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A Theory and an Empirical Evidence in Japan

Shin-ichi Fukuda
University of Tokyo
Ji Cong
Keiai University
Akihiro Nakamura
Institute for Posts Post and Telecommunications Policy

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Shin-ichi Fukuda (University of Tokyo) **

Ji Cong (Keiai University)

Akihiro Nakamura (Institute for Posts Post and Telecommunications Policy)

Abstract

The purpose of this paper is to investigate what type of firm chooses long-term loans when the manager maximizes his expected payoff. Our theoretical model extends previous models in the following four respects. First, we allow the case where firms have internal funds. Second, we explicitly solve the conditions under which firms choose long-term debt. Third, we allow no information arrival for some lenders because it makes a pooling equilibrium more natural outcome. Fourth, we explicitly consider the case where there exists a chance of renegotiation for defaulted short-term debt.

Our theoretical result shows that if a liquidation risk is present, the firm tends to choose long-term debt when it has large amount of external debt, when its average revenue is large, and when the manager has his own non-assignable control rent. It also shows that if there exists a chance of renegotiation, the firm tends to choose long-term debt when it has large amount of external debt and when its average revenue is small. We empirically investigate these hypotheses by using Japan's panel data for five industries. Except for the electric and electronic equipment industry, the results support our hypotheses for the case where a liquidation risk is present. However, in electric and electronic equipment industry, empirical results support our hypotheses for the case where there exists a chance of renegotiation. In addition, we support our hypotheses more significantly for the data of smaller companies and the data after financial liberalization.

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** Correspondence: Shin-ichi FUKUDA, Faculty of Economics, University of Tokyo, Hongo Bunkyo, Tokyo 113, JAPAN. E-mail: sfukuda@e.u-tokyo.ac.jp, FAX: 81-3-3818-7082.

1. Introduction

The purpose of this paper is to investigate what type of firm chooses long-term loans when the manager maximizes his expected payoff. Our theoretical model extends Diamond(1991, 1993) who formulated the choice of loan's term structure by private firms under asymmetric information. When there exists asymmetric information between lenders and borrowers, short-term debt lowers a good borrower's expected financing cost because of a possible arrival of good information. Thus, when there is no chance of liquidation destroying control rents, short-term debt is preferred by good type borrowers (see Flannery (1986)). However, when the funds are not available, there exists a liquidity risk of loss of control. This liquidity risk is particularly serious for the manager if he has a non-assignable control rent through production.[1] Thus, if the manager's control rent is large, long-term debt can be preferred by the firm to avoid the liquidity risk.[2]

Our theoretical model extends these results into four directions. First, we allow the case where firms have internal funds. This extension is particularly important for our empirical purposes because most firms finance their projects by their internal funds as well as by external funds. Second, we explicitly solve the conditions under which firms choose long-term debt. The conditions clarify what type of firm chooses long-term debt, and present a benchmark for our empirical studies. Third, we allow no information arrival for some short-term lenders. Although this extension complicates our analysis, it is crucial in our analysis to ensure the existence of a pooling equilibrium when a liquidation risk is present. Fourth, we explicitly consider the case where there exists a chance of renegotiation for defaulted short-term debt. Allowing the possibility of renegotiation, our model introduces another maturity choice problem for borrowers.

To the extent that external debt is risky debt, our theoretical results predict that the firm chooses long-term debt as the total amount of external debt increases. However, even if external debt is risky debt, the firm's average revenue and the manager's non-assignable control rent have different effects on the maturity choice depending on whether a liquidation risk is present or not. When a liquidation risk is present, long-term debt is preferred when the firm's average revenue is large and when the firm's manager has his own non-assignable control rent. This is because the firm can avoid the liquidation risk of losing them when long-term debt is chosen. On the other hand, when there exists a chance of renegotiation, the firm prefers long-term debt when its average

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1 Financial contracts in the case where the manager has a non-assignable control rent have been extensively discussed by Aghion and Bolton (1992), Hart and Moore (1994, 1995), Von Thadden (1995), and others.

2 Another case where long-term debt may be preferred by borrowers is that borrowers have moral hazard problem. See Rajan (1992).

revenue is small. This is because larger average revenue makes short-term debt less riskly and reduces its interest rate payments. However, the maturity choice of debt does not depend on the value of manager's non-assignable control rent when there exists a chance of renegotiation. Therefore, if the firm chooses long-term debt when its average revenue and the manager's non-assignable control rent are large, our model predicts that there exists a chance of liquidation for the firm.

An empirical part of this paper explores these theoretical hypotheses by using Japan's panel data after the 1970's. Except for electric and electronic equipment industry, empirical results support our hypotheses for the case where a liquidation risk is present. However, in electric and electronic equipment industry, empirical results support our hypotheses for the case where there exists a chance of renegotiation. The results hold more significantly for small companies than for large companies. In addition, when we split our sample periods before and after 1980, our hypotheses are supported more significantly by the data after 1980 than before 1980. The last result is consistent with a view that a series of financial liberalization erased much of the compartmentalization between long-term and short-term funds during the past decades in Japan.

