Corporate Investment, Cash Holdings and Financial Constraints: Insights from Japan

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September 2004

Abstract

We examine the impact of financial constraints on the behavior of 747 Japanese firms. Knowing that the design of an empirical test allowing to evaluate such an impact remains a puzzle in the literature, we apply two different approaches to explore the relationship between capital market imperfections and firms' financial policies in Japan. Specifically, we rely on Fazzari et al.(1988) and use the sensitivity of investment to internal funds to test for financial constraints. Alternatively, we deviate from this widespread metric and apply the new cash-based methodology put forward by Almeida et al.(2004). We find evidence proving that none of these approaches provide accurate tests of financial constraints. After classifying firms according to five distinct proxies for financial frictions, we find that more severe constraints are not systematically reflected through a higher investment-cash flow sensitivity. Turning to the cash-to-cash flow approach, we observe that even *a priori* less constrained firms exhibit a positive response of cash holdings to cash flow shocks. This indicates that these two established empirical tests fail to unambiguously appraise the impact of financial constraints.

Keywords: Financial constraints, capital market imperfections, investment, internal funds, investment-cash flow sensitivity, cash flow sensitivity of cash, Japan.

JEL Classification Numbers: G31, G32, G35

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1 Introduction

Prior to the nineties, the Japanese bank-centered financial system was often claimed to be superior to the Anglo-American market-based system. However, the long-lasting and poor performance of the Japanese economy over the last decade cast doubt on the validity of this conventional view. Although different explanations have been put forward, such as inadequate fiscal policies, an over-investment during the asset bubble and a severe liquidity trap, recent studies argue that the chronic slump may result from the partial failure of the financial system in efficiently allocating capital[1]. Accordingly, the decline of corporate investment may stem from capital market imperfections rather than traditional policy implications. More precisely, some Japanese firms may face a lack of external capital which constraint them in financing their potential investment.

Since the seminal paper by Modigliani and Miller (1958), many research have questioned the substitutability of internal and external finance, primarily on the grounds that there exists distinct imperfections in capital markets. Accordingly, some firms may face an external finance premium that constrains their financial decisions. Based on this intuition, a large body of the literature considers that the magnitude of financial constraints increases as the wedge between internal and external cost of funds widens. It follows that for a large cost differential, firms' investment should vary with the level of internal funds, rather than only with the expected future profitability.

Starting with Fazzari, Hubbard and Petersen (1988), many studies use the sensitivity of investment to cash flow to evaluate the effect of financial constraints on investment decisions. These studies group firms according to *a priori* criteria aimed to capture the intensity of financial frictions and find that investment of financially constrained firms is more sensitive to cash flow than unconstrained firms. Although this methodology is widespread in the corporate finance literature, some recent papers cast doubt on its theoretical foundations. More specifically, Kaplan and Zingales (1997) argue that a higher investment-cash flow sensitivity is not a necessary implication of greater capital market imperfections. Converse to the findings of Fazzari et al.(1988), they report a non-monotonic relationship between the sensitivity of investment to cash flow and the degree of financial frictions. Even though the current literature agrees on the distorting forces of financial constraints, the design of an accurate empirical test remains puzzling.

In this study, we apply two alternative approaches to appraise the impact of financial constraints on the behavior of Japanese firms. First, relying on the above controversial literature, we estimate the investment-cash flow sensitivity to evaluate whether this testing approach is relevant to identify the effect of capital market imperfections. Second,

[1] See e.g. Hanazaki and Horiuchi (2000), Yafeh (2000) and Patrick (2004).

deviating from the tradition, we use the cash-based methodology developed by Almeida, Campello and Weisbach (2004) to assess the influence of financial frictions on firms' behavior. Assuming that constrained firms may exhibit a systematic propensity to save cash out of cash flow for precautionary reasons, constrained firms should display a positive sensitivity of cash holdings to cash flow. Given that both approaches require classifying firms into *a priori* more and less constrained groups, we use and extend four well-established classification criteria (payout policy, leverage ratio, asset size and affiliation to a large conglomerate) and propose a new criterion (investment-dividend correlation).

The main contribution of our study consists in pointing out several limitations of the literature on financial constraints. Consistent with the latter theoretical developments rejecting the monotonicity hypothesis, our results suggest that the interactions between Japanese firms' investment and financial constraints are far more complex than what has been generally postulated. Alternatively, in order to build a sound measure of financial constraints, our findings emphasize that the recent theory on cash holdings is yet to be deeper explored. Finally, our results highlight the need for a better understanding of the relationship between the different actors of the particular Japanese financing process.

Using a sample of 747 firms listed on the Tokyo Stock Exchange over the 1997-2003 period, we find that both methodologies partially fail in predicting unambiguous effects on firms' behavior. As a consequence, we are not able to provide evidence that some firms may suffer a limited access to capital. Concerning the investment-cash flow sensitivities, we find no systematic differences between the more and less constrained groups. Clearly, our results neither confirm the intuition of Fazzari et al.(1988) nor the critical reassessment of Kaplan and Zingales (1997). As a result, we conclude that either the degree of financial constraints cannot be fully reflected through investment-cash flow sensitivities, or other firm characteristics which are not controlled for may drive our results.

Turning to the cash-to-cash flow sensitivities, we observe that the estimated sensitivities are significant for all groups. These findings widely diverge from the main predictions of Almeida et al.(2004), indicating that not only more constrained firms save cash in response to positive cash flow innovations. As a consequence, our results may point out the incompleteness of this approach. Indeed, from a theoretically point of view, we cannot assert with any certainty that the cash-to-cash flow sensitivities stem from precautionary reasons rather than other phenomena such as agency conflicts. Significantly, the conclusions of both approaches hold after having performed a number of robustness checks which include changes in the variables definitions, the empirical specifications, the sampling restrictions and the estimation methods.

The remainder of this study proceeds as follows. In section 2, we provide a review of the existing literature. Section 3 details the research methodology, describes the sample

and discusses some estimation issues. Section 4 and 5 present the results. Section 6 concludes.

2 Literature Review

In a world characterized by frictionless capital markets, as considered by Modigliani and Miller (1958), internal funds are perfect substitutes to external funds, that is financing decisions are irrelevant. However, in the real world, there exists several distorting forces that prevent capital markets to achieve such an utopian perfection. Among the most prominent are informational asymmetries, transaction and monitoring costs, weak enforcement of contracts, tax advantages, costs of financial distress and agency problems. On these grounds, much of the research on financial economics tends to deal with the consequences of capital market imperfections on firms' behavior. More specifically, a large body of the literature focus on how financial constraints affect investment decisions.

Based on the intuition that the financing sources may depend on firms' financial conditions and access to credit markets, Fazzari, Hubbard, and Petersen (1988) use the sensitivity of investment to cash flow as a measure of financial constraints. According to them, firms' investment not only vary with growth opportunities, often captured by Tobin's Q, but also with fluctuations in cash flow depending on whether the firm is *a priori* classified as constrained or unconstrained. Fazzari et al.(1988) use the observed retention practice, i.e. the ratio of dividends to income, to classify firms into three different groups. The prevailing idea is that firms that face a large cost disadvantage of external finance will *ceteris paribus* most likely shift their cash flow to investment instead of giving out dividends to shareholders. Therefore, the sensitivity of investment to cash flow is found to be higher for constrained firms, whereas investment decisions of unconstrained firms should not depend on cash flow levels.

Following this influential article, much of the debate has concentrated on how alternative proxies for capital market imperfections could improve the classification of firms into constrained and unconstrained groups. Commenting upon Fazzari et al.(1988), in the same issue, Blinder (1988), Poterba (1988) and Sims (1988), among others, suggest in turn that other criteria should divide the sample. Although subsequent studies apply a similar payout classification but arrive at heterogenous results (see, e.g. Fazzari and Petersen, 1993; Gilchrist and Himmelberg, 1995; and Alti, 2003), the whole issue on the actual reasons for firms to pay any dividends at all is disturbing. As a consequence, the participants to the discussion put forth an alternative classification based on firms' age or size, suggesting that the results of Fazzari et al.'s (1988) constrained group (paying low dividends) is driven by the fact that those firms are almost all young and small. Devereux

and Schiantarelli (1989) are the first, among many, to find that while younger firms exhibit a significantly higher sensitivity of investment to cash flow, surprisingly, larger firms are relatively more sensitive than smaller firms. They claim that large firms, having a more diverse ownership structure, face greater agency costs, keeping in mind that those firms may also have lower cash flow with respect to their total asset value.

Using the same classification criteria, Oliner and Rudebusch (1992) argue that information problems are likely to be large for young firms and therefore use the level of total assets (firms' size) as a proxy for transaction costs, assuming that small firms face relatively higher transaction costs. Through an interaction estimation, as opposed to grouping firms by classes, they find that neither age nor size can significantly explain the financing hierarchy. They maintain however, that their negative results certainly come from their sample where small firms are all still part of the US Fortune 500 companies. This finding reflects again the complexity of creating proxies for agency costs. Finally, both Vogt (1994), who investigates the difference between the pecking order and the net cash flow hypotheses (respectively under and overinvestment of managers due to either asymmetric information or unprofitable investment projects), and Kadapakkam, Kumar and Riddick (1998), using data from six OECD countries, confirm the above results of a higher investment-cash flow sensitivity for large firm size groups. Apart from Devereux and Schiantarelli's (1989) postulate, the intuition lies in the greater flexibility enjoyed by large firms in timing their investment decisions.

On a theoretical ground, the provocative and breakthrough paper by Kaplan and Zingales (1997) spurred a debate in the literature by challenging the approach of Fazzari et al.(1988). They show that contrary to prior ideas (never fully debated) the investment-cash flow sensitivity has no reason to increase monotonically with the degree of financing constraints. According to them, there is no obvious theoretical arguments proving that *a priori* more constrained firms invest more when internal funds increase. Moreover, they find that *undoubtedly financially constrained* firms encounter a lower sensitivity of investment to cash flow than *definitely not financially constrained* firms. They stress that the classification criteria should also be based on qualitative hypotheses such as firms' annual reports and management discussions of liquidity. In such a case, they show that the monotonicity argument of Fazzari et al.(1988) is not sustainable.

Hubbard (1998) criticized Kaplan and Zingales (1997) not on the monotonicity assumption but on the choice of the classification criteria. He argues that due to the small size of their sample and due to their relying on managerial statements, Kaplan and Zingales (1997) confuse financially constrained firms with observations from years when firms are financially distressed. Moreover, Hubbard (1998) argues that Kaplan and Zingales (1997) ignore the use of cash flow for purpose other than investment and use a sample

which lacks sufficient heterogeneity. Using a much larger and more recent sample (1317 firms), Cleary (1999) strongly supports Kaplan and Zingales' (1997) findings. He asserts that firms with high creditworthiness (classified as such based on a dividend growth criteria; firms increasing their dividends are likely not to be financially constrained) tend to have a greater sensitivity of investment to cash flow than firms that are less creditworthy.

