An Empirical Study of the Inter-Firm Cost Differential of External Finance*

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If capital markets are imperfect because of information asymmetry, it is considered that the costs of external finance such as equity or debt are higher than the opportunity cost of internal funds. I analyze whether there is a cost differential not only between internal and external finance, but also between equity and debt finance by estimating equations for both investment and debt. The period analyzed is from 1995 to 1996. The regression results for both listed and unlisted firms show that they face capital market imperfections. Furthermore, the costs of both equity and debt finance are lower for firms with net assets over ten billion yen than for others, which implies that costs differ with firm size.

1 Introduction

When there is asymmetry of information between corporate insiders and outside investors about investment opportunities of the firm, theories predict that the cost of external finance is higher than that of internal finance. As for such predictions, there is an abundant literature that examines study (1) whether the cost of external finance is higher than the opportunity cost of internal funds; and (2) whether there is a positive relationship between internal funds and the quantity of investment, especially for firms with high informational costs, holding constant underlying investment opportunities. For example, Hubbard (1998) summarizes that most empirical studies show affirmative results to both questions.[1] The purpose of this paper is to study whether the degree of informational cost varies across different classes of Japanese firms. Two features of this paper are that equity and debt finance are distinguished among external finances and that the sample used here includes unlisted firms.

As for imperfections of Japanese capital markets, Hoshi *et al.* (1991) and Goyal and Yamada (1998) investigate firm-level

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investment spending of listed firms. Hoshi *et al.* (1991) find that, among Japanese firms listed from 1965 to 1986, investments by 121 companies that belong to a *keiretsu* are less sensitive to cash flow and short-term securities than investments by 24 companies that do not belong. This suggests that the influence of capital market imperfections is weaker for the companies belonging to a *keiretsu*. Goyal and Yamada (1998) analyze the investments of listed non-financial companies in Japan from 1980 to 1993. From 1987 to 1990, which is defined as the asset inflation period, investment is affected not by fundamentals but by stock market valuations. By contrast, during the period of easy monetary policy from 1992 to 1993, investment displays lower sensitivity to internal funds. Their results imply that the capital market environment affects the cost wedge between internal and external finance.

In this paper, I analyze not only the cost wedge between internal and external finance but also that between equity and debt finance. When there exist problems of asymmetric information, the pecking order theory, by Myers and Majluf (1984), predicts that firms prefer internal over external finance, and regarding external finance, prefer debt over equity if costs of financial distress are ignored.

For example, Shyam-Sunder and Myers (1999) and Whited (1992) analyze the restriction of debt finance. Shyam-Sunder and Myers (1999) regress the amount of debt issued against the internal financial deficit. Concerning 157 mature and public companies, they find that external financing is dominated by debt, and that a simple pecking order model has greater first-cut explanatory power than a static tradeoff model. Whited (1992) estimates the Euler equation of an optimizing model of investment with a debt constraint and provide some evidence that information problems in debt markets affect investment. Both the above articles focus only on debt finance in external finance. By contrast, I analyze the cost of both equity and debt finance at the same time.

The data used here are from financial reports of listed firms, while data including unlisted firms are from the 'Results of the Basic Survey of Japanese Business Structure and Activities' (BSJBSA) by the Ministry of International Trade and Industry, Japan.[2] The latter data set contains unlisted firms, which makes analysis of unlisted firms possible, while most previous studies are concerned with listed firms only.

In the analysis, first I test whether the cost of external finance differs between firms listed on the first section of the Tokyo Stock Exchange (TSE) and the others. Next, I investigate, by the firm-level data in 1995 and 1996 of BSJBSA, a cost differential of external finance across firm size and capital relationship.

The main results are as follows. First, not only unlisted but also listed firms face financing constraints. Among firms listed

on the exchanges, the cost of equity finance does not differ between firms listed on the first section of the TSE and those listed on other exchanges, while that of debt finance is lower for firms listed on the first section of the TSE. The analysis of BSJBSA suggests that the costs of both equity and debt finance are lower for large-scale firms, about 80% of which are thought to be listed firms. As for small firms, results depend on capital relationship. Among independent firms, the cost of equity finance is higher for small firms. By contrast, among subsidiaries, the cost of external finance does not differ across different sizes of firms. This implies that information problems for subsidiaries may be alleviated by their parent firms that have information about them. In any case, the cost differential across size exists concerning external finance. This evidence is consistent with the joint claim that the size of a firm is a proxy of information asymmetry, and that information asymmetry is related to financing constraints.

The remainder of the paper is organized as follows. In the next section, the framework of the analysis is explained. Section 3 describes the data and variables used, and Section 4 provides their summary statistics. Section 5 reports regression results concerning listed firms' data, and Section 6 reports those concerning BSJBSA. Section 7 presents conclusions.

2 Framework

In this section, I develop an empirical framework that distinguishes equity and debt in external finance. For simplicity, let's consider a one-period model.[3] The manager of firm i is assumed to choose the level of investment I_i to maximize its profits. The return on investment is represented by a production function $F(I_i, q_i)$, where q_i is a measure of profitability of investment for firm i. I assume $F(I, q)$ is concave in I, i.e., $\partial F(I, q)/\partial I \equiv F_1(I, q) > 0$ and $\partial^2 F/\partial I^2 < 0$. Firms can finance investment either internally or externally. I assume that the amount of internal funds for firm i, represented by W_i, is exogenous. There are two types of external finance, one is equity and the other debt. For firm i, let the amount of funds raised by equity be E_i and that by debt be D_i. The total amount of external funds is represented by X_i, $X_i = E_i + D_i$. The budget constraint for firm i is $I_i = X_i + W_i$.

It is assumed that there is asymmetry of information concerning profitability of investment q_i, such that outside investors in capital markets cannot observe q_i as precisely as the manager of firm i can. I assume that this asymmetry of information drives the cost of external finance higher than that of internal finance. The degree of information problems may be different across firms, and the more severe information problems a firm comes up against, the higher cost it bears in raising funds exter-

nally. I *a priori* consider some classes in which firms face the same level of information problems, that is, the same cost of external finance. One aim of this paper is to investigate whether the cost of external finance is different across classes.

