

# WHAT MATTERS MORE IN R&D AND CAPITAL EXPENDITURES FINANCING BY JAPANESE FIRMS: MULTINATIONALITY OR BANK AFFILIATION?



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Japanese financial institutions are allowed to hold firms' shares and have critical roles in corporate governance generally and in financial and investment policies particularly. The most distinct feature of Japanese corporate governance is the existence of *keiretsu* groups and main bank relationships. *Keiretsu* are commonly known as horizontal business groups governed by a so-called main bank. The main bank is the main provider of loans and monitors corporate results. The law restricts banks to a maximum 5% stake in the firm. In spite of this restriction, the main bank is often the main shareholder in affiliated companies due to the importance of cross-shareholding practices between members of the group. Many studies focus on the implications of the *keiretsu* system on profitability, stability of funds, investment policy and other financing features of members. The results are mixed. Hoshi *et al.* (1991) conclude that *keiretsu* firms invest more than the independents when they are financially distressed. Weinstein and Yafeh (1998) advance that the bank-firm relationship in Japan does not improve the profitability but increases the availability of financing. Hall and Weinstein (2000) find no evidence that a firm's lead bank lends more voluntarily to financially distressed *keiretsu* firms than to non-members.

Fazzari *et al.* (1988) assume that the presence of imperfections in the capital market make it too costly for many firms to raise external capital and therefore constrain them to rely more on their internal funds. The magnitude of these imperfections is measured by the extent to which a firm's investment is correlated with its cash flow. The conventional wisdom is that multinational firms are more R&D intensive than domestic firms (Bae and Noh, 2001). Because of the diversification of their operations at an international level, some authors presume that multinational firms have a more stable cash flow and a weaker risk of bankruptcy. It follows that the low volatility of cash flows decreases the probability of bankruptcy and increases their credit-worthiness. However, the empirical evidence indicates that multinational firms have a lower

level of long-term debt than domestic firms (Chen *et al.*, 1997; Doukas and Pantzalis, 2003) but, in contrast, use more short-term debt than domestics do (Doukas and Pantzalis, 2003). Even if R&D activity is financially constrained, this investment is often well accommodated by the shareholders (Chan *et al.*, 1990; Doukas and Switzer, 1992; Szewczyk *et al.*, 1996), and in particular when multinational firms carry out the announcement (Bae and Noh, 2001). However, we cannot expect the same effect for R&D investments (or capital investments) carried out by Japanese firms, multinational or domestic, members or nonmembers of a *keiretsu*, on their performance.

To the best of our knowledge, there is no study that treats the relationship between finance, investment and performance related simultaneously to the *keiretsu* affiliation and to the internationalization of activities of Japanese firms. In an original way, the objective of this paper is double. First, we investigate the prevalence of the multinational character or the *keiretsu* affiliation in the investment financing area. As financing sources, we consider both cash flow and debt. For investment projects, we distinguish R&D and capital expenditures. Those investments don't present the same guarantee for banks and, therefore, don't have the same financing consideration. Examining the association between cash flow and investment is necessary to show if financial constraints are similar in each category of Japanese firms. Studying the relationship between debt and investment consists to test if the main bank is able to resolve financial problems. The second objective of our paper is to test the relationship between investment in R&D, capital expenditures and the performance of Japanese firms. Nagaoka (2006) shows the value relevance of R&D investment in Japanese context.

As regards to these objectives, three principal questions are raised in our study. First, what are the correlations between cash flow and investment and between long-term (versus short term) debt and investment in the Japanese context? Second, when the firm is multinational, *keiretsu*, multinational and *keiretsu*, independent and domestic, is the reliance on its cash flow, long-term debt or short-term debt less or more important? Third, in which category of

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firms, is the performance more affected by investment in intangible or in tangible assets?

To answer to these questions, we use two-stage Generalized Least-Squares random-effects estimation. In the first equation, we test the relationship between firms' investment and their structure and financial characteristics. The second equation tests the relationship between each kind of investment (tangible and intangible) and performance. Our sample consists of 1008 firms selected from manufacturing companies whose shares are listed on the Tokyo Stock Exchange at the period 2000 to 2002. The Japanese economy was in the middle of prolonged depression in this period (Ogawa, 2007). Hence, we should be careful in results' interpretation because they could correspond to this specific context. The comparison of our results with those of prior studies (notably realized outside the crisis period) could help us to know if the association between finance, investment and performance in Japan is structural or depends on the economic conditions. Our results suggest that cash flow is the principal source of financing of the two kinds of investment (tangible and intangible) and that firms which are both multinational and keiretsu are the most constrained ones regarding capital investments. For both multinational and domestic firms, the presence of a main bank alters the effect of R&D as well as capital investment on performance.

The remainder of the paper is organized as follows. The next section presents, in the Japanese context, a survey of findings from the literature on financial constraints, investment and performance, on the one hand, and the interaction with the internationalization degree and the keiretsu affiliation, on the other hand. Section II discusses the definition of multinationality and keiretsu affiliation. Section III describes the data and the variables measure. Section IV presents the methodology and the empirical model. Results are presented and discussed in section V. Section VI concludes the paper.

## ■ I. Related studies

We start this section with some elements about the relationship between debt, liquidity and investment. Then we try to test the validity of these considerations, firstly, in the multinational context and, secondly, in the Japanese keiretsu context.

### 1.1. THE RELATIONSHIP BETWEEN DEBT, LIQUIDITY AND INVESTMENT

According to Holmstrom (1989), R&D has five unique characteristics. It is long term in nature, high risk in terms of probability of failure, unpredictable in outcome, labor intensive and idiosyncratic. Although shareholders cannot know exactly the nature and the value of the developed product, they often react positively to the announcement of the R&D initiation enhancing *ceteris paribus* the market value of equity (Chan *et al.*, 1990; Doukas and Switzer, 1992; Szewczyk *et al.*, 1996). These characteristics lead many authors to consider R&D expenditures as a potential

measure of the presence of future opportunities and simultaneously as a criterion of information asymmetry and/or of agency problems. As a consequence, no external investor is willing to finance this type of project and high levels of R&D must be associated with higher cash levels (Dittmar *et al.*, 2003).