Adding to Hubbard's (1998) critics, Fazzari, Hubbard and Petersen (2000) respond to Kaplan and Zingales (1997) by providing evidence that their non-monotonicity view fails to coincide with the approach of most prior research. However, Kaplan and Zingales (2000), by maintaining their previous results and using Cleary's (1999) findings, argue that a monotonic relationship between investment and cash flow does not prove to be based on solid theoretical foundations. Pratag (2003), using a dynamic model of firm investment, shows that while a high sensitivity of investment to cash flow is an indicator of financing constraints, the reverse is not necessarily true. According to him, the classification of constrained firms should be based on unused lines of credit and proxied by the level of internal financial resources as a dynamic, rather than a static concept. He claims that the static results of Kaplan and Zingales (1997) are thus misleading since they conclude that firms with unused credits and a high sensitivity of investment to internal funds are considered as financially unconstrained.

Following this controversial debate, two major streams of research have appeared. The first focuses more on how to improve the definition of financial constraints through various classification criteria[2]. The second stream relies more on theoretical foundations and alternative research directions. In the spirit of the former, the classification of firms based on debt finance was first put forth by Whited (1992) who argues that a firm's payout policy is certainly simultaneously determined with her investment behavior. By taking into account firms' financial health, as well as the access to organized bond markets, Whited (1992) finds that internal funds of more constrained firms have a stronger impact on investment than for healthier firms, either by encountering difficulties in issuing new debts or by not participating in the corporate bond market. Finally, by using the leverage ratio as a classification scheme, Cleary (2002) provides strong supports for the generality of the Kaplan and Zingales' (1997) and Cleary's (1999) results. More constrained firms display an insignificant sensitivity of investment to cash flow indicating that, as debt level increases, firms are less willing to invest, regardless of internal funds.

As alternative proxy for capital market imperfections, a large body of the literature uses memberships in industrial or financial groups to distinguish constrained from unconstrained firms. Hoshi, Kashyap and Scharfstein (1991) are the first to present evidence that firms that have a close relationship to a main bank have a lower investment-cash flow sen-

[2]Table 1 presents a summary of the main papers and the classification criteria used.

sitivity than firms that are independent, that is unaffiliated to a large conglomerate (here the Japanese *keiretsu*). Their underlying argument is that close banking relationships reduce the information and incentive problems, either by taking part in the coordination of member firms' activities, financing part of their investments, or helping out affiliated firms in financial distress.

Hayashi (1997) analyses the sample of Hoshi et al.(1991) and shows that their results are driven by a few outliers and by the poor quality of their data. Hayashi (1997) agrees on the role of cash flow for investment but insists on the fact that access to a main bank does not induce significant differences on the sensitivity of investment to internal funds and that a closer relationship to a bank is simply an alternative to capital markets.

Contrasting with the US, the Canadian conglomerates and the Korean *chaebol* are close in some respects to the Japanese *keiretsu*. Schaller (1993) as well as Chirinko and Schaller (1995) show that Canadian firms with a dispersed ownership have an investment spending which is more sensitive to internal funds than firms concentrated in an interrelated group, even though the latter are typically larger. Shin and Park (1999) find that, in South Korea, the firms affiliated with the major *chaebol* produce similar results than Hoshi et al.(1991) Japanese firms. The main company, through cross-payment guarantees and its main bank system, finances part of the investment of member firms.

[Insert Table 1 Here]

Various other criteria are used to classify firms into financially constrained and unconstrained groups, proving that no one has yet found a clear-cut scheme to measure the impact of financial frictions. The remaining criteria used as proxies for capital market imperfections include the role of land as collateralizable assets (Hubbard and Kashyap, 1992; Schaller, 1993; Ogawa, Kitasaka, Yamaoka and Iwata, 1996; Ogawa and Suzuki, 1998); the presence of bond ratings, the access to a commercial paper market or the eligibility of secured convertible bonds (Whited, 1992; Gilchrist and Himmelberg, 1995; McGuire, 2003). Based on Kaplan and Zingales (1997), several indexes are constructed to reflect the sensitivity of investment to internal funds (Cleary, 1999; Lamont, Polk and Saá-Requejo, 2001; Baker, Stein and Wurgler, 2002). Finally, some authors compute various cross-country comparisons according to different classification criteria (see e.g. Kadpakkam et al., 1998; La Porta, Lopez-de-Silanes, Shleifer and Vishny, 1998; Leaven, 2003; and Cleary, 2002).

Lately, other related studies has focused less on debating about the classification criteria, but more on new research directions. Allayannis and Mozumbar (2001) bring back the main point of discord between Fazzari et al.(1988) and Kaplan and Zingales (1997) by showing that if the sample excludes financial distressed firms, that is with negative cash

flows observations, there is no significant differences in the investment-cash flow sensitivity between constrained and unconstrained firms. Dasgupta and Sengupta (2002) throw some new light on this debate by showing that due to the non-monotonicity of the cash flow sensitivity at a certain threshold, investment of constrained firms may respond more or less to an internal fund shock than unconstrained firms depending on its initial range of cash balances.

Similarly, Povel and Raith (2002) and Cleary, Povel and Raith (2004) develop a non-monotonic U-shaped model where firms' investment increases in the level of cash flow if the latter is positive or not too negative, but decreases for strongly negative levels of internal funds. The prevailing intuition lies in the two effects that determine the marginal cost of debt finance. They call the *cost effect* the harmful impact of an increase in investment that raises the debt burden through additional units of borrowed cash; on the other hand, the expected future value of the firm is increasing with extra investment which facilitate the repayment of debt. Contrary to the cost effect, this *revenue effect* lowers the marginal cost of debt finance. If a firm uses its internal funds for investment, the cost effect dominates the revenue effect, and therefore one obtains the Fazzari et al.'s (1988) results. Nevertheless, if a firm faces sufficiently negative cash flows, the firm tends to invest more as its internal funds decrease which leads to a U-shaped relationship between investment and cash flow.

Almeida and Campello (2001) show that firms face an endogenous change in borrowing capacity after an income shock. As long as firms are not entirely unconstrained, the indirect *amplification effect,* in which less constrained firms borrow relatively more and consequently are more sensitive to a cash flow innovation, leads to a negative relationship between the investment-cash flow sensitivity and the degree of financial frictions. If the firm is financially unconstrained, this sensitivity drops to zero in a non-monotonic fashion. Moyen (2002) extends the classification criteria to constrained and unconstrained models that corroborate respectively either the results of Kaplan and Zingales (1997) or Fazzari et al.(1988). Her appealing conclusion is that constrained firms exhibit a negative investment-dividend correlation, while the latter is positive for unconstrained firms. This result opens a new prospect for finding a suitable proxy for the sensitivity of investment to internal funds.

The outcome of about twenty years of research remains puzzling. No clear consensus has still emerged, neither from a theoretical nor from an empirical perspective. As a result, the current context leaves the door open for alternative lines of attack. In this spirit, Almeida, Campello and Weisbach (2004) develop a new methodology to test the effect of financial constraints on firms' behavior. Deviating from the investment-cash flow tradition, they rely on the demand for liquidity as a building block of their new model. Assuming that constrained firms should exhibit a systematic propensity to hoard cash out of cash

flow for precautionary reasons, they use the sensitivity of cash to cash flow to measure whether financial constraints affect cash policies. Using five well-established classification criteria, they find that constrained firms display a positive cash flow sensitivity of cash while unconstrained firms do not.

3 Methodology

In this study, we examine the impact of financial constraints on the behavior of Japanese firms. Knowing that the design of an empirical test allowing to evaluate such an impact remains a puzzle in the literature, we apply two different approaches to explore the relationship between capital market imperfections and firms' financial policies in Japan. Specifically, we rely on Fazzari et al.(1988) and use the sensitivity of investment to internal funds to test for financial constraints. Alternatively, we deviate from this widespread metric and apply the new cash-based methodology put forward by Almeida et al.(2004) to examine the link between the market frictions and firms' financial decisions.

3.1 Sample

In order to implement our two approaches, we construct a sample of all non-financial firms[3] listed on the Tokyo Stock Exchange (TSE) over the 1997-2003 period. All firm level data come from the Worldscope database which includes data on publicly traded companies. To ensure consistency and stability, we exclude firms with incomplete balance sheet data over the period. We eliminate firms with (i) a capital stock of less than 1 billion yen, (ii) negative cash dividends, (iii) cash holdings greater than the book value of total assets, (iv) negative total common equities, and (v) a market-to-book ratio exceeding 10[4]. In accordance with Hayashi (1997), who mentions the potential misleading effects of outliers, we remove firms in the bottom and top 0.5 centiles of the ratios of investment to total assets and cash flow to total assets, both of which being typically associated with mergers, acquisitions and other major business events. We use the year-end Japanese GDP deflator[5] (base 1995) to adjust all data. Our complete sample consists of 5,229 firm-years (747 firms).

[3] Based on the Worldscope "*General Industry Classification*", we exclude firms from classes 04 (Banks/Savings and Loan), 05 (Insurance) and 06 (Other Financial).

[4] (ii), (iii) and (iv) are probably due to measurment errors. (i) eliminates extremely small firms that could bias our results. Finally, (v) excludes over-valued firms.

[5] From the Bank of Japan's website (www.boj.or.jp/en/)

3.2 The investment-cash flow sensitivity approach

As previously mentioned, the validity of the investment-cash flow sensitivity as a (*monotonic*) measure of financial constraints remains controversial. As suggested by Fazzari et al.(1988) and many subsequent studies, we use cash flow to measure the availability of internal funds and the market-to-book ratio to control for future investment opportunities. All variables are end-of-period computed. We define $I_{i,t}$ as the investment of firm i over the period t (that is period t net fixed assets[6] minus period $t-1$ net fixed assets). Cash flow (CF) equals the sum of earnings before extraordinary items, taxes and depreciation. Q equals the market-to-book ratio. The market-to-book ratio is the market value of assets divided by the book value of assets. The market value of assets equals the book value of assets plus the market value of equities less the book value of equities[7]. A equals the book value of total assets, and *size* is the natural logarithm of the book value of assets. Our specification can be written as:

$$\frac{I_{i,t}}{A_{i,t-1}} = \beta_{0,i} + \beta_1 \frac{CF_{i,t}}{A_{i,t-1}} + \beta_2 Q_{i,t-1} + \beta_3 size_{i,t} + \varepsilon_{i,t} \tag{1}$$

Where $\beta_{0,i}$ is a firm-specific effect and $\varepsilon_{i,t}$ is the error term. We introduce size to take into account of possible economies of scale in investment decisions. According to Fazzari et al.(1988), a *constrained* firm, i.e. a firm facing greater capital market imperfections, should exhibit a positive investment-cash flow sensitivity ($\beta_1 > 0$), whereas an *unconstrained* firm, i.e. a firm with a perfect access to external funds, should not ($\beta_1 = 0$). Moreover, they suggest that the relationship between the magnitude of financial constraints and the investment-cash flow sensitivity is monotonically increasing; that is the investment of *a priori* more constrained firms should be more dependent to their internal funds. However, this methodology has been widely criticized. In particular, Kaplan and Zingales (1997) argue that *a priori* more constrained firms may not surely exhibit a higher sensitivity. Given these two competing views, we have no *a priori* expectations about the magnitude of β_1 for both constrained and unconstrained firms, but we nevertheless expect these coefficients to be non-negative. Finally, we anticipate a positive relationship between investment and the market-to-book ratio ($\beta_2 > 0$), since a rise in the market-to-book ratio is an indication of good investment opportunities, either with higher expected profits and/or lower costs of capital.