Let the cost of finance for firm i in class j be represented by the function $Z^j(E, D, W_i, k_i)$ where k_i is a measure of firm-specific information problems. I further restrict the cost function such as:

$$Z^j(E, D, W_i, k_i) = G^j(E, k_i) + H^j(D, k_i) + p(E + D + W_i)$$

where p is the opportunity cost of internal funds, which is assumed to be the same for all firms. The difference between equity and debt finance in this paper is represented by the cost function, G^j and H^j. I assume that $G^j(E, k)$ and $H^j(D, k)$ is convex in E and D, respectively, that is, $\partial G^j/\partial E \equiv G_1^j(E, k) > 0$, $\partial^2 G^j/\partial E^2 > 0$, $\partial H^j/\partial D \equiv H_1^j(D, k) > 0$, and $\partial^2 H^j/\partial D^2 > 0$. The marginal cost of equity finance is $G_1^j(E, k) + p$, and that of debt finance is $H_1^j(D, k) + p$. That is, $G_1^j(E, k)$ and $H_1^j(D, k)$ represent the excess marginal cost of equity and debt finance, respectively, in comparison with the opportunity cost of internal funds.

Under these assumptions, firm i in class j chooses I, E, and $D$to maximize:

$$F(I, q_i) - G^j(E, k_i) - H^j(D, k_i) - pI$$

subject to

$$I = E + D + W_i$$

The first-order conditions of the above problem are given by:

$$F_1(I_i, q_i) = p + G_1^j(I_i - D_i - W_i, k_i)$$

$$G_1^j(I_i - D_i - W_i, k_i) = H_1^j(D_i, k_i)$$

The second-order conditions are satisfied owing to the convexity assumptions.

The second condition states that a firm equates the marginal cost of equity finance to that of debt finance, which is for the cost minimization of external finance. Then, at the optimal level, the marginal cost of external finance is represented by $G_1^j + p$ or $H_1^j + p$. On the other hand, the first condition states that the firm should invest up to the point where the marginal cost of finance equals the marginal benefit of investment.

For the production and cost functions, I further assume the following quadratic forms:

$$F(x, q) = -\frac{1}{2}(\gamma x^2 - 2qx),$$

$$G^j(x, k) = \frac{\beta_E^j}{2}(x - \alpha_E + \theta_E k)^2,$$

$$H^j(x, k) = \frac{\beta_D^j}{2}(x - \alpha_D + \theta_D k)^2$$

where γ is a positive parameter, and β_E^j and β_D^j are both non-negative parameters. This form of the production function assumes that the larger the measure of profitability q is, the higher is the marginal revenue of investment. Concerning the cost function for equity, the cost of equity issuing and that of share repurchase are assumed to be symmetric, and the higher β_E^j is, the higher the increasing rate of marginal cost of equity finance is. These assumptions are also applied to debt finance. If β_E^j is zero for class j, then the

cost of equity finance is just the same as that of internal finance, which means there is no equity market imperfections for firms in class j. If β_b^j is zero, then the same goes for debt finance. In what follows, we call β_E^j the excess marginal cost of equity finance and β_b^j that of debt finance. The parameters θ_E and θ_D concern the firm-specific effects of information problems. When these parameters are positive, the larger a measure of firm-specific information problems k is, the higher the costs of external finance are.

Substituting these quadratic functions into the first-order conditions yields expressions for investment and debt:

$$I_i=\frac{1}{\gamma+\beta_E^j}Q_i+\frac{\beta_E^j}{\gamma+\beta_E^j}(W_i+D_i)-\frac{\beta_E^j\theta_E}{\gamma+\beta_E^j}k_i+\frac{\beta_E^j\alpha_E}{\gamma+\beta_E^j}$$

$$D_i=\frac{\beta_E^j}{\beta_b^j+\beta_E^j}(I_i-W_i)+\frac{\beta_E^j\theta_E-\beta_b^j\theta_D}{\beta_b^j+\beta_E^j}k_i+\frac{\beta_b^j\alpha_D-\beta_E^j\alpha_E}{\beta_b^j+\beta_E^j}$$

where $Q_i\equiv q_i-p$. Based on the above conditions, I obtain the following empirical specification for class j:

$$I_i=a_0+a_1W_i+a_2D_i+a_3Q_i+a_4k_i+\epsilon_{1i} \quad (1)$$

$$D_i=b_0-b_1W_i+b_2I_i+b_3k_i+\epsilon_{2i} \quad (2)$$

where ϵ_{1i} and ϵ_{2i} denote the error terms for firm i in class j.

By comparing the estimation equations with the first-order conditions, the parameter restrictions $a_1=a_2$ and $b_1=b_2$ are imposed. In addition, regarding the estimated coefficient for class j, $a_1=\beta_E^j/(\gamma+\beta_E^j)$ and $b_1=\beta_E^j/(\beta_b^j+\beta_E^j)$ are implied. The parameters a_1 and b_1 for class j reflect the degree of the excess marginal cost of equity and debt finance for class j, respectively. If firms in class j face perfect capital markets, then $\beta_E^j=0$ and $\beta_b^j=0$, which lead to $a_1=b_1=0$. In such a class, both investment and the amount of debt financing will not depend on the amount of internal funds. For the class with the excess marginal cost of equity finance being positive and with the excess marginal cost of debt finance being zero, i.e., $\beta_E^j>0$ and $\beta_b^j=0$, the estimated coefficients will be $a_1>0$ and $b_1=1$. $b_1=1$, meaning that the required amount of external funds I_i-W_i will be financed by debt only. For the class where excess marginal costs of equity and debt finance are both positive, i.e., $\beta_E^j>0$ and $\beta_b^j>0$, the estimated coefficients will be $a_1>0$ and $0<b_1<1$. For a firm in such a class, investment and debt issuing are constrained by its internal funds. Still more, the pecking order theory predicts that the excess marginal cost of equity finance is higher than that of debt finance, i.e., $\beta_E^j>\beta_b^j\geq 0$, which implies $a_1>0$ and $b_1>0.5$.