Banks prefer to use physical assets to secure loans and are reluctant to lend capital when projects involve substantial R&D investment. As a consequence, external financing will be more expensive for R&D investment than for ordinary investment, suggesting a close relationship between liquidity or cash flow and R&D investment. More importantly, the nature of the bank-firm relationship should affect the cash flow sensitivity although the investment is tangible. Houston and James (2001) test, by using a randomly selected sample of 250 US publicly traded firms over the period 1980-1993, the financial constraint hypothesis related to the reliance degree on bank debt and to the number of banks that a firm uses. The cash flow sensitivity of investment is lower for firms with multiple banking relationships suggesting that a close banking relationship renders firms more constrained. Moreover, cash flow sensitivity is significantly greater among "bank-dependent" firms, defined as those with at least 80% bank debt and no public debt.

### 1.2. THE RELATIONSHIP BETWEEN DEBT, LIQUIDITY AND INVESTMENT IN MULTINATIONAL FIRMS

If the general consensus is that there is a positive relationship between market values and R&D expenditures, the results founded by Bae and Noe (2001) show that R&D investments have a more pronounced effect for multinational firms than for domestic firms. Their sample consists of 563 or 498 manufacturing firms over the 1991-1995 period depending on the classification criteria of foreign sales ratio and foreign tax ratio. Bae and Noe (2001) test the effects of R&D expenditures on the market to book value of equity in both categories of firms (multinationals and domestics) and find that, regardless of the classification used, R&D as a percentage of sales has a positive effect on the market value for both domestics and multinationals, with a more pronounced effect for multinationals. The authors also investigate whether the degree of internationalization is associated with financial factors as determinants of the firms' R&D investments. Particularly, they find that R&D expenditures are significantly and positively related to cash flows for both multinationals and domestics and negatively related to prior-year debt ratio.

Multinational firms are subject to higher agency costs of debt than domestic firms because geographic diversity renders active monitoring more expensive in comparison to domestic firms (Doukas and Pantzalis, 2003). Fatemi (1988) finds that multinationals have a smaller long-term debt ratio than domestics. In addition, the former level of the cash flow exerts a positive effect on the level of R&D in the two categories of firms, but weaker in the case of multinationals which seem to be financially less constrained. Doukas and Pantzalis (2003) analyze the debt structure of

a group of American firms including domestics and multinationals over the 1988-1994 period. The results show that the debt ratios vary considerably according to the branch of industry and to the nature of the firm. In 13 industries out of the 22 that are studied, the level of long-term debt is lower for multinationals than for domestics, whereas the level of short-term debt is higher for multinationals in 12 industries. The authors compare these various ratios for the domestics and the multinationals according to their degree of internationalization. The results show that the level of long-term debt of multinationals decreases and that the level of short-term debt increases with the degree of internationalization. The long-term debt ratio of the domestics is 0.1895. However, the long-term debt ratio of multinationals is 0.1811, 0.1698 and 0.1646 according to whether the ratio of foreign asset and the ratio of foreign sales are superior either to 10%, or 20%, or 30%. For short-term debt, the results show that the ratio for the domestics is 0.0485 and this ratio is 0.0570, 0.0586 and 0.0632 for multinationals according to the selected degree of internationalization (10%, 20% and 30%).

### 1.3. THE RELATIONSHIP BETWEEN DEBT, LIQUIDITY AND INVESTMENT IN JAPANESE FIRMS

Regardless of the ownership structure, the topic of keiretsu affiliation also becomes interesting especially when we introduce the financing problems of investment activities. Weinstein and Yafeh (1998) find that the bank-firm relationships in Japan increase the availability of financing, but not the profitability. So, the relationship between investment and financing must be special because of the bank-firm relationship characteristics. Firstly, having a main bank provides flexible financing and reduces the need to carry long-term debt or liquidity (Brown *et al.*, 1994; Weinstein and Yafeh, 1998). In fact, the benefit of a close banking relationship resides in the low correlation between new investment opportunities and cash flow and not in lowering the cost of external financing (Houston and James, 2001). Secondly, as Jensen (1986) argues, a bank forces management to pay out cash flow and thereby constrains overinvestment. Nevertheless, the standard story on keiretsu is that the relationships are long term and much more concerned about generating long-term growth in business, than in maximizing short-term returns. So, if we believe that bank-firm relationships are special in Japan, we will expect major differences in the relation between cash flow and investment when we study keiretsu and independent firms.

Hoshi *et al.* (1991) use the Fazzari *et al.* (1988) model of financing constraints and investment-cash flow sensitivities. For the two groups of firms, they regress the investment on cash flow, Tobin's Q and various controls, and show, for the period between 1977 and 1982, that keiretsu members invest more than independents and that investments of the nonmembers are much more sensitive to variations in firm liquidity than the investments of keiretsu members. The explanation is that finance by main banks took the form of rolled-over short-term loans, and played the roles of easing short-term liquidity constraints. Hayashi and

Inoue (1991) use the same sample period of 1977-1982 in Hoshi *et al.* (1991) study but do not classify the firms according to main bank ties. They find that the liquidity effect exists only for domestic firms producing non-traded goods. Using the sample of Japanese manufacturing firms constructed by Hayashi and Inoue (1991), Hayashi (2000) finds that the access to a main bank neither increases nor decreases the sensitivity of capital investment to liquidity. Another interesting study is the one of Miyajima *et al.* (2002). The authors find that, in the 1980s and 1990s, physical investments of Japanese firms are relatively free from financial constraints, being different from R&D investments. The result also reports that keiretsu member firms demonstrate a much smaller sensitivity to internal funds than independent firms regarding R&D investments. A recent study of Ogawa (2007) shows that the impact of debt-asset ratio has a negative impact on R&D investment for the period 1999-2001, whether this impact is insignificant for 1988-1991. The author concludes that it is only in period 1999-2001, which is a period of prolonged depression in Japan, that debt was a heavy burden for the firm in implementing R&D investment.