[6] Net fixed assets include gross property, plant and equipment less accumulated reserves for depreciation, depletion and amortization.

[7] Our definition of the market-to-book ratio follows Houston and James (2001) and, except the omission of balance-sheet deferred taxes, the computation is the same as in Kaplan and Zingales (1997).

3.3 The cash flow sensitivity of cash approach

Even though most of the studies use sensitivity of investment to cash flow as a proxy for financial constraints, we follow Almeida et al.(2004) who suggest an alternative methodology allowing one to test the effects of financial constraints on firms' behavior. Based on Keynes' intuition in which liquid balance sheets are of key importance for investment policies, they develop a new framework by linking financial constraints to firms' demand for liquidity. They assume that firms anticipating financing constraints will save cash to overcome future restricted access to external funds. As documented by Opler et al.(1999), the excess of cash generated for precautionary motives increases the probability to fund future good opportunities (positive NPV projects). However, increasing cash holdings is costly since it diminishes the possibility for current investment. Accordingly, Almeida et al.(2004) postulate that if a firm is financially *unconstrained*, that is a firm which has a perfect access to external finance, it is irrelevant for the firm to increase her level of liquidity. On the other hand, they postulate that in order to balance current and future valuable investments, financially *constrained* firms show a systematic propensity to transform cash flow into cash holdings. Referring to the *cash flow sensitivity of cash*, they argue that looking at the propensity of saving cash out of cash flow provides a valid and theoretically founded measure of financial constraints. We strictly follow their methodology and define $Cash$ as holdings of cash plus marketable securities. Our specification is:

$$\frac{Cash_{i,t} - Cash_{i,t-1}}{A_{i,t-1}} = \alpha_{0,i} + \alpha_1 \frac{CF_{i,t}}{A_{i,t-1}} + \alpha_2 Q_{i,t-1} + \alpha_3 size_{i,t} + \upsilon_{i,t} \tag{2}$$

Where $\alpha_{0,i}$ is a firm-specific effect and $\upsilon_{i,t}$ is the error term. According to Almeida et al.(2004), the cash flow sensitivity of cash (α_1) should be positive for constrained firms, that is cash holdings should vary along with cash flow shocks, while unconstrained firms should not exhibit such a systematic behavior. Following Opler et al.(1999), $size$ controls for potential economies of scale in cash management. In addition, given that the cash policy of constrained firm depends on anticipated future investment opportunities, Q is introduced to capture information relative to the value of the firm's growth options.

3.4 Classification criteria

Testing for financial constraints on the Tokyo Stock Exchange and applying these two alternative approaches require splitting the sample into groups constituted of *constrained* and *unconstrained* firms. Since the literature has not yet provided strong evidences for one particular classification criteria, we use and extend four well-established classification criteria and propose a new criterion. Given that all listed firms exhibit some distorting

forces, it is unlikely that firms are totally unconstrained. As a consequence, we deviate from the literature and choose to name our groups as *more constrained* and *less constrained* rather than constrained and unconstrained. We assign firms that are neither in the so-called more or less constrained group to the *intermediate* firm group.

3.4.1 Criterion 1 : Payout

Inspired by Fazzari et al.(1988), we use a dividend ratio as proxy for capital market imperfections, assuming that firms paying dividends are less financially constrained since dividend payments convey information to investors and thus reduce information problems[8]. According to this intuition, a constrained firm would probably reduce their payout if at all feasible. Hence, we extend their basic idea by assuming that firms are reluctant to cut dividends or to increase them if they cannot be maintained in the future. Therefore not only the *level* matters but also the *growth rate*. We compute *payout* as the ratio of dividends to operating income[9]. We sort firms that are in the bottom (top) 25 centiles of the payout distribution for at least five out of seven years into the so-called more (less) constrained groups. Furthermore, we look at the payout growth for the remaining firms and add to the more (less) constrained group firms that are more than twice in the bottom (top) 25 centiles and exhibit a negative (positive) payout growth for at least five years. This selection criterion avoids the ambiguous effect of large changes in the dividend policy and its dynamics which appears to be essential in identifying the financial status of firms[10].

3.4.2 Criterion 2 : Leverage

As noted by Whited (1992), debt is the main source of external finance. This is *a fortiori* the case in the Japanese bank-based financial system. As a result, she suggests that debt policies may play an important role as proxy for capital market imperfections. Even though, the connection between leverage and financial constraints is empirically unclear, the literature on capital structure suggests three major propositions to group firms accord-

[8] Formerly, Fazzari et al.(1988) divide firms into three groups. The more financially constrained firms are defined as those with a ratio of dividends to income of less than 0.1 for at least 10 years out of 15 (the sample covers 1970-1984). The intermediate group contains firms with a payout ratio of more than 0.1 but less than 0.2. The last group includes all other firms. As a result, e.g. a firm which varies to a zero-dividend payment for nine years from a six- year period with a bit more than 0.1 is classified as not financially constrained. It is worth noting that Fazzari et al.'s (1988) classification scheme considers 334 out of 422 firms as not financially constrained. We find that this cut-off criteria is too severe for today's Japanese listed firms.

[9] We do not take into account possible *repurchases* since we lack enough observations.

[10] Fazzari et al.(1988) exclude firms with negative real sales growth. Since our sample covers mainly stagnation or recession periods, we do not use this rule.

ing to their debt policy. First, a high leverage accentuates *de facto* the interest repayment. Thus, the fraction of cash flow left to managers' discretion is reduced. As a consequence, a high leverage prevents managers to (over)invest in bad projects (typically associate with negative NPVs), lowering part of the agency problems which have a direct impact on the access to external finance. Second, a high leverage increases the firm's probability of default. Hence, the credit conditions put forward by debt holders as well as the expected return required by investors become more stringent. Third, a high leverage diminishes the future possibility of raising funds and thus restricts the flexibility of financing decisions. Although the first argument indicates that a high leverage could be associated with a less constrained position, we follow Cleary (2002) and assume that a high leverage induces a restricted access to external funds.

We compute *leverage* as the ratio of total debt to total assets and first assign to the more (less) constrained group firms in the top (bottom) 25 centiles of the leverage distribution for seven years[11]. In order to consider the dynamic behavior of debt policies, we assume that a firm which reduces significantly its leverage relaxes its financial constraints. Accordingly, we classify the remaining firms into the more (less) constrained group if they display positive (negative) leverage growth for five out of seven years.

3.4.3 Criterion 3 : Size

Following Gilchrist and Himmelberg (1995), we use asset size as a proxy for financial frictions. The traditional justification for size as a splitting criterion for financial constraints is that small firms are more likely to have limited access to external funds since they are often young, less long-familiar and thus more subject to capital market imperfections. We define a firm as more (less) constrained if its total asset lies within the bottom (top) 25 centiles during the whole period.

3.4.4 Criterion 4 : Keiretsu

Introduced by Hoshi et al.(1991), the sensitivity of investment to cash flow is supposed to be greater for independent, unaffiliated firms than for firms with close banking ties. They assume that firms having their corporate investment and guidance interrelated to one of the largest eight horizontal bank groups face less information and incentive problems[12].

[11] We require here seven years in the top (bottom) 25 centiles instead of at least five years because we assume that debt contracts are fixed for many years and thus should be more stable than dividend policies.

[12] Keiretsu is often limited to the six biggest corporate groups (Mitsubishi, Mitsui, Sumitomo, Fuyo, Dai-Ichi Kangyo (DKB), Sanwa), the so-called Roku-dai Kigyou Shudan in Japanese. We opt for a larger definition and add Tokai and Industrial Bank of Japan (IBJ). Horizontal bank groups, or financial keiretsu strongly differs from the vertical keiretsu, or production keiretsu (Seisan Keiretsu in Japanese), the canon-

Hayashi (1997), among others, criticizes and underestimates the impact of the results found by Hoshi et al.(1991). With debate left open, we choose to classify firms according to the *Industrial Groupings in Japan*, published by Dodwell Marketing Consultants (1996)[13], which uses the following quantitative and qualitative factors to measure the degree of affiliation to a keiretsu group: (i) the characteristics and historical background; (ii) the total number of shares held by the top ten shareholders; (iii) the different sources and amounts of main bank loans; (iv) the number of shared board members; (v) the overall relations within the group; (vi) the firm's connections to other groups. We define less constrained firms those that are listed in Dodwell's *Industrial Groupings in Japan*, that is, firms with relationships with a main group. The remaining firms are assumed to be more financially constrained.

3.4.5 Criterion 5 : Investment-dividend correlation

Finally, we suggest a new classification criterion based on the correlation between investment and dividend payments. Moyen (2002) suggests that the investment-dividend correlation may prove useful in classifying firms. Motivated by this intuition, we assume that firms exhibiting a negative (positive) investment-dividend correlation are more (less) likely to face financial constraints. Indeed, a negative correlation indicates a trade-off between investment and dividend payments, and reveals that either the firm invests and lowers its dividends, or pays out regular dividends and cuts its investment. Conversely, a positive correlation shows that the firm is not limited in their corporate policies, that is it can pay dividends without forgoing investment. Controlling for investment opportunities in our two specifications (1) and (2) avoids potential classification problems, which could be the case if a firm chooses to cut investment due to valueless investment prospects. We compute the investment-dividend correlation for each firm and assign to the more (less) constrained group firms displaying a correlation lower (greater) than -0.3 $(+0.3)$[14].

3.5 Estimation issues

In order to estimate our two baseline equations, we need to take into account several econometric issues and problems due to possible measurement errors of our variables.

ical example being the Toyota Group which connects Toyota Motors with its principal suppliers. Member companies of the Mitsubishi group, for instance, are members of both vertical and horizontal keiretsu. With the relocation of several suppliers in South-East Asia and recent acquisitions by foreigners, the vertical keiretsu is now less home-based than the horizontal keiretsu. Nevertheless, in terms of influencing member firm behaviors, vertical keiretsu still remains economically cohesive and is left for further research.