When the estimated coefficients a_1 and b_1 are different across classes, the first-order conditions make it possible to interpret the following wedge given the parameter γ to be the same across classes. As for equity, the higher the estimated coefficient a_1 of a class is, the higher the excess marginal cost of equity finance is for firms in that class. As for debt, we need to compare both a_1 and b_1 simultaneously.

Regarding class m and class n, if the estimated coefficients satisfy $a_1^m = a_1^n$ and $b_1^m = b_1^n$, it implies $\beta_E^m = \beta_E^n$ and $\beta_D^m = \beta_D^n$, that is, there is no cost differental between the two classes. If the estimated coefficients satisfy $a_1^m = a_1^n$ and $b_1^m > b_1^n$, it implies $\beta_E^m = \beta_E^n$ and $\beta_D^m < \beta_D^n$. That is, the excess marginal cost of equity finance is not different between the two classes, but firms in the class whose b_1 is lower face the higher excess marginal cost of debt finance. If the estimated results are $a_1^m > a_1^n$ and $b_1^n \geq b_1^m$, it implies $\beta_E^m > \beta_E^n$ and $\beta_D^m > \beta_D^n$, that is, both the excess marginal cost of equity and debt finance are lower for firms in the class whose a_1 is smaller and whose b_1 is larger. If the coefficients satisfy $a_1^m > a_1^n$ and $b_1^m > b_1^n$, equity finance is less costly for firms in the class whose a_1 is smaller. However, we cannot tell in which class firms are burdened with higher cost in debt finance.

The above discussion concerns the situation where the financing cost of equity and debt are different. The case where equity and debt are perfect substitute is as follows. Let the cost function be $C^j(X_i, k_i) + pI_i$ for firm i in class j with $X_i = I_i - W_i$. In this case, firm i is assumed to choose the amount of investment I to maximize $F(I, q_i) - C^j(I - W_i, k_i) - pI$. Under the quadratic cost function, that is, $C^j(X, k) \equiv \beta^j(X - \alpha + \theta k)^2/2$, the first-order condition is:

$$I_i = \frac{1}{\gamma + \beta^j} Q_i + \frac{\beta^j}{\gamma + \beta^j} W_i - \frac{\beta^j \theta}{\gamma + \beta^j} k_i + \frac{\beta^j \alpha}{\gamma + \beta^j} \tag{3}$$

If β^j is zero, the marginal cost of external finance is p, that is, there is no cost wedge between internal and external finance. In such a case, the amount of internal funds W_i and the amount of investment I_i have no positive relationship, which means that the estimated coefficient on internal funds will be zero in Eq. (3). On the other hand, for firms in class whose β is positive, the marginal cost of external finance differs from the opportunity cost of internal funds, and consequently investment is restricted by the amount of internal funds. In regressing Eq. (3) for such a class, the estimated coefficient on internal funds will be positive.

Most existing studies such as those of Fazzari, Hubbard and Petersen (1988), Hoshi *et al.* (1991), and Goyal and Yamada (1998), test for the significance of the coefficient on internal funds W based on Eq. (3) or on Eq. (1) with the constraint $a_2 = 0$.[4] One feature differing from previous studies is based not on Eq. (1) but on Eq. (3), to take account of the difference between equity and debt finance.

On the other hand, the condition $b_1 = b_2 = 1$ in Eq. (2) implies that the costs of equity and debt finance are positive and zero, respectively. Taking real investment as exogenous, Shyam-Sunder and Myers (1999) estimate Eq. (2) with restrictions of

$b_1 = b_2$ and $b_3 = 0$ for large public companies in the U.S. The simple pecking order hypothesis predicts $b_0 = 0$ and $b_1 = 1$. In their results for gross debt issues, the coefficient b_0 is almost zero and b_2 is 0.85, which is significantly less than 1.0. By contrast, I investigate capital market imperfections by considering regression results for Eq. (1) and (2) simultaneously.

3 Data

In this paper, I focus on the long-term financing decision. For this purpose, the variables are defined as follows. Most variables in 1996 are deflated by the total assets of 1995, which are used as initial assets of 1996, as a precaution against heterosckedasticity. I measure investment ratio, INV, as the acquisition cost of fixed assets in 1996 minus their retirement and sales in the same period normalized by initial assets. I define EBD as operating income plus depreciation expense minus interest payments minus taxes payments normalized by initial assets, and WORK as the change in the amount of current assets less current liabilities normalized by initial assets. By these variables, I construct the internal fund ratio W by W=EBD−WORK as a proxy for internal funds. The debt issued, DDEBT, is defined as the change in fixed debt from 1995 to 1996 normalized by initial assets. Furthermore, I use notations WD=W+DDEBT and X=INV−W.

As a proxy for profitability, I use sales growth, GSALE, from 1995 to 1996.[5] One of the problems in the analysis is that profitability is unobservable. In this framework, I assume that outside investors cannot observe a firm's profitability as precisely as the managers can because of asymmetric information. Hence, if we can observe profitability for managers, the information problems considered in this paper will disappear.[6] On the other hand, it is necessary to construct a measure for profitability that is uncorrelated with the amount of internal funds in order to make estimated coefficients unbiased. This is because a link between internal funds and investment for a given firm could reflect the link between profitability and investment if internal funds are correlated with profitability. One measure of expected profitability of a firm is Tobin's q. Though Tobin's q is a problematic measure, it is impossible to observe even Tobin's q for unlisted firms in the data used here. In the following test, I use sales growth for profitability.[7]

As a measure of firm-specific information problems k, I use fixed assets in 1995 normalized by total assets in 1995 as fixed asset ratio RTANG for Eq. (1). For Eq. (2), I use fixed debt divided by the sum of fixed debt and equity in 1995 as debt ratio RDEBT. Using the above variables, (1) and (2) with coefficient restrictions are represented by:

$$\mathrm{INV} = a_0 + a_1\mathrm{WD} + a_3\mathrm{GSALE} + a_4\mathrm{RTANG} + \epsilon_1$$

$$\mathrm{DDEBT} = b_0 + b_1 x + b_3\mathrm{RDEBT} + \epsilon_2$$

If outside investors can evaluate fixed assets easier than intangible assets, firms with large portions of fixed assets come up against less severe information problems, which makes external finance less costly for them. This reasoning predicts a coefficient on RTANG to be positive. On the other hand, for firms with a high debt ratio, it may be difficult for them to raise funds by debt. This implies that firms with a high debt ratio face a larger cost of debt finance, which predicts a coefficient on RDEBT to be negative.