### 1.4. THE RELATIONSHIP BETWEEN R&D INVESTMENT AND PERFORMANCE IN JAPANESE FIRMS

Most of the empirical studies show the existence of a positive relationship between R&D investment and firm performance. By using a sample of manufacturing Japanese firms over the period 1991, 1994-2000, Nagaoka (2006) tests the effect of the R&D investment on the market value of the Japanese firms. Its results show that there is a positive relationship between R&D asset ratio and Tobin's Q. The study shows also the effectiveness of R&D activities on the market value of the Japanese firms improved in the 1990s and it became highly significant at the end of the 1990s. These results confirm those found by Lee and Shim (1995), who test the existence of a positive relationship between R&D expenditure and firm's long-run performance (measured by the market growth in sales) for both American and Japanese corporations over the period 1986-1990. By using a sample of 143 Japanese firms and 143 U.S. firms selected from six different high-tech industries, the authors found that there is a positive and significant correlation between R&D expenditures and market growth in both countries. But Lee and Shim (1995) presume that the link between R&D and firm performance may be dependent on other strategic factors such as firm size, diversification activity and capital intensity. So, the authors study the moderator effect of R&D on the performance of American and Japanese firms. Their results show that, by contrast with American firms, the moderating effects of R&D do not explain Japanese firms' performance. Hence, strategic variables presented in the study (debt structure, advertising intensity, diversification, firm size, labor productivity and export activity) contribute to the performance of the Japanese firms. This performance, related to these corporate strategies, should not vary with the degree of R&D intensity in Japan.

## ■ II. MEASURE OF MULTINATIONALITY AND KEIRETSU MEMBERSHIP

Multinational corporation and keiretsu concepts have never had economic substance and need to be clarified.

### II.1. MEASURE OF MULTINATIONALITY

In our study, two criteria are simultaneously used to distinguish multinational firms from domestic ones. These criteria are Foreign Assets to Total Assets (FATA) and Foreign Sales to Total Sales (FSTS). The foreign sales ratio has been widely used as a measure to identify multinational from domestic firms because other data is less easily available. Foreign sales, however, include both sales by foreign subsidiaries and sales related to exports from the parent company. Using this measure may lead to mixing international trade with international investment (Bae and Noh, 2001). To avoid this potential problem and to ensure the robustness of empirical evidence, we use, as Doukas and Pantzalis (2003), both foreign sales ratio and foreign assets ratio as classification criteria. The first ratio represents the benefit (performance) of foreign activities and the second the cost (investment) of foreign activities (Chen *et al.*, 1997). The coefficient of correlation between the two criteria is 0.86. In our study, the firm is considered as a multinational if FATA and FSTS ratios are both superior to the average obtained for the total sample, which are 12.76% and 16.68% respectively. The firm is considered as domestic if its FATA ratio or its FSTS ratio is inferior to 12.76% and 16.68% respectively.

### II.2. KEIRETSU MEMBERSHIP

Japanese banks are allowed to hold firms' shares up to 5% of its total outstanding shares. In the literature, there is no unified classification of keiretsu affiliation. Each keiretsu has a major commercial bank (city bank) as a major lender to the member firms. By implication, the independent firms are either the unaffiliated firms or the weakly related members. According to Fujiki (2000), we consider as horizontal keiretsu, a firm belonging to one of the six major industrial groups (Mitsui, Mitsubishi, Sumitomo, Fuji (or Fuyô), Sanwa, and Daiichi-Kangyô) or when a well-identified ("by tradition") keiretsu member holds more than 20% of controlling interest. In the *Worldscope* database, the information about the firm's ownership structure is available only for the last year. Nevertheless, Keiretsu membership is stable and robust to classification criteria (Hoshi *et al.*, 1991). A large majority of institutions, both financial and non-financial, are members of the same group and are, by definition, long-term and stable partners. In our paper, we consider that the keiretsu affiliation is stable and did not move during our analysis period (2000-2002). Our interest in studying keiretsu is to test the effect of bank affiliation on the relationship between financial variables and investments. So, the keiretsu membership is a binary variable, which is equal to one if a firm is affiliated with six major

industrial groups (Mitsui, Mitsubishi, Sumitomo, Fuji (or Fuyô), Sanwa, and Daiichi-Kangyô) and other small horizontal groups and to zero otherwise. We considered as not keiretsu, all firms that are independent, affiliated with vertical groups or having weak links with main banks or with another members of horizontal keiretsu.

## ■ III. DATA AND VARIABLES MEASURE

Our sample consists of 3024 firm-year observations, identified through the *Worldscope* CD-ROM database after excluding firms with missing financial and ownership structure information. Firms are selected from manufacturing companies whose shares are listed on the Tokyo Stock Exchange. The analysis period is for the year 2000 to 2002. The Japanese economy was in the middle of prolonged depression in this period (Ogawa, 2007). Thus, we should be careful in the results' interpretation because they can depend on special economic conditions.

In our study, we distinguish four categories of variables. The structural variables include the group identification of the firm (multinational or not, keiretsu or not, both multinational and keiretsu). The investment-related variables distinguish the R&D and the capital expenditures. The financial variables represent the financing modes of tangible and intangible assets (cash flow, long term debt and short term debt). The performance variables include three measures of firm performance which are Tobin's Q, ROA and ROE ratios. Finally, we have identified two control variables represented by sales growth and the size of the firm.