[13] We thank Patrick M. McGuire for providing us with *the Industrial Groupings in Japan*. Even though we would prefer to group firms year by year, we have access only to the 1996 edition.

[14] This cut-off corresponds to the bottom (top) 25 percentiles.

First, since our sample has a panel configuration (cross-section and times series), we have to consider the correlation structure of the residual. Although not reported, for both equations (1) and (2), the Hausman test rejects the null hypothesis in which the individual effects are uncorrelated with the independent variables. As a result, we estimate our two baseline specifications via fixed-effect estimators which remove correlations in the errors of firm-specific effects. In addition, the computation of a joint Wald test rejects the significance of time effects. This result is not surprising if we keep in mind the macroeconomic conditions prevailing in Japan during this period. Moreover, given the potential contemporaneous correlations across cross-sectional units (firms), we also test for cross-sectional independence using the Breusch-Pagan statistic. For both specifications, we reject the null hypothesis of cross-sectional independence. As a consequence and due to the unspecified time effects, we use the Huber-White ("sandwich") procedure to estimate the variance-covariance residual matrix.

One of the main points of our study consists in testing whether the estimated cash flow coefficients (β_1 and α_1) differs across groups. Since we estimate equations (1) and (2) for each group independently, the slopes refer to different samples and thus the difference between two group estimates cannot be directly tested. We overcome this problem by creating a dummy composed of ones (zeros) if a firm belongs to the more (less) constrained group. In the specification (1), by interacting the cash flow variable with the dummy, we use a Wald test to assess whether the difference in cash flows is significant.

Pointed out by Poterba (1988) and many subsequent studies, the use of Q in investment demand equations could bias the results in the sensitivity of cash flow for investment. Indeed, investment may be sensitive to cash flow since cash flow innovations may contain new information on investment opportunities that are not captured by Q. As a consequence, if Q is a noisy measure of future investment prospects, the informational content of cash flow innovations will bias the results towards a higher investment-cash flow sensitivity. This argument spurred a debate in the literature since several studies show that higher investment-cash flow sensitivities for constrained firms are due to measurement errors in Q and interpretation problems[15]. The measurement error of Q originates in the use of average Q (here the market-to-book ratio) rather than the direct measure of future profitability, that is marginal q. However, since the value of marginal q is not observable in actual data, it is difficult to better approximate investment prospects than by relying on average Q.

Related studies put forward different techniques to deal with measurement error in Q. Bond and Meghir (1994) suggest an Euler-based model of investment which relies not on the computation of Q. Cummings, Hasset and Oliner (1999) develop a GMM

[15] See for example Erickson and Whited (2000), Gomes (2001) and Alti (2003).

estimation using analysts' forecast as an instrument. Finally, Erickson and Whited (2002) create a measurement error-consistent GMM estimator. However, none of these attempts succeeds in consistently ruling out potential bias. Since no proper solutions exist for the present, we keep our possibly biased estimations. Nevertheless, as robustness checks, we estimate equations (1) and (2) with different proxies for investment opportunities in order to evaluate the influence of Q on the investment-cash flow sensitivities.

A last possible measurement error may stem from the variable used as proxy for internal funds. Even though the most common measure of firms' liquidity is cash flow, this may be an imperfect proxy for changes in internal funds. Knowing that this variable represents nothing but a series of accounting elements and financial decisions, usually net of interest, taxes and depreciation, cash flow cannot fully mimic firms' net worth. Such caveats notwithstanding, as most relevant studies, we use cash flow as a proxy for the availability of internal funds, given that no other items in published accounting data allow for a better measure.

4 The investment-cash flow sensitivity

Table 2 provides summary statistics of all classification criteria. On average, Japanese firms spend only 1% of their total assets in investment, which is in accordance with the approximative proportion of 2% found in Ogawa (2003), covering 1993-1998. Knowing that more than 40% of firm-years disinvested from 1997 to 2003 illustrates that the stagnation or recession was especially severe. Moreover, it is worth noting that about one out of twelve firm-years shows a negative cash flow, leading to an averaged cash flow of only 6% of total assets.

[Insert Table 2 Here]

By comparing firms classified as more or less constrained, regardless of the classification criteria, we find that no *a priori* and overall trend can be formulated out of the summary statistics table. The investment ratio is significantly higher for firms with a high leverage ratio, with large total assets or for firms exhibiting a negative correlation between investment and dividend. This, in turn, suggests that external credit markets are partly used for larger investments and, due to economies of scales, larger firms are more willing to raise their investment expenditures than smaller firms. Moreover, larger firms seem to face higher earnings and have better investment opportunities compared to smaller firms. Finally, we observe that the two most used criteria on Japan, that is the payout ratio and the keiretsu classification, do not show any significant differences between the most and the less constrained firm groups.

[Insert Table 3 Here]

Estimation results of equation (1) are reported in Table 3. The whole sample shows that all the independent variables are significantly different from zero at the 1% margin. The cash flow sensitivity of investment is equal to 0.081, indicating that, on average, a 100 yen increase in cash flow results in an additional 8 yen of investment. Considering the less constrained group, we find that only the payout criterion does not show a significant response of investment to cash flow. On the other hand, the more constrained group shows a more heterogeneous result depending on the classification criteria. We observe that while the sensitivity of investment to cash flow is significant in the leverage and the keiretsu criteria, we find no evidence that this sensitivity is significant for the payout, size and correlation criteria.

With unbalanced results, a Wald test on the difference of cash flow coefficients, using an interaction variable, allows one to determine which of the various criteria shows a distinct variation in sensitivity. The rejection of equality of the coefficients indicates that the sensitivity of investment to cash flow innovations of the more constrained firms is significantly different from the less constrained group. We observe that, excepting for the size criterion, none of the classification criteria show significant differences in cash flow sensitivities. Surprisingly, Q is significant for the whole sample and the intermediate groups, but not for the more and less constrained firm groups. Finally, regardless of the classification criteria or subgroups, the variable *size* is always extremely significant.

Clearly, the above results do not allow one to draw any clear conclusions on the link between the sensitivities and the degree of financial constraints. Therefore, we strongly reject the main findings of both Fazzari et al.(1988) and Kaplan and Zingales (1997). Although the above specifications are consistent with prior empirical methodologies, we compute alternative robustness checks to appraise the quality of our results. As previously discussed, managers' investment decisions rely more on fundamental measure of profitability, through marginal q, than on the market-to-book ratio (average Tobin's Q). Accordingly, the first robustness check looks at replacing our market-to-book ratio by the definition of Fazzari et al.(1988), that is the ratio of market value of equities plus book value of debts minus book value of inventories to the book value of net fixed assets. Table 4 shows that the results are not altered by this alternative proxy for investment opportunities and confirms that Q is not significant for both more and less constrained groups.

[Insert Table 4 Here]

These findings could result from two different mechanisms. First, assuming that Q

performs well in capturing investment opportunities, our results indicate that neither less or more constrained firms accurately base their investment decisions on growth prospects. On one hand, if the constraints are highly binding, firms can *de facto* not undertake all the positive NPV projects. On the other hand, firms with a large availability of low-cost external funds may not found their investment decisions on expected future profitability, indicating potential unsettled agency conflicts. Second, our results may be driven by a poor performance of Q in measuring investment opportunities. In such a case, we would have to explain why Q performs worse for the more and less constrained groups than for the intermediate groups. Even though potential problems could originate from an inefficient market valuation or from the informational contents of cash flow, we leave this question unanswered. However, for completeness, we take into account the complementary critics made on the misspecification of Q in Ogawa and Suzuki (2000) by adding instead of the traditional market-to-book ratio the real sales growth. We find that while the control for growth prospects slightly differs from the previous proxies for investment opportunities, the conclusions on the sensitivity of investment to cash flow remain unchanged.

Second, as suggested by Hayashi (1997), a pooled ordinary least square (OLS) procedure can still produce an unbiased estimator for cash flow if corrected for possible serial correlations in the error term. Indeed, one possible bias of our panel estimation could stem from the fact that due to firms' heterogeneity, we remove some serial correlations while introducing firm-specific effects. As a result, we apply an OLS estimation on our different subsets, corrected again with the Huber-White estimator of variance, to see whether the firm-specific effects are captured by the estimated fixed effects. Panel A of Table 5 indicates that the investment-cash flow sensitivities differ for only one of the five classification criteria. More importantly, since all of the coefficients relative to the *size* variable are not significant, we conclude that the firm-specific effects, especially the asset size, play an important role in our investment demand estimations.

[Insert Table 5 Here]

Third, Hubbard (1998) and Fazzari et al.(2000) criticize Kaplan and Zingales' (1997) findings arguing that the latter mix financially distressed with financially constrained firms. Recently, Allayannis and Mozumdar (2001) find that the inclusion of financially distressed firms alters the results. According to them, we exclude negative cash flow observations, even though this leads to an unbalanced panel sample. Consistent with Allayannis and Mozumdar (2001), Panel B of Table 5 reports mostly insignificant differences in sensitivities of investment to cash flow between the more and less constrained firms. However, it is worth noting that the estimated sensitivities of all subsets are now much

higher, highlighting the likely misleading effect of distressed firms.

Finally, we run a number of alternative regressions, although not reported, of our basic specification: (i) we modify the payout cutoff criteria, either by following Cleary (2002) or Fazzari et al.(1988), excluding or not firms with negative sales growth; (ii) we check different cutoffs for leverage, size and investment-dividend correlations; (iii) we restrict firms as part of a keiretsu main bank group to those that are only part of the nucleus companies or with a shareholder group greater than 50 percent; (iv) we remove Q and/or *size* as an independent variable leaving *cash flow* attached to only one independent variable or to none of them; and (v) we check whether the regression results changed over the years by estimating each year separately.

Apart from a tighter definition of keiretsu affiliated member firms, our alternative results are qualitatively identical to the basic specifications. Noteworthy, only the *size* criterion differentiates more from less constrained firms. More precisely, the investment-cash flow sensitivity of *a priori* less constrained firms is significantly *higher*. This latter result is in accordance with Devereux and Schiantarelli (1989) and Vogt (1994) who argue that with a dispersed ownership structure and based on managerial agency considerations, larger firms may face greater financial frictions. Moreover, Kadapakkam, Kumar and Riddick (1998) document that the larger firms' higher sensitivity of investment to cash flow may also result from the larger flexibility enjoyed in timing their investment decisions. Since small firms are typically known to face greater capital market imperfections, the above results contradict Fazzari et al's (1988) prediction, and reinforce the idea that financial constraints are not fully reflected through the sensitivity of investment to cash flow.