In the test on BSJBSA, I restrict sample firms to those investigated in both 1995 and 1996, and classified as manufacturing industries, whose net assets were non-negative.[8,9] Furthermore, I exclude the following samples; First, I exclude firms whose acquisition cost and retirement and sales of fixed assets in 1996 are both zero, because we cannot distinguish whether they are really zero or failed to reply. Second, excluded are firms whose absolute values of one of INV, W, or DDEBT exceed one, and firms whose GSALE are out of three times the standard deviation in light of the mean.

As for the *a priori* classification of firms according to information problems, I use firm size represented by the amount of net assets. The rationale for size is that outside investors may have less information about small firms because most of them do not disclose their financial statements and are not well known publicly. I define firms whose net assets are less than a billion yen as 'small firms', firms whose net assets are more than a billion yen and less than ten billion yen as 'medium firms', and firms whose net assets are more than ten billion yen as 'large firms'. In addition to firm size, I use capital relationship, that is, parent firms or subsidiaries, for a classification, one reason being that subsidiaries may be able to access capital markets through their parent firms. Another reason for grouping firms by capital relationship is to weaken bias by using non-consolidated accounting data because BSJBSA investigates only such data. BSJBSA asks each firm if there is a firm owning more than 50% of your company's shares, and if there are firms in which your company owns 20% or more of the shares. Based on responses to these questionnaire, I define firms not owned over 50% of its shares and owning more than 20% of other firms' shares as 'parent firms', those owned over 50% of its shares as 'subsidiaries', and those not owned over 50% of its shares and not owning more than 20% of other firms' shares as 'independent firms.'

Though BSJBSA makes it possible to analyze unlisted firms, it does not contain as wide a range of items as financial statements do. Then, compared with BSJBSA, I examine capital market imperfections for listed firms using financial statements. I

use non-consolidated accounting data from the *Kaigin Kigyo Zaimu Data Bank* (*The JDB Corporate Finance Data Bank*, hereafter 'JDB data'). The sample I analyze consists of firms in the manufacturing industry[10] listed either on the TSE, the Osaka Stock Exchange, or the Nagoya Stock Exchange. I divide listed firms into those listed on the first section of the Tokyo Stock Exchange (hereafter 'TSE first section') and the others. Firms listed on the TSE first section would be well known publicly. Then, I test whether external financing is less costly for firms on the TSE first section than the others. Like the analysis of BSJBSA, I restrict the sample to firms that settled their accounts between June 1994 and May 1995, between June 1995 and May 1996, and between June 1993 and May 1994,[11] and whose net assets were non-negative in the above three periods.

JDB data makes more appropriate data available. I call variables identical to those in BSJBSA as not-adjusted and variables defined in the following way as adjusted. As for debt issues, $DDEBT^a$ is defined as the change in the sum of straight bonds, convertible bonds, bonds with warrants, long-term loans, and long-term loans from related companies all in fixed debt normalized by initial assets. Non-adjusted variable DDEBT contains long-term accounts payable and so on that do not directly relate to financing behavior, whereas adjusted variable $DDEBT^a$ does not. As for internal funds, BSJBSA does not inquire of firms their dividend payout. Adjusted internal fund ratio W^a is defined as non-adjusted internal fund ratio W minus the sum of dividend payout, interim dividend payout, and bonuses to executives normalized by initial assets. By these adjusted variables, I define $WD^a = W^a + DDEBT^a$ and $X^a = INV - W^a$.

Table 1 presents the number of sample firms with distinctions of capital relationship and the level of net assets in 1995. The table shows that the number of large firms in BSJBSA is 1035 against 856 in JDB data. If BSJBSA contains all listed firms, 83% of large firms in BSJBSA are presumed to be listed. For example, one of the listing standards of the TSE is that a firm's net assets should be more than a billion yen on the nearest settlement. Then, small firms in this analysis can hardly be listed. Though some medium firms may be listed, the actually listed firms are relatively rare as Table 1 shows. Thus, the results of testing the costs for large firms in BSJBSA, at least partially reflect those for listed firms.

4 Summary Statistics

Table 2 provides summary statistics for each class. The numbers of listed firms are 744 for the TSE first section and 490 for the others. The sum of sales for firms listed on the others is 7% of that for firms listed on the TSE first section, and the sum of assets

Table 1 The number of sample firms

		The amount of net assets						
		0- -3	3- -10	10- -30	30- -100	100- -300	300-	Total
BSJBSA	Parent	427	883	935	706	425	403	3779
	Subsidiaries	663	790	562	319	111	44	2489
	Independent	1212	1358	800	259	43	9	3681
	Total	2302	3031	2297	1284	579	456	9949
JDB data	TSE 1st	1	1	9	59	237	437	744
	Others	4	19	77	208	158	24	490
	Total	5	20	86	267	395	461	1234

Note. This table presents the number of sample firms in 1995 with distinctions of the level of net assets. The amount of net assets is in hundred million yen. For BSJBSA, 'parent' firms are those not owning over 50%of its shares and owning more than 20% of other firms' shares, 'subsidiaries' are those owning over 50% of its shares, and 'independent' firms are those not owning over 50% of its shares and not owning more than 20% of other firms' shares. For JDB data, 'TSE 1st' means firms listed on the first section of the Tokyo Stock Exchange and 'others' means those listed on the other exchanges.

is similar. Thus, the size of firms listed on the non-TSE first section is relatively small. The number of large firms in BSJBSA, most of which are presumed to be listed, is 1035, which is about 10% of all sample firms. Though the number of large firms in BSJBSA is small, large firms' share of sales is 73% and that of total assets is 78%.

The means of investment ratio INV are 2.04% for the TSE first section and 3.75% for large firms of BSJBSA. Their difference is more than 1%, which is larger than the differences in other variables. Especially regarding investment, it seems that BSJBSA and JDB data do not correspond with each other. Even if BSJBSA, JDB data, or both were biased, the comparison within the same database is meaningful as long as the biases are the same within each database.