### III.1. STRUCTURAL VARIABLES: GROUP IDENTIFICATION

In this paper, we distinguish four groups of firms: multinational but not keiretsu (MUL), keiretsu but not multinational (KEI), multinational and keiretsu (MUL-KEI) and the remaining firms of our sample that are domestic and independent (OTHER). MUL variable equals 1 if the firm is multinational but not affiliated to a keiretsu and 0 if not. 679 firm-years are observed for this category. KEI equals 1 if the firm is a keiretsu member but not multinational; otherwise KEI equals 0. This category includes 300 firm-year observations. MULKEI equals 1 if the firm is both multinational and a keiretsu member and 0 if not. This binary variable is obtained by multiplying the two variables MUL and KEI (MUL\*KEI). 105 firm-year observations are collected for this category of firms. Finally, OTHER variable equals 1 if the firm is both domestic and independent and 0 if the firm is multinational or keiretsu. It is the most important group in size with 1940 firm-year observations.

### III.2. INVESTMENT VARIABLES

As is standard, the R&D intensity (designed R&D) is computed as R&D expenses deflated by sales. The capital expenditures ratio (CEXP) is computed as expenditures on plant, property and equipment deflated by total assets.

### III.3. FINANCIAL VARIABLES

Cash flow (CF) is measured as net income before extraordinary items and depreciation and is expressed as a percentage of sales. The long-term debt ratio (LTD) is measured by long-term debt (excluding capitalized leases) over total assets. The short-term debt ratio (STD) is measured as the ratio of debt in current liabilities to total debt. The STD measure includes the current portion of long-term debt but does not include accounts and accrued expenses, which may fluctuate seasonally and may not represent ongoing sources of short-term financing (Doukas and Pantzalis, 2003).

### III.4. PERFORMANCE VARIABLES

Return on Equity (ROE) measures the efficiency of a firm to generate benefits from the shareholders' equity and it is equal to the net income deflated by total equity. The Return on Assets (ROA) measures the efficiency of a firm to generate profits from using its assets and it is calculated by dividing a company's net income by its total assets. Tobin's Q compares the market value of a company with the book value of its assets and it is calculated by dividing the market value by the assets' book value.

### III.5. CONTROL VARIABLES

The size of the firm and its sales growth are used as control variable. Size is measured by the natural logarithm of market capitalization (lnMC). This variable is used to control the effect of the financial variables on the investment in capital or in R&D by the Japanese firms. The sales growth (SGROW) is the annual rate of growth in sales which is measured by the ratio of the difference between sales of year  $t$  and sales of year  $t-1$  to sales of year  $t-1$  ( $SGROW = (sales_t - sales_{t-1}) / sales_{t-1}$ ). It is specially used to control the effect of investment on the performance of firms.

## IV. Methodology

The objective of our paper is double. First, we examine the link between investment, financial constraints and debt maturity choice related to the keiretsu affiliation and/or to the internationalization of activities of Japanese firms. Second, we study the relationship between R&D investment and capital expenditures, on the one hand, and the performance of Japanese firms according to whether they are members of keiretsu and multinationals, on the other hand. These objectives are summarized by two equations presented below. We have used the Generalized Least-Squares random effects to estimate the two equations.

To test the relationship between firm's investment and its structure, we have estimated the following slope-dummies equation:

$$\begin{aligned} INV_{it}^j = & \alpha_0 + \alpha_1 (MUL * CF_{it-1}) \\ & + \alpha_2 (MUL * LTD_{it-1}) + \alpha_3 (MUL * STD_{it-1}) \\ & + \alpha_4 (KEI * CF_{it-1}) + \alpha_5 (KEI * LTD_{it-1}) \\ & + \alpha_6 (KEI * STD_{it-1}) + \alpha_7 (MULKEI * CF_{it-1}) \\ & + \alpha_8 (MULKEI * LTD_{it-1}) + \alpha_9 (MULKEI * STD_{it-1}) \\ & + \alpha_{10} (OTH * CF_{it-1}) + \alpha_{11} (OTH * LTD_{it-1}) \\ & + \alpha_{12} (OTH * STD_{it-1}) + \alpha_{13} \ln MC_{it} + \varepsilon_{it} \end{aligned}$$

where subscripts  $i$  and  $t$  designate the  $i^{\text{th}}$  firm and the year  $t = [2000, 2001, 2002]$  respectively.  $\alpha_0, \alpha_1, \dots, \alpha_{13}$  are parameters,  $\varepsilon$  is a random term with usual properties and  $INV^j$  measures the investment level, ( $j = \{RD, CEXP\}$ ).

This equation investigates whether the multinationality or/and the keiretsu affiliation are associated with financial factors (or firm size) as determinants of Japanese firms' R&D and capital investments. In other words, we attempt to see whether the keiretsu affiliation or the degree of multinationality matters more in the R&D and the physical capital financing by Japanese firms and if the firm's size alters the relationship between the financial characteristics of each category of firms and the investment policy. According to Kim *et al.* (2004), who observed that Japanese business groups have heterogeneous features and an important along which heterogeneity can be captured is the size of the groups, we included the natural logarithm of market capitalization as an explanatory variable in the first equation. Finally, in order to avoid the problem of instantaneity bias, all the variables are estimated with a lag of one period. Estimation is via Generalized Least Squares random effects.

The relationship between performance and investment is measured through the estimation of the following equation:

$$PERF_{it}^k = \beta_0 + \beta_1 (INV_{it}^j) + \beta_2 (SGROW_{it}) + u_{it}$$

where  $\beta_0, \beta_1$  and  $\beta_2$  are parameters,  $u$  is a random term with usual properties and  $PERF^k$  measures the performance ( $k = \{Q, ROE, ROA\}$ ).