As a result, we conclude that our findings neither confirm the intuitions of Fazzari et al.(1988) nor the alternative position of Kaplan and Zingales (1997), that is, a higher degree of financial constraints does not seem to be reflected by higher investment-cash flow sensitivities. More precisely, we claim that measures of the above sensitivity fail to translate unambiguously the effect of capital market imperfections. Nonetheless, our study raises several remarks. First, there is obviously no clear cut consensus on how to classify firms as financially constrained and unconstrained. Indeed, even if we assume that the investment sensitivity to cash flow is *per se* a good methodology for financial constraints, our different criteria may fail to assign firms into more and less constrained groups and therefore our classification could lead to hazardous outcomes. Thus, even though similar criteria perform well in other contexts and countries, our results suggest that our criteria may not succeed in identifying financial constraints, pointing out that the wedge between internal and external cost of funds may be due to other phenomena in today's Japan, especially regarding the poor performance of the Japanese economy since

the early nineties.

If we believe that investment-cash flow sensitivities are not necessarily a satisfactory methodology, another problem could stem from the influence of macroeconomic conditions on estimated sensitivities. As a matter of fact, the major studies focusing on financial constraints in Japan cover high growth periods[16], either in the late seventies or during the eighties along with the asset bubbles. In such a framework, firms enjoying a better access to external credit markets, either with tighter links to a main bank group or a sounder financial health, can pretend to invest in projects without systematically altering their low-cost internal funds. During times of greater investment opportunities and substantial returns on investment, firms facing larger financial frictions might use their cash flow more intensively for new undertakings than they would in today's situation. Now that growth prospects have sharply declined, the difference in investment-cash flow sensitivity tends to drop to zero. Arguably, firms facing difficulties in raising external funds may keep relatively more of their own funds for precautionary motives.

Finally, consistent with the latter theoretical developments, our results strongly reject the monotonicity hypothesis. Indeed, our sample might reflect a U-shaped relationship between investment and cash flow. Povel and Raith (2002) argue that if investment is a non-monotonic function of a firm's internal funds, any testing strategy based on the monotonic assumption is likely to deliver ambiguous outcomes. Built on an optimal financial contracting model, they suggest that neither Fazzari et al.'s (1988) nor Kaplan and Zingales' (1997) conclusions are suitable. More interestingly, they put forth that the financial position of a firm depends on two factors: the capital market imperfections faced by the firm and the availability of internal funds. They show that these two factors have opposite effect on firms' investment decisions. As a consequence, the empirical relationship between investment and financial constraints depends on whether the variables used to classify firms are more related to capital market imperfections, firms' internal funds or both. Given the potential U-shaped relationship, the classification criteria may significantly influence empirical results. In the same spirit, Moyen (2002) theoretically investigates whether financial constraints are sufficient to reproduce the empirical findings of both Fazzari et al.(1988) and Kaplan and Zingales (1997). Focusing on the dynamic behavior of firms' investment decisions, she finds that her simulated regression results are very sensitive to the selected criteria to identify the extent to which firms experience financial constraints.

From an empirical perspective, our study seems to corroborate the current state of research. Indeed, the fact that the intensity of financial constraints is not reflected through the investment-cash flow sensitivities suggests that our results indicate a more complex

[16] See e.g. Hoshi et al.(1991) and Hayashi (1997).

relationship between investment and financial frictions than assumed in prior studies, especially regarding the present Japanese situation. Clearly, despite the growing literature, the main contribution of this study lies in emphasizing the need to further explore the multiple links between investment and financial constraints.

5 The cash flow sensitivity of cash

Table 6 shows the summary statistics of cash holdings after splitting firms according to our five criteria. Japanese firms hold on average approximately 15 % of their total assets in cash and marketable securities. Although it may appear surprisingly high if we compare it to the 10% obtained by Almeida et al.(2004), these findings are consistent with Pinkowitz and Williamson (2001), who provide evidence that Japanese firms hold more cash than US firms. For the payout and leverage classification criteria, we notice that less constrained firms hold significantly more cash than more constrained firms; we remark the converse for the size and keiretsu classification criteria. Finally, the investment-dividend correlation classification criterion indicates no significant differences in cash holdings across groups.

[Insert Table 6 Here]

Even though we are more interested in the propensity of saving cash out of cash flow, these statistics point out some appealing descriptive phenomena. First, we note that firms distributing large dividends hold on average more cash. This suggests an absence of trade-off between the level of cash and the payout policy. Second, in line with Pinkowitz and Williamson (2001), low-levered firms exhibit larger cash positions, indicating that high levels of cash allow firms to lessen the need of debt financing. Third, as documented by Opler et al.(1999), we observe that larger firms hold less cash, denoting potential economies of scale in cash management. Fourth, consistent with Hoshi et al.(1991), we find that firms part of a *keiretsu* lower significantly the need for cash holdings. This suggest that the parent company may group cash holdings of affiliated firms to lower agency costs and generate economies of scale in cash management.

[Insert Table 7 Here]

Results of the panel regressions relative to the cash flow sensitivity of cash (equation (2)) are reported in Table 7. As for the investment-cash flow sensitivity approach, we correct this fixed-effect panel estimation for across-firm heteroskedasticity and within-year correlations using the Huber-White error structure estimator. Considering the whole sample, we find a significant and positive sensitivity of cash to cash flow. The sensitivity,

which is about 0.16, indicates that for each 100 yen of additional cash flow (divided by total assets), an average Japanese firm roughly saves 16 yen. Q is not significant while *size* exhibits an expected significant and positive sign. Regarding the various criteria, we note that all subgroups (more constrained, less constrained and intermediate) display a significant and positive cash flow sensitivity of cash. According to the leverage, size and keiretsu classification criteria, the sensitivities appear larger for less constrained firms, while the payout and investment-dividend correlation criteria produce the opposite result. However, contrary to the investment-cash flow sensitivity, it is worth stressing that the difference in the cash-to-cash flow sensitivity is irrelevant and is therefore not reported. Furthermore, all estimations for Q turn out to be insignificant in respect to any particular subgroup, signaling the lack of connection between cash policies and investment opportunities. Finally, since the coefficients for *size* vary a lot across estimations, no regular tendency can be derived. Clearly, our results widely differ from the predictions of Almeida et al.(2004), who find that only constrained firms should increase their stock of cash in response to positive cash flow shocks.

In order to examine the strength of our results and to deal with potential specification and estimation issues, we perform several robustness checks. First, following the investment-cash flow sensitivity approach, we consider possible problems due to the measurement of the market-to-book ratio. Even though, no studies to our knowledge stress the possible mismeasurement errors due to Q in a cash holding equation, we replace our former market-to-book ratio by the definition of Fazzari et al.(1988) and real growth sales as suggested by Ogawa and Suzuki (2000)[17]. Table 8 shows that the qualitative results are not affected by alternative proxies for investment opportunities. Second, as pointed out earlier in section 4, if we were to find OLS estimates that largely differ from the fixed effect estimation, this would suggest that our estimations are not consistent. Table 9 shows that the cash flow sensitivities of cash are not affected by such a change in the estimation techniques. Finally, similar to the investment-cash flow sensitivity approach, we perform, but do not report, several alternative specifications[18] and find strong qualitative similarities compared to the baseline equations.

[Insert Tables 8 and 9 Here]

[17] As in section 4, the market-to-book ratio used in Fazzari et al.(1988) is the ratio of market value of equities plus book value of debts minus book value of inventories to the book value of net fixed assets.

[18] (i) we change the payout cutoff criteria, excluding or not firms with negative sales growth; (ii) we use different cutoffs for leverage, size and investment-dividend correlations; (iii) we consider an alternative and more restricted classification by limiting the more constrained group to firms with a tight relationship to a main bank group. (iv) we exclude Q as an explanatory variable; and (v) we estimate year by year to verify whether the sensitivities change over time.

Without ambiguity, the additional tests reinforce our prior findings and confirm that a change in cash holdings reacts positively to cash flow shocks for both more and less constrained firms. As a consequence, financial constraints cannot fully translate into higher sensitivities of cash holdings to cash flow. This caveat calls interesting questions. Indeed, even though we find similar results as Almeida et al.(2004) for more constrained firms, that is a significant and positive sensitivity of cash holdings to cash flow, how come *a priori* less constrained firms display a systematic propensity to save cash out of cash flow? One possible explanation may rely on the bad performance of our classification criteria. As a matter of fact, if our criteria fail in grasping relevant information about capital market imperfections, the estimated slopes bring little insights on the propensity to transform cash flow into cash for each group. Nonetheless, since we find homogeneous results with five distinct and well-established criteria, it is unlikely that our results are driven by bad performing schemes.

In contrast, assuming that our classification criteria perform well, one could postulate that the methodology proposed by Almeida et al.(2004) is not able to measure the importance of financial constraints. Indeed, from a theoretical point of view, we cannot assert with certainty that firms saving cash out of cash flow exhibit such a behavior for precautionary reasons. Referring to an asymmetric information perspective, our results could be the consequence of agency problems. There exists a large and growing literature dealing with situations where managers have objectives that diverge from those of shareholders. Stein (2003) presents various circumstances where managers' utility increases along with the firm's size, that is where managers typically use cash flow to run large firms. As a matter of fact, our estimated cash flow sensitivity of cash could stem from managers inflating cash positions for personal reasons like "empire-building" behavior or "reputation concerns". In such cases, the cash flow sensitivity of cash no more reflects precautionary motives but rather indicates large agency problems. Interestingly, the insignificant estimates of Q seem to indicate that changes in cash positions are not driven by future prospects, which corroborates our agency-based explanation.

In addition, Stein (2003), among others, argues that the degree of agency problems is function of institutional factors such as outside investor protection, contract enforcement, quality of auditing, disclosure requirement, in other words, aspects that are ultimately associate with *corporate governance* issues. Given that the financial system in Japan widely differs from those in force elsewhere, the effectiveness of Japanese corporate governance has been extensively investigated in the literature. Traditionally, in the US and UK, corporate governance mechanisms work through capital market discipline, while Japanese-style mechanisms mainly rely on intermediaries, i.e. bank participation. In the former countries, managerial incentives (stock-options, performance-based compensation), hostile takeovers

and liquid labor market for top managers are frequently observed. Conversely, Japanese corporate governance primarily refers to large shareholder groups and bank participation, both of which operates through direct intervention and monitoring.

Although many studies provided empirical evidence supporting the superiority of the Japanese system[19], the overall poor economic performance since the early nineties, the unprecedented banking crisis and several corporate scandals raised some doubt about its efficiency. While considerable reforms are underway, Patrick (2003) points out that there has been only minor improvements so far and that inertia is still dominating. Given the lack of disciplinary instruments, it would not be surprising that our findings stem from important governance problems. Recently, Kalcheva and Lins (2004) explore the determinants and implications of corporate governance practices on firms' cash holdings. Using a sample covering 32 countries (including Japan), they find that firms with *expected* managerial agency problems hold a higher level of cash. Even though this latter argument provide only little guidance on the effect of cash flow on cash balances, it confirms that cash policy cannot be analyzed without referring to agency costs, *a fortiori* in Japan.