In JDB data, the mean of internal fund ratio W is 5.58% for the TSE first section, which is higher than the mean 4.87% for the others. For adjusted internal fund ratio W^a, the means (standard deviations) are 4.85% (6.70) for the TSE first section and 4.22% (9.37) for the others. The variable W contains dividends, whereas the adjusted internal fund ratio W^a does not. By adjusting dividends, the adjusted internal fund ratio W^a decreases by approximately 1% from W, but the ranking of the means does not change across classes. In BSJBSA, the mean of internal fund ratio W for small firms is lower by approximately 1.5% than that of medium or large firms, whose differences are significant.

The changes in fixed debt DDEBT are, on average, negative for all classes. For

Table 2 Summary statistics

		JDB data	BSJBSA data				
		TSE 1st	Others	Small	Medium	Large	Parent
of firms		744	490	5333	3581	1035	3779
Sales	sum	158.951	11.599	18.963	41.770	166.826	171.795
Assets	sum	178.630	12.380	13.997	36.385	183.898	188.024
INV	mean	2.04	2.05	4.17	4.33	3.75	3.36
	std. dev.	3.61	4.22	8.37	7.10	4.67	5.61
W	mean	5.58	4.87	4.74	6.24	6.25	4.47
	std. dev.	6.79	9.42	11.64	10.12	8.52	8.94
GSALE	mean	3.13	2.11	3.08	2.87	3.46	2.63
	std. dev.	9.41	12.77	18.23	18.23	17.24	16.75
RTANG	mean	27.35	29.47	36.13	34.25	29.92	32.20
	std. dev.	11.85	12.79	17.08	15.51	13.32	14.07
DDEBT	mean	−1.18	−0.97	−0.50	−0.56	−0.99	−0.63
	std. dev.	6.01	6.04	9.73	7.15	6.10	7.15
RDEBT	mean	31.16	29.78	57.61	34.34	26.53	45.19
	std. dev.	18.74	20.96	25.61	21.92	18.68	25.62

Note. The table reports the sum of sales and assets for 1995. Those are in trillion yen. It also reports the sample means (%) and standard deviations (%) of variables defined as follows: INV is the acquisition cost of fixed assets in 1996 minus their retirement and sales in the same period normalized by total assets in 1995. W is EBD−WORK where EBD is operating income plus depreciation expense minus interest payments minus taxes payments normalized by total assets in 1995, and WORK is the change in the amount of current assets less current liabilities normalized by total assets in 1995. GSALE is sales growth from 1995 to 1996. RTANG is fixed assets in 1995 normalized by total assets in 1995. DDEBT is the change in fixed debt from 1995 to 1996 normalized by assets in 1995. RDEBT is fixed debt divided by the sum of fixed debt and equity in 1995.

listed firms, the means (standard deviations) of the adjusted change in fixed debt $DDEBT^a$ are −1.15% (5.75) for the TSE first section and −0.90% (5.99) for the others. The difference in the means between DDEBT and $DDEBT^a$ is less than 1%. For firms listed on the TSE first section in aggregate, the change in liquid debt normalized by initial assets is 1.6%, the normalized change in fixed debt is −1.0%, and the normalized change in equity is 1.7%. The change in total assets is 2.4%. This indicates that, from 1995 to 1996, the growth of total assets depended on both the growth of equity and that of debt. Though the total amount of debt increases, fixed debt decreases while liquid debt increases. The reason for the gap between fixed debt and liquid debt remain for future research, and I will focus instead on long-term finance, that is, fixed debt, in the remainder of this paper.

Table 3 provides the correlation coefficients among variables. The correlation

Table 3 The correlation matrix for BSJBSA

	INV	W	EBD	WORK	GSALE	DDEBT	RTANG
W	0.331						
EBD	0.280	0.514					
WORK	−0.169	−0.761	0.165				
GSALE	0.096	0.113	0.228	0.042			
DDEBT	0.313	−0.366	−0.025	0.402	0.024		
RTANG	0.163	0.123	0.145	−0.032	−0.000	−0.057	
RDEBT	−0.012	−0.049	−0.207	−0.100	0.009	−0.111	0.262

Note. The table reports the correlation matrix for BSJBSA. The number of sample firms is 9949.

coefficient between the change in cash equivalent plus working capital WORK and investment ratio INV is −0.169. Fazzari and Petersen (1993) reported that the coefficient on working capital investment is negative in a real investment regression, which implies that firms can relax financial constraints by adjusting working capital. They argue that long-run financing constraints should be estimated with control for working capital investment. The correlation coefficients between WORK and INV are, −0.083 for firms listed on the TSE first section, −0.117 for firms listed on the others, −0.178 for small firms in BSJBSA, −0.167 for medium firms in BSJBSA, and −0.062 for large firms in BSJBSA. The larger the firms are, the nearer to zero their correlation coefficient is. This may imply that smaller firms may adjust working capital investment to real investment more flexibly. In the following analysis, I include the change in working capital and cash equivalents in the internal funds. A more detailed analysis is left for future research.

5 Results for Listed Firms

In this section, I present the regression results for listed firms. The results for BSJBSA are offered in the next section.

Table 4 reports the regression results of Eq. (1) by adjusted variables, for the TSE first section in the upper part and for the others in the lower part. I exclude firms whose absolute value of adjusted internal fund ratio W^a exceeds 0.5.[12] Column 2 to 4 are results by OLS and Column 5 by the instrumental variable method. Column 2 shows the results with the constraint $a_2=0$, and Column 3 shows one without any parameter restrictions. By comparing them, the regressions with $DDEBT^a$, Column 3, have a higher adjusted R^2 than without $DDEBT^a$, Column 2, for both TSE first section and the others. Column 4 reports the results of standard regression for Eq. (1), that is, with the constraint $a_1=a_2$. By comparing Columns 3 and 4, the parameter constraint $a_1=a_2$ is seems to be not too strong.[13] The above three are estimated by OLS. However, in (1) and (2),