The equations to be estimated are keiretsu-affiliated firms, multinational firms, both keiretsu and multinational firms, and other firms. Estimation is via two-stage Generalized Least-Squares random-effects. The investment variables are considered as endogenous and instrumented with regressors of Equation (1):  $CF_{it-1}$ ,  $LTD_{it-1}$ ,  $STD_{it-1}$  and  $\ln MC_{it}$ .

## V. Results and analysis

We present in this section three sets of results. The first one presents some descriptive statistics of our study. In the second, we provide the estimates of the first equation and we analyse the impact of the keiretsu affiliation and/or the multinationality degree on the investment financing in Japanese firms. The third set proposes the estimates of the second equation and we investigate the relationship between investment in R&D and/or material goods and Japanese firms' performance.

## V.1. SUMMARY STATISTICS

Table 1a presents summary statistics. It reports the mean and the standard deviation of the variables. Comparison tests are reported in Table 1b. R&D and capital expenditures are more important for firms that are only multinational (MUL) or both multinational and keiretsu (MULKEI). This result is consistent with the fact that keiretsu firms invest more in the R&D area only when their activities are internationalized. With respect to cash flow, multinational firms (keiretsu or not) have high averages relative to domestic keiretsu firms. Hence, as several

authors argue, multinationals rely more on internal than external financing. For the total sample in panel A, bank debt makes up a significant proportion of short-term debt. When we compare panel B with panels C and D, we show that the long-term debt ratio for multinational but not keiretsu firms (MUL) is lower than those observed in keiretsu but not multinational firms (KEI). The importance of the short-term debt is a characteristic of the keiretsu (but not multinational) firm (panel C). When we compare panel B with panel E, we observe unlike Doukas and Pantzalis (2003) that multinational firms do not use in mean and median more short-term debt than domestics

**Table 1a: Summary statistics**

Variables	Whole sample (Panel A)	MUL (Panel B, N = 679)	KEI (Panel C, N = 300)	MULKEI (Panel D, N = 105)	OTHER (Panel E, N = 1940)
<i>Investment variables</i>					
R&D	2.50 (2.95)	3.84 (2.95)	2.16 (2.04)	3.96 (2.56)	2.07 (2.95)
CEXP	3.85 (3.25)	5.07 (3.21)	3.82 (3.01)	5.12 (2.72)	3.42 (3.22)
<i>Financial variables</i>					
CF	6.16 (7.22)	7.62 (7.54)	4.61 (5.47)	6.19 (5.51)	5.97 (7.36)
LTD	11.93 (11.92)	11.68 (10.30)	12.58 (10.79)	12.25 (8.94)	11.88 (12.66)
STD	14.85 (13.51)	14.13 (12.43)	16.53 (12.95)	11.52 (8.37)	14.98 (14.09)
<i>Performance variables</i>					
Q	1.54 (1.91)	1.96 (2.23)	1.32 (1.35)	1.45 (0.74)	1.45 (1.91)
Q > 1	51.25%	70.29%	54.66%	67.92%	44.12%
ROE	1.14 (13.73)	1.27 (15.01)	-1.19 (13.77)	2.23 (12.62)	1.41 (13.35)
ROA	1.40 (4.49)	1.73 (5.21)	0.66 (3.77)	1.81 (3.37)	1.39 (4.40)
<i>Control Variables</i>					
SGROW	2.46 (16.29)	2.08 (17.86)	1.80 (12.32)	2.77 (14.64)	2.66 (16.43)
lnMC	13.03 (1.58)	13.74 (1.51)	13.15 (1.51)	14.29 (1.73)	12.73 (1.50)

Note: Standard Deviation in brackets.

**Table 1b: Comparison tests**

Variable	MUL and KEI			MULKEI and OTHER		
	<i>Is there a difference?</i>	Test on the equality of medians (U)	Test on the equality of means (t)	<i>Is there a difference?</i>	Test on the equality of medians (U)	Test on the equality of means (t)
<i>Investment variables</i>						
RD	Yes	-9.62***	-8.82***	Yes	-9.17***	-6.43***
CEXP	Yes	-6.22***	-5.58***	Yes	-7.30***	-5.32***
<i>Financial variables</i>						
CF	Yes	-6.72***	-6.13***	Yes/No	-2.19*	-0.30
LTD	No	0.88	1.21	Yes/No	-2.01*	-0.30
STD	Yes	3.82**	2.68**	No/Yes	1.17	2.50*
<i>Performance variables</i>						
Q	Yes	-5.36***	-5.53***	Yes	-4.45***	0.03
ROE	Yes	-3.34***	-2.36**	No	-1.55	-0.62
ROA	Yes	-4.93***	-3.15***	No	-1.89	-0.95
<i>Control Variables</i>						
SGROW	No	0.28	-0.24	No	-0.95	-0.07
LMC	Yes	-5.26***	-5.47***	Yes	-9.05***	-10.30***

\*\*\*, \*\* and \* indicate significance at the 1%, 5% and 10% levels, respectively.

do. For multinational and keiretsu firms (panel D), the long-term debt ratio is greater (12.25) than the short-term debt ratio (11.52). This is perhaps due to the period analysis. Japan was in the middle of prolonged depression (Ogawa, 2007) and firms were roughly being enabled to easily access to a short term credit. This is not the case of independent keiretsu firms which have in mean more short-term debt (16.53) than long-term debt (12.58).