Naturally, in order to assess the validity of our beliefs, we should deeper explore the influence of agency problems on cash policies. Specifically, we should model and test whether the results for the more constrained firms are due to precautionary reasons, while those for the less constrained firms come from agency conflicts. Implementing such a test would require to construct proxies that are able to identify the magnitude of agency problems. More generally, to evaluate the impact of financial constraints on firms' behavior using the cash policy, it is important to consider to what extent introducing agency problems modify the main predictions of Almeida et al.(2004). Clearly, this task appears challenging since this requires to build a framework that is able to endogenize the incentive effects of financial decisions, for instance the dividend policy.

6 Conclusions

The aim of this study was to appraise the impact of financial constraints on the behavior of Japanese firms. Applying two testing strategies to explore the relationship between capital market imperfections and firms' financial policies, we find evidence proving none of these approaches provide accurate tests of financial constraints. Specifically, relying on prior studies, we estimate the sensitivity of investment to internal funds and the sensitivity of cash holdings to cash flow on a sample of 747 firms over the 1997-2003 period. After classifying firms according to five distinct proxies for financial frictions, we find that more severe constraints are not systematically reflected through a higher investment-cash flow

[19] See Yafeh (2000) for an overview.

sensitivity. Turning to the cash-to-cash flow approach, we observe that even *a priori* less constrained firms exhibit a positive response of cash holdings to cash flow shocks. This indicates again that these two established empirical tests fail to unambiguously evaluate the impact of financial constraints.

Our study contributes to the current debate on financial constraints on several grounds. First, our results confirm the recent theoretical developments, in which the monotonic responses of the investment-cash flow sensitivities to financial constraints are rejected. As a matter of fact, our findings suggest that the influence of such constraints on firms' investment is more complex than envisioned by the traditional view. Second, we are, to our knowledge, the first to point out the limitations of the cash-to-cash flow sensitivity approach, that is the hypothesis that firms hoard cash only for precautionary motives. Finally, we show that the traditional theory on financial constraints seems to perform poorly on the very particular financial system of today's Japan.

Our findings indicate that a lot of work still needs to be done to better understand the implications of market frictions on firms' behavior. One suggestion is that future research should not treat internal funds only as an independent variable but endogenize it in a dynamic framework. Moreover, even though we find that the cash-to-cash flow approach is appealing, one should integrate thoroughly agency problems to avoid systematic counterfactual effects. Concerning Japan, further research would have to pay attention to the undergoing capital market reforms, especially vis-à-vis to corporate governance issues.

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Table 1: Classification Criteria used in the literature

This table presents the main classification criteria used in the literature on financial constraints. Apart from the six major criteria (payout, size, age, leverage, group and index), [a] refers to collateralizable assets, [b] indicates the access to a commercial paper market and/or the presence of bond ratings and [c] refers to the eligibility of secured convertible bonds.

Papers	Payout	Size	Age	Leverage	Group	Index	Others
Fazzari et al. (1988)	X						
Devereux and Schiantarelli (1989)		X	X				
Hoshi et al. (1991)					X		
Oliner and Rudebush (1992)		X	X				
Whited (1992)				X			
Hubbard and Kashyap (1992)							X[a]
Schaller (1993)					X		
Vogt (1994)		X					
Gilchrist and Himmelberg (1995)		X					X[b]
Ogawa et al.(1996)							X[a]
Hayashi (1997)					X		
Chirinko and Schaller (1997)					X		
Kaplan and Zingales (1997)	X					X	
Kadapakkam et al. (1998)		X					
Ogawa and Suzuki (1998)							X[a]
Shin and Park (1999)					X		
Cleary (1999)	X					X	
Lamont et al.(2001)						X	
Baker et al. (2002)						X	
Cleary (2002)				X			
McGuire (2003)							X[c]
Almeida et al. (2004)	X	X					X[b]

Table 2: Summary statistics of investment, cash flow, market-to-book and size

This table shows the summary statistics for cash holdings (*cash* in text) of the different groups classified according to five criteria[1]."I-D correlation" refers to the investment-dividend correlation and * indicates that the difference between the mean of more constrained group (MC) and the less constrained group (LC) is different from zero at 1 per-cent. INT refers to the intermediate group.

	$\frac{I_{i,t}}{A_{i,t-1}}$			$\frac{CF_{i,t}}{A_{i,t-1}}$		
	Mean	Median	Std.Dev.	Mean	Median	Std.Dev.
Criterion 1: Payout						
MC	0.005	-0.002	0.043	0.043	0.044	0.053
LC	0.008	0.001	0.029	0.047	0.049	0.040
INT	0.013	0.006	0.035	0.068	0.067	0.045
p-value $(MC - LC \neq 0)$	0.116			0.165		
Criterion 2: Leverage						
MC	0.014	0.004	0.044	0.050	0.052	0.043
LC	0.008	0.003	0.029	0.073	0.073	0.047
INT	0.012	0.004	0.037	0.058	0.058	0.048
p-value $(MC - LC \neq 0)$	0.000*			0.000*		
Criterion 3: Size						
MC	0.009	-0.001	0.039	0.055	0.056	0.049
LC	0.012	0.007	0.032	0.069	0.071	0.044
INT	0.012	0.004	0.037	0.060	0.060	0.048
p-value $(MC - LC \neq 0)$	0.042			0.000*		
Criterion 4: Keiretsu						
MC	0.011	0.003	0.036	0.062	0.061	0.049
LC	0.010	0.003	0.035	0.060	0.061	0.044
p-value $(MC - LC \neq 0)$	0.113			0.204		
Criterion 5: I-D correlation						
MC	0.014	0.004	0.039	0.062	0.061	0.048
LC	0.009	0.004	0.032	0.062	0.062	0.047
INT	0.011	0.003	0.038	0.060	0.062	0.047
p-value$(MC - LC \neq 0)$	0.001*			0.638		

[1]See in text for definitions.

Table 2 - Continued

	$Q_{i,t-1}$			$size_{i,t}$			
	Mean	Median	Std.Dev.	Mean	Median	Std.Dev.	Obs.
Criterion 1: Payout							
MC	1.000	0.966	0.270	11.332	11.148	1.397	875
LC	0.919	0.883	0.260	11.221	11.103	1.008	588
INT	1.056	0.998	0.333	11.837	11.549	1.422	3'766
p-value$(MC - LC \neq 0)$	0.000*			0.077			
Criterion 2: Leverage							
MC	1.039	1.011	0.230	12.061	11.835	1.561	1'442
LC	1.043	0.963	0.389	11.496	11.257	1.249	1'946
INT	1.012	0.961	0.295	11.586	11.361	1.359	1'841
p-value$(MC - LC \neq 0)$	0.708			0.000*			
Criterion 3: Size							
MC	0.943	0.894	0.305	10.045	10.122	0.469	1'169
LC	1.148	1.083	0.293	13.507	13.248	0.914	1'435
INT	1.006	0.944	0.321	11.416	11.352	0.512	2'625
p-value$(MC - LC \neq 0)$	0.000*			0.000*			
Criterion 4: Keiretsu							
MC	1.018	0.965	0.343	11.502	11.253	1.331	2'905
LC	1.046	0.998	0.272	11.959	11.891	1.444	2'016
p-value$(MC - LC \neq 0)$	0.001*			0.000*			
Criterion 5: I-D correlation							
MC	1.052	0.975	0.385	11.821	11.549	1.454	1'162
LC	1.001	0.964	0.265	11.675	11.376	1.401	1'568
INT	1.040	0.995	0.314	11.600	11.382	1.357	2'499
p-value$(MC - LC \neq 0)$	0.000*			0.008*			

Table 3: The investment-cash flow sensitivity: baseline regressions

This table displays the fixed-effects estimation results of the investment-cash flow regressions (equation (1)) for the whole sample and for our five classification criteria. The White-Huber estimator corrects the error structure heteroskedasticity and correlation. The p-value refers to a Wald test assessing whether the estimated sensitivities statistically differ between more and less constrained firms ($MC - LC \neq 0$). The robust t-statistics are in brackets.

Dependent variable $\frac{I_{i,t}}{A_{i,t-1}}$	*Independent variables* $\frac{CF_{i,t}}{A_{i,t-1}}$	$Q_{i,t-1}$	$size_{i,t}$	*Obs.*	R^2	p-value
All sample	0.081	0.008	0.054	5'229	0.246	
	(4.25)	(3.05)	(8.21)			
Criterion 1 : Payout						
More constrained (MC)	0.045	-0.005	0.080	875	0.217	0.814
	(1.10)	(-0.60)	(4.42)			
Less constrained (LC)	0.061	-0.001	0.053	588	0.276	
	(1.32)	(-0.10)	(4.03)			
Intermediate	0.100	0.010	0.049	3'766	0.248	
	(4.21)	(3.44)	(6.36)			
Criterion 2 : Leverage						
More constrained (MC)	0.148	0.003	0.075	1'442	0.247	0.102
	(3.24)	(0.48)	(5.64)			
Less constrained (LC)	0.063	0.009	0.033	1'946	0.246	
	(2.26)	(2.99)	(3.45)			
Intermediate	0.060	0.011	0.055	1'841	0.244	
	(2.04)	(1.94)	(4.85)			
Criterion 3 : Size						
More constrained (MC)	0.052	0.007	0.058	1'169	0.275	0.006
	(1.35)	(1.35)	(4.01)			
Less constrained (LC)	0.196	0.003	0.041	1'435	0.250	
	(5.99)	(0.85)	(3.67)			
Intermediate	0.046	0.011	0.059	2'625	0.234	
	(1.64)	(2.68)	(6.19)			

Table 3 - Continued

Dependent variable $\frac{I_{i,t}}{A_{i,t-1}}$	Independent variables $\frac{CF_{i,t}}{A_{i,t-1}}$	$Q_{i,t-1}$	$size_{i,t}$	$Obs.$	R^2	p-value
Criterion 4 : Keiretsu						
More constrained (MC)	0.067	0.008	0.044	2'905	0.246	0.407
	(2.57)	(2.40)	(4.99)			
Less constrained (LC)	0.099	0.005	0.073	2'016	0.239	
	(3.53)	(1.13)	(6.51)			
Criterion 5 : I-D correlation						
More constrained (MC)	0.066	0.008	0.044	1'162	0.183	0.119
	(1.33)	(1.09)	(2.46)			
Less constrained (LC)	0..138	0.010	0.062	1'568	0.317	
	(4.95)	(2.40)	(6.37)			
Intermediate	0.049	0.007	0.053	2'499	0.246	
	(1.75)	(2.09)	(5.55)			

Table 4: Alternative specifications for the investment-cash flow sensitivities: possible measurement errors in Q

This table presents the results of the fixed-effects estimations used to adress possible measurement errors of Q from the baseline equation (1). We report results of our five classification criteria. Panel A displays the results using the Q definition of Fazzari et al.(1988) (Q^a). Panel B shows the results relying on the real growth sales (GS) taken as an alternative proxy for investment opportunities. The White-Huber estimator corrects the error structure heteroskedasticity and correlation. The robust t-statistics are in brackets. The p-value refers to a Wald test assessing whether the estimated sensitivities statistically differ between more and less constrained firms ($MC - LC \neq 0$).