Table 4 The regression results of Eq. (1) for listed firms

Method	OLS	OLS	OLS	IVM
Firms listed on the TSE first section				
Constant	−0.001	−0.004	−0.004	−0.004
	(0.003)	(0.003)	(0.003)	(0.003)
W^a	0.120**	0.318**		
	(0.019)	(0.023)		
$DDEBT^a$		0.339**		
		(0.027)		
WD^a			0.324**	0.285**
			(0.023)	(0.042)
GSALE	0.038**	0.026*	0.026*	0.028*
	(0.014)	(0.012)	(0.012)	(0.013)
RTANG	0.053**	0.044**	0.044**	0.046**
	(0.011)	(0.010)	(0.010)	(0.010)
Adj R^2	0.093	0.251	0.251	0.248
Firms listed on the others				
Constant	0.005	0.003	0.003	0.003
	(0.004)	(0.004)	(0.004)	(0.004)
W^a	0.229**	0.377**		
	(0.022)	(0.024)		
$DDEBT^a$		0.367**		
		(0.035)		
WD^a			0.376**	0.384**
			(0.024)	(0.033)
GSALE	0.012	0.005	0.005	0.004
	(0.015)	(0.014)	(0.014)	(0.014)
RTANG	0.021	0.015	0.015	0.015
	(0.014)	(0.012)	(0.012)	(0.012)
Adj R^2	0.194	0.341	0.342	0.342

Note. The table presents the regression results of Eq. (1) for listed firms whose absolute value of adjusted internal fund ratio W^a is below 0.5. The numbers of sample firms are 744 for the TSE first section and 487 for the others. 'IVM' indicates the instrumental variable method. Standard errors of coefficients are in parentheses. Superscripts ** and * indicate that the coefficient is significant at the 1 and 5% level, respectively.

there are two endogenous variables, I_i(INV) and D_i(DDEBT). Then, Column 5 reports the results estimated with one-period lag variables of endogenous variables and exogenous variables themselves as instruments. A comparison with Columns 4 and 5 shows that OLS and the instrumental variable method have similar results. In summary, the model with two types of external finance has more explanatory power than that with a single type of external finance, and the simultaneous

equation bias does not seem to be so severe.

Column 4 of Table 4 indicates that, for the TSE first section and the others, the coefficients on WD^a are 0.32 and 0.38, respectively. They are both positive and significant, suggesting that listed firms are confronted with capital market imperfections. The tests concerning the difference in these coefficients across classes are reported in the upper part of Table 5. I pool all samples and estimate Eq. (1) with the interaction variable between WD and a dummy variable LIST, taking one for the TSE first section and zero for the others. If the coefficient on WD×LIST is different from zero, the excess marginal cost of equity finance is different across classes, as discussed in Section 2. The table reports

Table 5 The regression results for listed firms with dummy variables

Method Data adjustment	OLS non	OLS adj.	INV non	INV adj.
Eq.(1)				
Constant	−0.004	−0.001	−0.004	−0.001
	(0.002)	(0.002)	(0.003)	(0.002)
WD	0.370**	0.369**	0.382**	0.362**
	(0.021)	(0.022)	(0.035)	(0.037)
WD×LIST	−0.040	−0.038	−0.040	−0.033
	(0.026)	(0.028)	(0.045)	(0.051)
GSALE	0.013	0.016	0.012	0.016
	(0.009)	(0.009)	(0.009)	(0.009)
RTANG	0.033**	0.031**	0.032**	0.032**
	(0.008)	(0.008)	(0.008)	(0.008)
Adj R^2	0.307	0.292	0.306	0.292
Eq. (2)				
Constant	0.027**	0.019**	0.029**	0.020**
	(0.002)	(0.002)	(0.002)	(0.002)
X	0.540**	0.520**	0.580**	0.555**
	(0.024)	(0.024)	(0.031)	(0.031)
X×LIST	0.091**	0.095**	0.112**	0.120**
	(0.030)	(0.030)	(0.039)	(0.040)
RDEBT	−0.058**	−0.046**	−0.058**	−0.045**
	(0.006)	(0.006)	(0.006)	(0.006)
Adj R^2	0.551	0.541	0.547	0.537

Note. The table presents the regression results for listed firms whose absolute value of adjusted internal fund ratio W^a is below 0.5. The number of sample firms is 1231. The dummy variable LIST takes one for the TSE first section and zero for the others in 1995. For data adjustment, 'non' indicates the results with non-adjusted data and 'adj.' those with adjusted data. Standard errors of coefficients are in parentheses. Superscripts ** and * indicate that the coefficient is significant at the 1 and 5% level, respectively.

the results with non-adjusted data or with adjusted data, and by OLS or by the instrumental variable method. It shows that the coefficients on WD×LIST are not significantly different from zero in any regression. Then, the marginal excess cost of equity finance is thought to be not different across classes.

Since the coefficient on WD in Eq. (1) is not different across classes, firms in the class with the lower coefficient on $x$are more constrained in debt finance, as discussed Section 2. The lower part of Table 5 reports the results of Eq. (2) with X× LIST.[14] The coefficients on X× LIST are all significantly positive, suggesting that the excess marginal cost of debt finance is lower for firms listed on the TSE first section than those on the others.

To summarize the results concerning listed firms from 1995 to 1996, the excess marginal cost of equity finance is not different between the TSE first section and the others, while that of debt finance is lower for the TSE first section. This implies that the listing on the TSE first section provides firms with cheaper access not to equity but to debt markets, partly because disclosure or being well known makes information problems less important.

6 Results for BSJBSA

In this section, I report the difference in financial constraint across size by BSJBSA. In BSJBSA, items like long-term debt or dividends and the data in 1994 are not available, which makes it impossible to adjust data and to use lagged variables for instruments. However, the results of JDB data are robust across data adjustments and estimation methods. Analogously, I only estimate equations with non-adjusted data by OLS.