Concerning the performance variables, Table 1a shows that for all categories of firms, Tobin's Q is greater than 1. This indicates that the market value is greater than the book value of firms. This statement is especially true for multinational firms who have the highest Q-ratio. 70% (respectively 68%) of the multinational (multinational and keiretsu) firms have a Tobin's Q greater than 1 (Panel B and D). So, the internationalized activities of multinational firms make them more valorized than others. For the ROA and ROE ratios, the statistics show that they have low values for all categories of firms. But the firms who are both multinational and keiretsu have the highest values (2.23% and 1.81%). This suggests that this category of firms is more efficient to generate profits from using its assets and its shareholders' equity than other firms. But, when we compare the performance of keiretsu domestic firms (KEI) with that of the domestic non-keiretsu firms (OTHER), we can conclude that the first category of firms is less profitable than the second. The values of Q, ROA

and ROE ratios are in means lower for keiretsu firms than for non-keiretsu firms. Our results are consistent with those of Brown et al. (1994) who found that ROA ratio and profit margin are significantly lower for keiretsu firms than for non-keiretsu ones. They affirm that membership in a keiretsu does not give member firms a measurable advantage in profitability.

Finally, we can notice that sales growth ratio is positive for all categories of firms. This means that for the four groups, there is an increase in sales, especially for the firms who are both multinational and affiliated to a keiretsu. Also, the statistics show that multinational firms, especially when they are both multinational and keiretsu, are larger in terms of size (measured by natural logarithm of market capitalization) than all other types of firms.

## V.2. ESTIMATING FIRM'S INVESTMENTS

Estimation results of R&D intensity and capital expenditures ratio equations are shown in Table 2.

For all categories of firms, Table 2 indicates that the prior-year cash flow is an explanatory factor of the R&D investment (column 2) and contributes substantially in the release of the capital expenditures (column 1). Indeed, the coefficients of the prior-year cash flow (combined with each binary variable) on the R&D and on the capital expenditures (CEXP) are positive and significant for

Table 2. GLS random effects estimation results of R&amp;D and capital expenditures

Variables	CEXP equation				R&D equation			
	Coef.	z	Coef.	z	Coef.	z	Coef.	z
InMC			0.24	(3.93)***			0.27	(5.01)***
MUL*CF <sub>it-1</sub>	0.17	(9.52)***	0.16	(8.48)***	0.07	(4.90)***	0.06	(4.17)***
MUL*LTD <sub>it-1</sub>	0.03	(1.72)	0.02	(1.33)	-0.01	(0.91)	-0.02	(1.42)
MUL*STD <sub>it-1</sub>	0.01	(0.49)	0.01	(0.59)	0.01	(0.66)	0.01	(0.70)
KEI*CF <sub>it-1</sub>	0.16	(4.73)***	0.16	(4.59)***	0.04	(1.68)	0.04	(1.65)
KEI*LTD <sub>it-1</sub>	0.02	(1.02)	0.01	(0.41)	-0.03	(1.73)	-0.04	(2.38)*
KEI*STD <sub>it-1</sub>	-0.03	(1.44)	-0.02	(1.03)	-0.03	(1.93)	-0.02	(-1.59)
MULKEI*CF <sub>it-1</sub>	0.23	(3.86)***	0.22	(3.64)***	0.03	(0.75)	0.02	(0.57)
MULKEI*LTD <sub>it-1</sub>	-0.02	(0.51)	-0.04	(0.83)	0.01	(0.16)	-0.01	(0.34)
MULKEI*STD <sub>it-1</sub>	0.06	(1.24)	0.05	(1.06)	0.04	(1.09)	0.03	(0.77)
OTHER*CF <sub>it-1</sub>	0.10	(8.07)***	0.09	(7.03)***	0.03	(3.34)***	0.02	(2.56)**
OTHER*LTD <sub>it-1</sub>	0.02	(2.65)***	0.02	(2.03)*	-0.03	(4.08)***	-0.03	(4.70)***
OTHER*STD <sub>it-1</sub>	-0.02	(2.61)***	-0.01	(1.77)	-0.03	(4.43)***	-0.02	(3.72)***
Intercept	2.96	(16.9)***	-0.09	(0.11)	2.84	(18.3)***	-0.62	(0.87)
R <sup>2</sup>	0.2037		0.2019		0.1085		0.1404	
Wald $\chi^2$	222.41		239.81		112.91		140.56	

\*\*\*, \*\* and \* indicate significance at the 1%, 5% and 10% levels, respectively.

almost all categories of firms (MUL, KEI, MULKEI and OTHER). The investment activities, although in R&D and in capital investment area, are more sensitive to prior-year cash flow variations for multinational than for the other groups of firms. The effect of prior-year cash flow on CEXP is more important for firms that are multinationals and affiliated to a keiretsu.

The access of a multinational to a main bank increases the sensitivity of tangible investments to liquidity. These results indicate that publicly traded firms that rely on a single bank are significantly more cash-flow-constrained than firms that maintain multiple bank relationships especially for large investment projects. In some way, our result is inconsistent with the results of Houston and James (2001), Hayashi (2000) and Miyajima *et al.* (2002). Also, when we compare domestic keiretsu firms (KEI) with domestic independent firms (OTHER), we find some difference in the effect of prior-year cash flow on CEXP. This effect is stronger for the domestic keiretsu firms than for the domestic independent firms. The access of a domestic firm or of a multinational firm to a main bank increases the sensitivity of capital investments to liquidity. Although the impact of prior-year cash flow on R&D investments is ambiguous for the multinational

firms, we can argue, in contrast with these authors, that finance by main banks does not play any roles of easing liquidity constraints.

Except for the independent and domestic firms (OTHER), the effect of prior-year long-term debt and prior-year short-term debt on CEXP and on R&D are insignificant. These results do not change when we control with the size of the firms. Neither keiretsu affiliation nor internationalization activity facilitates access to the bank loan. These results are not consistent with the idea that the main bank may help members of the keiretsu, even if when their activities are internationalized by allowing a long-term debt or a short-term debt. A positive and significant correlation between prior-year long-term debt and capital expenditures (CEXP) is found only for independent and domestic firms. Independent firms benefit from inter-bank competition and negotiate the terms of the appropriations more easily. The effect of debt (short or long term) is negative on R&D investment and significant at 0.001 level for this category of firm. Our result is similar to Ogawa (2007) who find, for 1999-2001 (approximately the same period used in our study), that debt-asset ratio of Japanese firms has negative effect on R&D investment, implying that massive debt outstanding deter R&D activities.

