funds	**-0,8202**
		- Ownership of mutual funds	-0,3187
FRENCH	Explained variables	- Risk of R&D investment	**-0,9730**
		- Horizon of R&D investment	**-0,9888**
	Explanatory variables	- Ownership of banks	**-0,6807**
		- Ownership of pension funds	**0,7590**
		- Ownership of mutual funds	0,4652