Concerning BSJBSA, I test the joint hypothesis that size is a proxy for information problems and that external finance is more costly for firms with more information problems. Let SMALL be a dummy variable that takes one for small firms and zero for the others, and LARGE be one that takes one for large firms and zero for the others. In order to test the difference over all samples, Eq. (1) is estimated with WD× SMALL and WD×LARGE, and Eq. (2) is estimated with X×SMALL and X× LARGE. In addition, to take account of the possibility that the cost of external finance depends on whether internal fund ratio is positive or negative, I include DUMW× WD in Eq. (1) and DUMW×X in Eq. (2), where DUMW is a dummy variable that takes one for firms with positive W and zero otherwise.[15]

Table 6 reports the results with all samples. In the estimation, to consider the possibility that the cost of external finance depends on capital relationship, regressions include interaction variables between dummy variables, ESUB or EPAR, and WD or X. The dummy variable ESUB

Table 6 The regression results for BSJBSA

Eq. (1)		Eq. (2)	
Constant	−0.002	Constant	0.020**
	(0.001)		(0.001)
WD	0.106**	X	0.329**
	(0.015)		(0.017)
DUMW×WD	0.351**	DUMW×X	0.094**
	(0.013)		(0.015)
SMALL×WD	0.054**	SMALL×X	0.135**
	(0.011)		(0.014)
LARGE×WD	−0.099**	LARGE×X	−0.016
	(0.021)		(0.027)
ESUB×WD	−0.027*	ESUB×X	0.042**
	(0.011)		(0.014)
EPAR×WD	0.019	EPAR×X	−0.109**
	(0.010)		(0.013)
GSALE	0.006	RDEBT	−0.040**
	(0.003)		(0.003)
RTANG	0.056**	Adj R^2	0.364
	(0.004)		
Adj R^2	0.386		

Note. The table presents the regression results with all samples in BSJBSA by OLS. The number of sample firms is 9949. A dummy variable DUMW takes one for firms with positive W and zero otherwise, SMALL takes one for firms whose net assets are less than a billion yen and zero otherwise, LARGE takes one for firms whose net assets are more than ten billion yen and zero otherwise, ESUB takes one for firms owing subsidiaries or affiliated firms in 1995 and zero otherwise, and EPAR takes one for subsidiaries in 1995 and zero otherwise. Standard errors of coefficients are in parentheses. Superscripts ** and * indicate that the coefficient is significant at the 1 and 5% level, respectively.

takes one for firms owing subsidiaries or affiliated firms in 1995 and zero otherwise, and EPAR takes one for subsidiaries in 1995 and zero otherwise.

The results indicate that both the coefficient on DUMW×WD in Eq. (1) and that of DUMW×X in Eq. (2) are significantly positive, suggesting that the costs of external finance depend on whether internal funds are over zero or not. Next, we check the difference across size. Concerning large firms, the coefficient on LARGE×WD is significantly negative while that on LARGE×X is not different from zero. This implies that for large firms, the excess marginal costs of equity and debt finance are lower than those for the others. Both the coefficients on SMALL×WD and SMALL×X are significantly positive, which implies that for small firms, the excess marginal cost of equity finance is higher but that of debt finance is ambigu-

ous. In summary, there is a cost differential across size, where the larger the size of a firm, the lower the excess marginal cost, especially of equity finance.

Concerning the costs for parent firms, the coefficient on ESUB×WD is significantly negative while that on ESUB×X is significantly positive. Consequently, the excess marginal costs of both equity and debt finance for parent firms are considered to be lower than those for the others. As for subsidiaries, the coefficient on EPAR×WD is not different from zero and that on EPAR×X is significantly negative, which implies that the excess marginal cost of debt finance for subsidiaries is higher. This result suggests that information problems are more severe for subsidiaries, or that firms with severe financial constraint may become subsidiaries by raising funds through other firms.[16)]

Table 7 presents the results separately by capital relationship to check the size effect for each capital relationship. The coefficients on LARGE×WD and LARGE×X indicate that the excess marginal costs of both equity and debt finance are lower for large parent firms than for other parent firms. Among subsidiaries, the excess marginal cost of equity finance is lower for large firms, but that of debt finance is ambiguous. There are few large firms among independent firms. Thus, the results over the entire sample of Table 6 do not change even if holding a constant capital relationship.

Regarding small firms, Table 7 suggests that small subsidiaries are not burdened significantly larger costs in comparison with medium subsidiaries, whereas small independent firms are. This implies that though subsidiaries bear higher external finance cost than others do, information problems for small subsidiaries are relatively less important, and parent firms may reduce the cost of external finance for their subsidiaries.

As for debt finance, I focus not on all debt but only on long-term debt. If the cost issuing equity or long-term debt for subsidiaries is high, they may raise funds by short-term debt, which will makes their liquid debt to total asset ratio high. The means of liquid debt, fixed debt and net asset normalized by total assets in 1995 were 41.83%, 25.29%, and 32.88%, respectively, for parent firms. For subsidiaries, they were, respectively, 52.25%, 18.81%, and 28.94%, and for independent firms, 41.38%, 29.25%, and 29.38%. These figures indicate that, on average, subsidiaries have a high liquid debt ratio and a low fixed debt ratio. This may possibly be reflected in the relatively lower cost of short-term debt finance for subsidiaries. An analysis distinguishing between short-term and long-term debt is left for future research.

7 Concluding Remarks

In this paper, I have analyzed whether

Table 7 The regression results for BSJBSA : separately by capital relationship

Class # of firms	Parent firms 3779	Subsidiaries 2489	Independent firms 3681
Eq. (1)			
Constant	0.002	−0.013**	0.004
	(0.002)	(0.003)	(0.003)
WD	0.162**	0.116**	0.031
	(0.019)	(0.028)	(0.022)
DUMW×WD	0.203**	0.391**	0.404**
	(0.021)	(0.027)	(0.020)
SMALL×WD	0.018	−0.0002	0.135**
	(0.019)	(0.020)	(0.019)
LARGE×WD	−0.090**	−0.165**	0.081
	(0.023)	(0.043)	(0.062)
GSALE	0.0001	0.017*	−0.0004
	(0.005)	(0.007)	(0.006)
RTANG	0.055**	0.085**	0.030**
	(0.006)	(0.007)	(0.006)
Adj R^2	0.247	0.433	0.418
Eq. (2)			
Constant	0.013**	0.026**	0.023**
	(0.002)	(0.003)	(0.003)
X	0.413**	0.400**	0.195**
	(0.021)	(0.031)	(0.026)
DUMW×X	−0.005	−0.046	0.247**
	(0.024)	(0.029)	(0.023)
SMALL×X	0.068**	0.031	0.220**
	(0.022)	(0.027)	(0.025)
LARGE×X	0.027	−0.221**	0.364**
	(0.029)	(0.059)	(0.112)
RDEBT	−0.032**	−0.070**	−0.032**
	(0.004)	(0.006)	(0.004)
Adj R^2	0.345	0.316	0.428