	Panel A: Market-to-book						Panel B: Real growth sales					
Dependent variable	*Independent variables*						*Independent variables*					
$\frac{I_{i,t}}{A_{i,t-1}}$	$\frac{CF_{i,t}}{A_{i,t-1}}$	$Q^a_{i,t-1}$	$size_{i,t}$	Obs	R^2	p-value	$\frac{CF_{i,t}}{A_{i,t-1}}$	$GS^a_{i,t-1}$	$size_{i,t}$	Obs	R^2	p-value
Criterion 1 : Payout												
More constrained (MC)	0.040	-0.001	0.082	875	0.217	0.800	0.037	-0.001	0.079	875	0.0217	0.869
	(1.09)	(-0.85)	(4.17)				(1.00)	(-0.11)	(4.42)			
Less constrained (LC)	0.062	-0.001	0.082	588	0.275		0.059	0.038	0.048	588	0.286	
	(1.41)	(-0.85)	(4.17)				(1.41)	(2.62)	(3.68)			
Intermediate	0.096	0.003	0.047	3766	0.252		0.128	0.012	0.046	3766	0.245	
	(4.19)	(5.38)	(6.14)				(5.70)	(2.07)	(6.04)			
Criterion 2 : Leverage												
More constrained (MC)	0.146	0.001	0.073	1442	0.247	0.111	0.154	0.015	0.073	1442	0.248	0.137
	(3.33)	(0.88)	(5.43)				(3.57)	(1.38)	(5.46)			
Less constrained (LC)	0.066	0.002	0.029	1946	0.247		0.088	0.001	0.031	1946	0.240	
	(2.41)	(3.59)	(3.05)				(3.25)	(0.21)	(3.32)			
Intermediate	0.059	0.003	0.052	1841	0.248		0.088	0.014	0.054	1841	0.243	
	(2.17)	(3.39)	(4.64)				(3.35)	(1.71)	(4.75)			
Criterion 3 : Size												
More constrained (MC)	0.039	0.003	0.057	1169	0.285	0.006	0.067	0.009	0.056	1169	0.274	0.006
	(1.05)	(3.67)	(4.04)				(1.78)	(1.19)	(3.86)			
Less constrained (LC)	0.192	0.001	0.039	1435	0.251		0.204	0.026	0.039	1435	0.252	
	(5.90)	(1.77)	(3.50)				(6.60)	(2.14)	(3.54)			
Intermediate	0.058	0.001	0.056	2625	0.232		0.073	0.008	0.057	2625	0.231	
	(2.25)	(2.54)	(5.80)				(2.93)	(1.11)	(6.08)			

Table 4 - Continued

Dependent variable $\frac{I_{i,t}}{A_{i,t-1}}$	Panel A: Market-to-book *Independent variables* $\frac{CF_{i,t}}{A_{i,t-1}}$	$Q^a_{i,t-1}$	$size_{i,t}$	*Obs*	R^2	*p*-value	Panel B: Real growth sales *Independent variables* $\frac{CF_{i,t}}{A_{i,t-1}}$	$GS_{i,t-1}$	$size_{i,t}$	*Obs*	R^2	*p*-value
Criterion 4 : Keiretsu												
More constrained (MC)	0.069	0.002	0.041	2905	0.246	0.416	0.088	0.006	0.042	2905	0.244	0.439
	(2.85)	(3.19)	(4.80)				(3.73)	(0.86)	(4.82)			
Less constrained (LC)	0.098	0.001	0.070	2016	0.239		0.112	0.018	0.071	2016	0.240	
	(3.52)	(1.44)	(6.12)				(2.75)	(2.75)	(6.37)			
Criterion 5 : I-D correlation												
More constrained (MC)	0.062	0.002	0.040	1162	0.186	0.108	0.086	0.009	0.041	1162	0.181	0.121
	(1.26)	(1.75)	(2.23)				(1.74)	(0.99)	(2.29)			
Less constrained (LC)	0.138	0.002	0.058	1568	0.319		0.164	0.011	0.060	1568	0.315	
	(5.31)	(3.54)	(5.74)				(6.61)	(1.61)	(6.15)			
Intermediate	0.050	0.001	0.051	2499	0.145		0.064	0.011	0.052	2499	0.245	
	(1.88)	(2.96)	(5.42)				(2.49)	(1.26)	(5.48)			

Table 5: Alternative specifications for the investment-cash flow sensitivities: OLS estimations and distressed firms

This table presents the results of two different robustness checks for our five classification criteria. Panel A display the results of the pooled ordinary least squares estimations of specification (1). Panel B reports the results of the fixed-effects estimations of our baseline equation (1), excluding financially distressed firms. The White-Huber estimator corrects the error structure heteroskedasticity and correlation. The robust t-statistics are in brackets. The p-value refers to a Wald test assessing whether the estimated sensitivities statistically differ between the more and the less constrained firms ($MC - LC \neq 0$).

	Panel A: OLS						Panel B: Financial Distressed					
Dependent variable	*Independent variables*						*Independent variables*					
$\frac{I_{i,t}}{A_{i,t-1}}$	$\frac{CF_{i,t}}{A_{i,t-1}}$	$Q_{i,t-1}$	$size_{i,t}$	Obs	R^2	p-value	$\frac{CF_{i,t}}{A_{i,t-1}}$	$Q_{i,t-1}$	$size_{i,t}$	Obs	R^2	p-value
Criterion 1 : Payout												
More constrained (MC)	0.084	0.004	0.001	875	0.015	0.178	0.187	-0.009	0.077	718	0.236	0.751
	(2.77)	(0.87)	(0.61)				(2.53)	(-1.02)	(3.84)			
Less constrained (LC)	0.131	-0.003	0.001	588	0.032		0.120	-0.000	0.059	528	0.284	
	(2.93)	(-0.61)	(1.14)				(1.05)	(-0.04)	(3.90)			
Intermediate	0.099	0.005	0.001	3766	0.023		0.135	0.010	0.049	3534	0.259	
	(6.20)	(2.13)	(1,.14)				(3.83)	(3.25)	(6.25)			
Criterion 2 : Leverage												
More constrained (MC)	0.164	0.001	-0.001	1442	0.024	0.000	0.321	-0.002	0.081	1294	0.283	0.022
	(4.62)	(0.05)	(-0.50)				(3.79)	(-0.32)	(6.13)			
Less constrained (LC)	0.109	0.003	0.001	1946	0.045		0.089	0.009	0.030	1837	0.247	
	(5.93)	(1.45)	(0.72)				(2.52)	(3.10)	(3.05)			
Intermediate	0.124	0.005	-0.001	1841	0.033		0.117	0.009	0.053	1649	0.248	
	(5.93)	(1.36)	(-1.74)				(2.19)	(1.59)	(4.31)			
Criterion 3 : Size												
More constrained (MC)	0.084	0.010	0.001	1169	0.022	0.469	0.108	0.008	0.063	1040	0.309	0.063
	(3.29)	(2.15)	(0.53)				(1.95)	(1.50)	(4.71)			
Less constrained (LC)	0.136	0.001	0.000	1435	0.038		0.274	0.001	0.035	1343	0.251	
	(5.54)	(0.52)	(0.03)				(5.16)	(0.19)	(3.02)			
Intermediate	0.112	0.002	-0.000	2625	0.023		0.108	0.009	0.059	2383	0.281	
	(5.71)	(0.79)	(-0.11)				(2.25)	(2.11)	(5.78)			

Table 5 - Continued

Dependent variable $\frac{I_{i,t}}{A_{i,t-1}}$	Panel A: OLS *Independent variables* $\frac{CF_{i,t}}{A_{i,t-1}}$	$Q_{i,t-1}$	$size_{i,t}$	Obs	R^2	p-value	Panel B: Financial Distressed *Independent variables* $\frac{CF_{i,t}}{A_{i,t-1}}$	$Q_{i,t-1}$	$size_{i,t}$	Obs	R^2	p-value
Crierion 4 : Keiretsu												
More constrained (MC)	0.103	0.004	0.000	2905	0.024	0.258	0.131	0.007	0.044	2645	0.265	0.703
	(6.42)	(1.79)	(0.08)				(3.34)	(1.93)	(4.99)			
Less constrained (LC)	0.118	-0.001	0.000	2016	0.021		0.160	0.004	0.069	1849	0.246	
	(5.09)	(-0.32)	(0.83)				(3.66)	(1.02)	(5.84)			
Criterion 5 : I-D correlation												
More constrained (MC)	0.076	0.003	-0.001	1162	0.011	0.650	0.174	0.005	0.039	1066	0.201	0.885
	(2.56)	(0.78)	(-1.25)				(2.02)	(0.85)	(2.17)			
Less constrained (LC)	0.151	0.008	0.000	1568	0.067		0.164	0.010	0.066	1429	0.326	
	(6.98)	(2.50)	(0.19)				(3.72)	(2.30)	(6.14)			
Intermediate	0.097	0.002	0.001	2499	0.020		0.114	0.005	0.051	2285	0.262	
	(5.04)	(0.98)	(1.68)				(2.55)	(1.60)	(5.30)			

Table 6: Summary statistics of cash holdings

This table shows the summary statistics for cash holdings ($cash$) of the different groups classified according to our five criteria[2]."I-D correlation" refers to the investment-dividend correlation and * indicates that the difference between the mean of more constrained group (MC) and the less constrained group (LC) is different from zero at 1 per-cent. INT refers to the intermediate group.

$Cash$	Mean	Median	Std.Dev.	Obs
Criterion 1 : Payout				
MC	0.131	0.112	0.083	875
LC	0.155	0.135	0.097	588
INT	0.151	0.126	0.102	3'766
p-value (MC-LC$\neq$ 0)	0.000*			
Criterion 2 : Leverage				
MC	0.106	0.094	0.066	1'442
LC	0.194	0.172	0.114	1'946
INT	0.132	0.114	0.081	1'841
p-value (MC-LC$\neq$ 0)	0.000*			
Criterion 3 : Size				
MC	0.149	0.127	0.095	1'169
LC	0.127	0.106	0.088	1'435
INT	0.159	0.133	0.103	2'625
p-value (MC-LC$\neq$ 0)	0.000*			
Criterion 4 : Keiretsu				
MC	0.160	0.134	0.107	2905
LC	0.131	0.112	0.081	2016
p-value (MC-LC$\neq$ 0)	0.000*			
Criterion 5 : I-D correlation				
MC	0.152	0.130	0.095	1'162
LC	0.146	0.120	0.105	1'568
INT	0.147	0.124	0.095	2'499
p-value (MC-LC$\neq$ 0)	0.126			

[2]See in text for definitions.