In the Japanese financial market, it was pointed out that main banks' monitoring provided information about borrowers by using a short-term loan. Fukuda and Cong (2000) argue that it would be difficult for the main banks

to provide long-term information about firm growth, since the main bank has traditionally been engaged in providing short-term funds. However, if we focus our attention on the coefficient of prior-year short-term debt, no major diffe-

**Table 3. G2SLS random effects estimation results of performance (Endogenous: CEXP)**

	MUL		KEI		MULKEI		OTHER	
	Coef.	z	Coef.	z	Coef.	z	Coef.	z
<b>Dep. Var.: Q</b>								
CEXP	0.19	2.19*	0.003	0.05	0.041	0.57	0.28	7.61***
SGROW	0.01	1.97*	0.006	2.01*	0.006	2.41*	0.01	4.33***
Intercept	0.71	1.52	1.271	5.86***	1.122	2.93**	0.34	2.54*
<i>First stage estimates Instrumented: CEXP</i>								
SGROW	0.01	1.65	-0.00	0.38	0.00	0.36	0.01	2.06*
lnMC	-0.05	0.36	0.23	1.22	0.35	1.31	0.12	1.75
CF1	0.15	6.17***	0.13	3.67***	0.15	2.44*	0.15	10.8***
LTD1	0.00	0.04	0.01	0.21	-0.07	1.76	0.03	3.92***
STD1	-0.02	1.14	-0.03	1.47	-0.00	0.04	-0.01	1.09
Intercept	4.74	2.63**	0.56	0.22	0.03	0.01	0.75	0.90
<b>Dep. Var.: ROE</b>								
CEXP	2.62	3.47***	1.65	1.90*	0.67	0.46	2.59	6.71***
SGROW	0.26	7.60***	0.30	4.74***	0.25	2.33*	0.16	6.16***
Intercept	-13.26	3.23***	-8.39	2.38*	-2.17	0.28	-8.11	5.7***
<i>First stage estimates Instrumented: CEXP</i>								
SGROW	0.01	1.67	0.00	0.17	-0.01	0.62	0.01	1.43
lnMC	-0.07	0.52	0.24	1.43	0.19	1.17	0.15	2.05*
CF1	0.16	6.26***	0.17	4.54	0.28	4.34***	0.14	10.2***
LTD1	0.01	0.56	0.01	0.29	-0.04	1.03	0.03	3.61***
STD1	-0.02	1.40	-0.02	1.04	0.08	1.89	-0.01	0.97
Intercept	4.95	2.73**	0.00	0.00	-0.07	0.03	0.49	0.56
<b>Dep. Var.: ROA</b>								
CEXP	1.25	3.78***	0.60	2.97**	0.41	1.04	1.06	7.1***
SGROW	0.12	10.9***	0.08	4.05***	0.11	4.85***	0.09	11.2***
Intercept	-5.29	2.97**	-1.83	2.24*	-0.56	0.27	-2.51	4.6***
<i>First stage estimates Instrumented: CEXP</i>								
SGROW	0.01	1.90	0.01	0.61	-0.00	0.18	0.00	0.50
lnMC	-0.03	0.20	0.25	1.59	0.22	1.18	0.21	2.69**
CF1	0.13	5.14***	0.20	5.24***	0.23	3.61***	0.11	8.48***
LTD1	-0.01	0.25	0.01	0.32	-0.04	1.06	0.02	2.95**
STD1	-0.02	1.33	-0.01	0.66	0.06	1.31	-0.01	0.79
Intercept	4.80	2.45*	-0.43	0.20	0.23	0.09	-0.10	0.10

\*\*\*, \*\* and \* indicate significance at the 1%, 1% and 5% levels, respectively.

rences are observed between all categories of firms. In fact, according to Fukuda and Cong (2000), since information has a property of public goods, profit-maximizing private banks could not afford to provide sufficient information

about the growth opportunities of corporations. Thus, the policy-based allocation of long-term or short-term funds could be evaluated from a different point of view than the provision of information by main banks.