Note. The table presents the regression results separately by capital relationship in 1995 by OLS. Standard errors of coefficients are in parentheses. Superscripts ** and * indicate that the coefficient is significant at the 1 and 5% level, respectively.

there is a cost differential between internal and external finance, and whether it depends on a firm's characteristics such as firm size or capital relationship. One feature of this analysis is the distinction between equity and debt finance, whereas the existing literature treats them all together as external finance. Another fea-

ture is the analysis of investment behavior concerning not only listed firms but also unlisted firms by using BSJBSA. The results from JDB data show that capital markets are imperfect for listed firms, and that there exists a cost differential between firms listed on the TSE first section and those listed elsewhere in debt finance but not in equity finance. The results from BSJBSA show that not only listed but also unlisted firms are financially constrained. Large firms whose net assets are over ten billion yen, approximately 80% of which are listed, have lower equity and debt finance costs. Among independent firms, small firms whose net assets are below a billion yen have higher costs than the others, whereas among subsidiaries, small firms do not have higher costs. Smaller subsidiaries may be helped by their parent firms in equity finance. This evidence is consistent with the argument that the size of firms is a proxy for information problems, and that external financing is more costly for firms with more information problems.

In the analysis, I used data from 1995 to 1996. It is not certain whether the results in this paper depend on this period or not. For firms in the TSE first section in this period, fixed debt decreased while liquid debt increased on average, as reported in Section 4. The decrease in fixed debt might be caused by the increase in bankruptcy probability, or other reasons. I can not control these factors, and it will be necessary to examine investment spending using panel-data.

Notes

1) There is other evidence concerning the reflections of asymmetric information. For example, Seyhun (1986) reports that, by stock investment, corporate insiders obtain excess returns whereas outside investors do not, which implies that corporate insiders have superior information. Asquith and Mullins (1986) find that equity issues are associated with a negative share price response, which is consistent with the argument of Myers and Majluf (1984).

2) BSJBSA investigates firms having establishments classified in industries such as mining, manufacturing, wholesale, retail, and some restaurants with 50 or more employees and with 30 million yen or more capitalization.

BSJBSA data does not contain the item distinguishing listed firms from unlisted ones.

3) The discussion of this section is similar to that of Kaplan and Zingales (1997), in which there is one type of external finance.

4) Hubbard (1998) and Kaplan and Zingales (1997) discuss problems in estimating Eq. (3).

5) For example, Morck, Shleifer and Vishny (1990) and Goyal and Yamada (1998) use sales growth as a proxy for investment opportunities.

6) Of course, we may be able to observe it ex-post.

7) If sales growth is not appropriate as a proxy for profitability, the estimated coefficients are biased. However, even though the estimated coefficients for a class may be biased, provided that the degree of bias is the same across classes, the difference in coefficients may turn out to be an unbiased estimator of the true

difference.

8) If costs of financial distress are ignored, a firm will finance investment by issuing a security not affected by managers' inside information (i.e. 'debt' in this paper). On the other hand, if costs of financial distress are severe, a firm will issue equity or pay down debt. To control financial distress even partially, I drop firms with negative net assets from the sample and use debt ratio for the control variable in Eq. (2).

9) The resulting data set contains 11002 firms. Their means (standard deviations) for the following variables are: 0.039 (0.081) for INV, 0.052 (0.125) for W, −0.005 (0.093) for DDEBT, and 0.052 (1.272) for GSALE.

10) It must be noted that the definition of industry in JDB data is not perfectly coincident with that of BSJBSA data.

11) BSJBSA in 1995 inquired of firms their data between March 1995 and April 1994. However, firms with difficulty in answering for the above period could supply data on the nearest settlement day before June 1, 1995. Then, I regard BSJBSA in 1995 as the investigation between June 1994 and May 1995. Similarly, I regard BSJBSA in 1996 as the investigation between June 1995 and May 1996. Moreover, I need data between June 1993 and May 1994 for instruments. There were no firms moving between the TSE first section and the others in these periods.

12) There is no firm listed on the TSE first section whose absolute value of W or W^a exceeds 0.5. There are three firms listed on the other exchanges whose absolute values of W exceed 0.5. For these three firms, the absolute value of W^a also exceeds 0.5.

13) I estimate the equation similar to Column 3 with the constraint $a_2 = a_1 + \gamma$. The coefficients on γ are 0.021 (s.e. 0.021) for the TSE first section and −0.010 (s.e. 0.029) for the others. Neither of them are different from zero at the 10% significance level.

14) To check the constraint, I estimate Eq. (2) with the constraint $b_1 = b_2 + \gamma$ by adjusted data using OLS. For the TSE first section and the others, the estimated values of γ are 0.142 (s.e. 0.040) and 0.044 (s.e. 0.042), respectively. The former is different from zero at the 1% significance level, while the latter is not different from zero at the 10% significance level. However, I focus on the results with the constraint $b_1 = b_2$.

15) The number of firms with positive internal fund ratio $W > 0$ are 914 in small parent firms, 1276 in medium parent firms, 698 in large parent firms, 1168 in small subsidiaries, 777 in medium subsidiaries, 140 in large subsidiaries, 1855 in small independent firms, 884 in medium independent firms, and 43 in large independent firms.

16) Gilchrist and Himmelberg (1995) obtain results showing that investments of small firms appear to be more sensitive to cash flow than those of large firms, implying that capital markets are imperfect especially for small firms. Lamont (1997) reports that oil companies reduced their nonoil investments when the 1986 oil price decline reduced the cash flow of oil firms. If capital markets were perfect, the reduction in cash flow for a company's oil segment would not affect investment of the same company's nonoil segment. This fact implies that external capital markets are imperfect, and that the financing costs of different parts of the same firm are interdependent, both of which are consistent with the findings in this paper.

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