Table 7: The cash flow sensitivity of cash: baseline regression

This table displays the fixed effects estimation results of the cash holdings regressions (equation (2)) for the whole sample and for our five classification criteria. The White-Huber estimator estimations corrects the error structure heteroskedasticity and correlation. The robust t-statistics are in brackets.

Dependent variable	Independent variables				
$\frac{Cash_{i,t}-Cash_{i,t-1}}{A_{i,t-1}}$	$\frac{CF_{i,t}}{A_{i,t-1}}$	$Q_{i,t-1}$	$size_{i,t}$	Obs	R^2
All sample	0.169	-0.001	0.022	5'229	0.128
	(5.92)	(-0.13)	(2.86)		
Criterion 1 : Payout					
More constrained (MC)	0.151	-0.001	0.001	875	0.117
	(2.49)	(-0.12)	(0.09)		
Less constrained (LC)	0.338	-0.018	0.049	588	0.144
	(3.34)	(-1.78)	(2.23)		
Intermediate	0.152	0.002	0.024	3'766	0.127
	(4.47)	(0.58)	(2.55)		
Criterion 2 : Leverage					
More constrained (MC)	0.217	-0.022	0.006	1'442	0.111
	(4.20)	(-2.26)	(0.46)		
Less constrained (LC)	0.178	0.003	0.018	1'946	0.156
	(3.40)	(0.71)	(1.23)		
Intermediate	0.139	0.003	0.039	1'841	0.107
	(3.15)	(0.48)	(3.04)		
Criterion 3 : Size					
More constrained (MC)	0.197	-0.006	0.031	1'169	0.130
	(3.78)	(-0.81)	(1.93)		
Less constrained (LC)	0.112	-0.005	0.001	1'435	0.108
	(2.10)	(-0.88)	(0.12)		
Intermediate	0.176	0.004	0.028	2'625	0.134
	(4.07)	(0.75)	2.41		

Table 7 - Continued

Dependent variable $\frac{Cash_{i,t}-Cash_{i,t-1}}{A_{i,t-1}}$	Independent variables $\frac{CF_{i,t}}{A_{i,t-1}}$	$Q_{i,t-1}$	$size_{i,t}$	Obs	R^2
Criterion 4 : Keiretsu					
More constrained (MC)	0.225	-0.003	0.031	2'905	0.136
	(5.41)	(-0.57)	(2.77)		
Less constrained (LC)	0.121	-0.002	0.005	2'016	0.121
	(3.29)	(-0.36)	(0.51)		
Criterion 5 : I-D correlation					
More constrained (MC)	0.067	0.002	0.026	1'162	0.128
	(1.14)	(0.39)	(1.71)		
Less constrained (LC)	0.207	-0.013	0.010	1'568	0.143
	(3.52)	(-1.37)	(0.63)		
Intermediate	0.193	0.038	0.030	2'499	0.111
	(4.95)	(0.69)	(2.68)		

Table 8: Alternative specifications for the cash flow sensitivity of cash: possible measurement errors in Q

This table reports the results of the fixed-effects estimations used to adress posible measurement errors of Q from the baseline equation (2). We present the results of our five classification criteria. Panel A displays the results using the Q definition of Fazzari et al.(1988) (Q^a). Panel B shows the results relying on the real growth sales (GS) taken as an alternative proxy for investment opportunities. The White-Huber corrects the error structure heteroskedasticity and correlation. The robust t-statistics are in brackets.

	Panel A: Market-to-book					Panel B: Real growth sales				
Dependent variable	*Independent variables*					*Independent variables*				
$\frac{Cash_{i,t}-Cash_{i,t-1}}{A_{i,t-1}}$	$\frac{CF_{i,t}}{A_{i,t-1}}$	$Q^a_{i,t-1}$	$size_{i,t}$	Obs	R^2	$\frac{CF_{i,t}}{A_{i,t-1}}$	$GS^a_{i,t-1}$	$size_{i,t}$	Obs	R^2
Criterion 1 : Payout										
More constrained	0.156	-0.002	0.024	875	0.120	0.159	0.041	0.001	875	0.127
	(2.80)	(-1.03)	(3.13)			(2.84)	(2.54)	(0.04)		
Less constrained	0.309	-0.001	0.052	588	0.140	0.295	0.048	0.046	588	0.144
	(3.07)	(-0.59)	(2.35)			(3.13)	(1.68)	(2.12)		
Intermediate	0.188	-0.003	0.024	3766	0.131	0.159	0.048	0.022	3766	0.137
	(5.45)	(-2.52)	(2.55)			(4.98)	(5.41)	(2.38)		
Criterion 2 : Leverage										
More constrained	0.218	-0.006	0.014	1442	0.125	0.176	0.048	0.007	1442	0.115
	(4.32)	(-3.16)	(1.15)			(3.64)	(3.19)	(0.52)		
Less constrained	0.210	-0.002	0.014	1946	0.158	0.185	0.073	0.014	1946	0.171
	(4.12)	(-1.73)	(1.15)			(3.91)	(5.20)	(1.01)		
Intermediate	0.152	-0.001	0.039	1841	0.107	0.153	0.031	0.039	1841	0.113
	(3.56)	(-0.64)	(3.08)			(3.65)	(3.38)	(3.12)		
Criterion 3 : Size										
More constrained	0.203	-0.002	0.031	1169	0.133	0.185	0.047	0.032	1169	0.140
	(4.02)	(-2.85)	(2.04)			(3.55)	(3.55)	(1.98)		
Less constrained	0.134	-0.004	0.006	1435	0.116	0.102	0.056	0.000	1435	0.118
	(2.49)	(-2.26)	(0.44)			(2.01)	(3.13)	(0.01)		
Intermediate	0.206	-0.002	0.030	2625	0.136	0.191	0.044	0.026	2625	0.143
	(4.88)	(-1.68)	(2.57)			(4.74)	(4.46)	(2.25)		

Table 8 - Continued

Dependent variable $\frac{Cash_{i,t}-Cash_{i,t-1}}{A_{i,t-1}}$	Panel A: Market-to-book *Independent variables* $\frac{CF_{i,t}}{A_{i,t-1}}$	$Q_{i,t-1}$	$size_{i,t}$	*Obs*	R^2	Panel B: Real growth sales *Independent variables* $\frac{CF_{i,t}}{A_{i,t-1}}$	$GS_{i,t-1}$	$size_{i,t}$	*Obs*	R^2
Criterion 4 : Keiretsu										
More constrained	0.256	-0.004	0.033	2905	0.142	0.219	0.040	0.030	2905	0.142
	(6.17)	(-3.17)	(3.00)			(5.63)	(4.17)	(2.69)		
Less constrained	0.130	-0.001	0.007	2016	0.123	0.124	0.050	0.004	2016	0.135
	(3.65)	(-1.41)	(0.70)			(3.70)	(4.13)	(0.38)		
Criterion 5 : I-D correlation										
More constrained	0.091	-0.001	0.027	1162	0.150	0.077	0.038	0.023	1162	0.154
	(1.55)	(-1.15)	(1.77)			(1.38)	(2.53)	(1.55)		
Less constrained	0.220	-0.004	0.016	1568	0.148	0.176	0.059	0.007	1568	0.156
	(4.04)	(-2.60)	(1.02)			(3.48)	(3.72)	(0.47)		
Intermediate	0.217	-0.002	0.030	2499	0.113	0.206	0.043	0.029	2499	0.116
	(5.59)	(-1.64)	(2.79)			(5.51)	(4.36)	(2.66)		

Table 9: Alternative specifications for the cash flow sensitivity of cash: OLS estimations

This table presents the results of the pooled ordinary least squares (OLS) estimations of specification (2). The White-Huber estimator corrects the error structure heteroskedasticity and correlation. The robust t-statistics are in brackets.

Dependent variable $\frac{Cash_{i,t}-Cash_{i,t-1}}{A_{i,t-1}}$	*Independent variables* $\frac{CF_{i,t}}{A_{i,t-1}}$	$Q_{i,t-1}$	$size_{i,t}$	*Obs*	R^2
All sample	0.149	0.004	-0.001	5229	0.0275
	(8.69)	(1.82)	(-3.27)		
Criterion 1 : Payout					
More constrained (MC)	0.155	0.001	-0.001	875	0.031
	(3.849	(0.21)	(-1.11)		
Less constrained (LC)	0.239	-0.006	-0.001	588	0.032
	(4.37)	(-0.83)	(-0.26)		
Intermediate	0.136	0.006	-0.001	3766	0.025
	(6.66)	(2.15)	(-3.11)		
Criterion 2 : Leverage					
More constrained (MC)	0.161	-0.007	-0.001	1442	0.025
	(5.83)	(-1.21)	(-0.17)		
Less constrained (LC)	0.183	0.008	-0.002	1946	0.041
	(5.59)	(2.02)	(-2.89)		
Intermediate	0.117	0.004	-0.001	1841	0.018
	(4.13)	(1.00)	(-2.45)		
Criterion 3 : Size					
More constrained (MC)	0.162	-0.003	-0.009	1169	0.024
	(5.29)	(-0.55)	(-0.32)		
Less constrained (LC)	0.092	0.004	0.001	1435	0.018
	(3.00)	(0.97)	(1.49)		
Intermediate	0.164	0.009	-0.000	2625	0.036
	(6.21)	(2.79)	(-0.02)		

Table 9 - Continued

Dependent variable $\frac{Cash_{i,t}-Cash_{i,t-1}}{A_{i,t-1}}$	*Independent variables* $\frac{CF_{i,t}}{A_{i,t-1}}$	$Q_{i,t-1}$	$size_{i,t}$	*Obs*	R^2
Criterion 4 : Keiretsu					
More constrained (MC)	0.181	0.004	-0.001	2905	0.033
	(7.51)	(1.24)	(-2.29)		
Less constrained (LC)	0.107	0.004	-0.001	2016	0.021
	(4.59)	(1.07)	(-2.89)		
Criterion 5 : I-D correlation					
More constrained (MC)	0.153	0.003	-0.001	1162	0.028
	(4.20)	(1.01)	(-1.61)		
Less constrained (LC)	0.151	0.009	-0.001	1568	0.031
	(4.27)	(1.36)	(-1.63)		
Intermediate	0.146	0.002	-0.001	2499	0.024
	(6.25)	(0.75)	(-2.16)		