**Table 4. G2SLS random effects estimation results of performance (Endogenous: R&D)**

	MUL		KEI		MULKEI		OTHER	
	Coef.	z	Coef.	z	Coef.	z	Coef.	z
<b>Dep. Var.: Q</b>								
R&D	0.43	3.21***	0.18	2.11*	0.14	2.03*	0.41	7.84***
SGROW	0.02	3.43***	0.01	2.76**	0.01	2.76**	0.02	6.89***
Intercept	0.01	0.01	0.88	4.43***	0.74	2.38*	0.42	3.43***
<i>First stage estimates Instrumented: R&amp;D</i>								
SGROW	-0.02	4.27***	-0.02	2.57**	-0.02	1.96*	-0.02	3.78***
InMC	0.48	4.59***	0.35	3.20***	0.52	2.43*	0.36	5.54***
CF1	-0.01	0.34	0.06	2.46*	-0.12	2.08*	0.07	5.39***
LTD1	-0.04	2.69**	-0.02	1.07	-0.08	2.23*	-0.05	6.79***
STD1	-0.01	0.92	-0.01	0.98	-0.07	1.75	-0.01	1.01
Intercept	-1.85	1.26	-2.22	1.52	-0.41	0.14	-2.14	2.71**
<b>Dep. Var.: ROE</b>								
R&D	5.72	3.53***	5.49	3.79***	1.57	1.02	4.14	6.54***
SGROW	0.38	7.30***	0.38	4.14***	0.26	2.31*	0.23	7.85***
Intercept	-22.45	3.37***	-14.03	4.09***	-5.10	0.78	-8.04	5.45***
<i>First stage estimates Instrumented: R&amp;D</i>								
SGROW	-0.02	4.92***	-0.02	1.68	-0.02	0.79	-0.02	3.70***
InMC	0.47	4.44***	0.33	3.06**	0.50	2.50*	0.34	5.27***
CF1	-0.01	0.34	0.08	3.04**	-0.13	1.60	0.06	4.64***
LTD1	-0.04	2.35*	-0.01	0.91	-0.08	1.88	-0.04	5.96***
STD1	-0.01	0.98	-0.01	0.79	-0.07	1.48	-0.01	1.53
Intercept	-1.73	1.16	-2.12	1.47	-0.28	0.10	-1.92	2.38*
<b>Dep. Var.: ROA</b>								
R&D	2.14	3.43***	1.25	3.09**	0.23	0.64	1.69	7.00***
SGROW	0.17	9.36***	0.10	4.60***	0.11	4.80***	0.11	12.1***
Intercept	-7.30	2.86**	-2.36	2.45*	0.62	0.40	-2.46	4.39***
<i>First stage estimates Instrumented: R&amp;D</i>								
SGROW	-0.02	5.82***	-0.02	2.24*	-0.02	1.09	-0.01	3.86***
InMC	0.45	4.26***	0.34	3.15**	0.53	2.59**	0.34	5.08***
CF1	-0.01	0.61	0.07	2.68**	-0.13	1.87	0.05	4.13***
LTD1	-0.04	2.55*	-0.02	1.02	-0.09	2.09*	-0.04	5.33***
STD1	-0.02	1.20	-0.01	0.91	-0.07	1.54	-0.01	1.92
Intercept	-1.41	0.95	-2.20	1.51	-0.51	0.18	-1.79	2.18*

\*\*\*, \*\* and \* indicate significance at the 1%, 5% and 10% levels, respectively.

### V.3. ESTIMATING FIRMS' PERFORMANCE

Estimation results of Equation (2) are shown in Table 3 and Table 4. In Table 3, the capital expenditure ratio variable (CEXP) is assumed to be an endogenous factor of performance, whereas the research and development intensity variable (R&D) plays this role in Table 4. First-stage estimates are reported in both cases.

For multinational firms, Table 4 indicates that the capital expenditures ratio affects positively and significantly the three performance variables, measured with Tobin's Q, ROE and ROA ratios. This relationship is true even after controlling the effect of sales growth (which has also a positive and significant effect on all the performance variables). This phenomenon is also observed when we consider the impact of the R&D variable. Let us notice that, for multinational firms, the effect of intangible assets (R&D) on performance is higher than that of tangible assets (CEXP), especially for Q and ROE ratios. These results confirm those found by Lee and Shim (1995) and Nagaoka (2006). In other words, investment in R&D activities positively affects the performance of multinational Japanese firms.

Estimates presented in Table 3 also indicate that investments in equipments and plant properties of firms affiliated to a keiretsu (multinational or not) have a significant and positive but lower in absolute value effect on their performance. One explanation is that bank-controlled firms are risk averse and therefore might excessively direct their capital investment towards the low return ventures. We can observe from Table 4 that there is a positive and significant relationship between R&D activities and the three performance ratios. This means that the R&D activities can improve not only multinational firms' performance but also domestic firms' performance. However, in accordance with the results of Bae and Noe (2001), this positive effect is more pronounced for multinational Japanese firms (MUL) than all other categories of firms. This finding is not a surprise insofar as multinational firms are, by convention, more R&D intensive than domestic firms. Another explanation, advanced by the theory of internalization, is that multinational members are able to transform the output of R&D into new products at a lower cost than domestic members.

One important result is that the firms which are both multinational and keiretsu (MULKEI) have less important performance measured by Tobin's Q when they increase their R&D investments. The presence of a main bank in multinational firms seems to alter the positive effect of R&D on performance. When we consider the other performance ratios, the relationship between performance and investment in R&D or in material goods is never

statistically significant. We can notice that the performance of firms who are both multinational and affiliated to a keiretsu is much more explained by the growth in sales than by the nature of their investment (intangible or tangible). Table 3 and Table 4 show that sales growth has positive and significant effect on the three performance variables.

Finally, for the domestic and independent firms (OTHER), it appears that there is a positive and significant relationship between the three performance variables and the investment in tangible or in intangible assets. For this category of firms, investment in R&D or in material goods improves performance. The effects are in most cases more important than those of the keiretsu firms (KEI). Independently of the internationalisation character and when we compare the results of domestic firms (keiretsu or not), the presence of a main bank alters the effect of investments on performance.

## VI. CONCLUSION

This study examines, first, the effect of financing features in relation with the multinational character and the keiretsu membership on R&D and physical investments of Japanese firms and, second, the effect of these investments on the performance measured also by Tobin's Q, ROE and ROA. On a total sample composed of 3024 firm-year observations over the 2000-2002 period, we specify the effects of the cash flow, long-term debt, short-term debt and size on R&D and capital expenditures for multinational, keiretsu, both multinational and keiretsu, and both domestic and independent firms. The results show evidence of the importance of the multinational and the keiretsu affiliation aspects in the financing of R&D and of the capital expenditures by Japanese firms. It is shown that the multinational firms affiliated to a keiretsu are more constrained than all other categories of firms regarding capital investments. The relationship between R&D investment and internal resources is more ambiguous and does not vary considerably according to firm category. As Houston and James (2001), Hayashi (2000) and Miyajima *et al.* (2002) conclude, the presence of the main bank does not alleviate the financial constraint problem. Except for domestic and independent firms, the effects of short-term debt and long-term debt are not significant on R&D or on capital investment. Another important result is that the firms which are either multinational or domestic have less important performance notably measured by Tobin's Q when they increase their R&D investments. The presence of a main bank in the multinational firms or in the domestic firms seems to alter the positive effect of R&D on performance. ■

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