In Japan, government had a strong influence on long-term credit allocation to designated sectors for a long time.[3] For example, Table 1 shows that for the 1950s and 60s, nearly 90% of loans supplied by the city and local banks were short-term funds, while nearly 90% of loans supplied by the long-term credit banks were long-term funds. Since long-term funds were used for capital investment, this implies that long-term funds supplied by the long-term credit banks (and possibly trust banks) contributed to economic growth in postwar Japan. However, during past decades, Japan has experienced a series of changes in the industrial structure and financial liberalization. Consequently, much of the compartmentalization between long-term and short-term funds have been erased in various respects. Our empirical result in section 10 supports this view and shows that Japan's private long-term loans were determined as a consequence of the manager's "profit" maximization after the 1980s.

The paper proceeds as follows. Section 2 presents a basic structure of our model. Section 3 specifies long-term and short-term debt contracts. Section 4 calculates the payoffs of borrowers with short-term debt for three alternative cases. Section 5 and section 6 respectively investigate the maturity choices by good type borrowers and by all borrowers. Section 7 explains the data and the estimation method for our empirical studies. Section 8 reports our

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[3] In previous literature, Teranishi (1982) is one of the first ones which considered this issue. In empirical studies, Takei and Teranishi (1991) showed that the allocation of long-term funds by government accelerated economic growth and productivity in postwar Japan. Packer (1994) stressed the role of long-term credit banks that have obtained a license from the Ministry of Finance under the Long-Term Credit Bank Law.

main estimation results, and Section 9 examines their robustness. Splitting our sample periods before and after 1980, section 10 shows that our hypotheses are supported more significantly by the data after 1980 than before 1980. Section 11 summarizes our results and refers to a possible extension.

2. The Model

Consider borrowers who need to fund their indivisible investment projects. There are three dates, 0, 1, and 2. All projects require the fixed amount of K in capital at date 0 and produce cash flows only at date 2 (none at date 1). Each borrower has his own internal fund of W. However, since $K > W$, he needs to fund external debt of K-W for the project. For analytical simplicity, we assume no outside equity: all equity is owned by the borrower.

Borrowers and lenders are risk neutral. Lenders consume at date 2 and have a constant returns-to-scale investment technology that returns R per unit invested per period. One unit invested at date 0 returns R units at date 1; and if this is invested until date 2, the terminal value is R^2. There are many potential lenders who all observe the same information. Thus, borrowers face a competitive loan market at each date, and can borrow as long as lenders receive an expected return of R per period, per unit loaned.

Borrower's technological environments are summarized in Figure 1. When successful, each borrower's project yields a cash flow of X which is assumed to be greater than R^2K (that is, $X > R^2K$). It also produces a non-assignable control rent of C if the management has control right at date 2. Examples of the non-assignable control rent might be the manager's desire to keep his business going, the manager's consumption of perquisites, or the manager's disutility from dismissing long-standing employees.

All projects can be liquidated at date 1 for a liquidation value of L which is assumed to be less than $R(K\text{-}W)$. A successful project yields a higher cash flow when not liquidated, because $L < R(K\text{-}W) < X/R$. If it is liquidated, the borrower can consume no cash flows nor control rents. In this case, an optimal financial contract is a debt contract enforced by the right to liquidate if the debt is not fully repaid. We assume that projects have no liquidation value at date 2.

There are two types of borrowers. The two types of borrowers differ only in the probability that the return X is received from their projects. The types of borrowers are as follows.

Type G borrower: The project returns a cash flow of X for sure at date 2.
Type B borrower: The project returns a cash flow of X with probability q but returns zero with probability 1-q.

Since $X > R^2K$, the project of type G borrower has a positive net present value in terms of cash flows. On the other hand, for the project of type B borrower, we assume that $qX < R^2(K-W)$. and $qC > R^2W$. The first assumption indicates that type B borrower's project has a negative net present value in terms of cash flows. However, the second assumption implies that type B borrowers never liquidate their project when they have the control right to force the liquidation.

The project's ex ante prospects and the ex post cash flows are private information observed only by the borrower. No one but a borrower knows his own type. Lenders' information on borrowers' type, which is summarized in Figure 2, is as follows. At date 0, lenders only know that the borrower is type G with probability f and type B with probability $1-f$. We assume that $R^2(K-W) \leqq [f+(1-f)q]X$. This assumption implies that on average, the project has a positive net present value in terms of cash flows.

At date 1, all lenders receive information sent by borrowers. However, all borrowers cannot send the information to lenders. We assume that borrowers can send the information with probability s $(0 < s < 1)$. This implies that lenders receive no information with probability $1-s$.

We also assume that the received information reveals only some of type G borrowers. That is, even if lenders receive the information, they can identify only some of type G borrowers and none of type B borrowers. Let e denote the probability that a type G borrower can reveal his type at that time. Then, when lenders receive the information, their subjective probability that a borrower who did not reveal his type is type G is

$$(1) \qquad g = \frac{(1-e)f}{(1-e)f + (1-f)}.$$

That is, when lenders received the information, they evaluate that the borrower who did not reveal his type is type G with probability g and type B with probability $1-g$.

The received information is not verifiable so that we cannot write contracts contingent on it. However, the terms of refinancing at date 1 will depend on whether borrowers can reveal their types or not.

3. Debt Contracts

(i) Long-term debt

Long-term debt is debt floated at date 0 that matures at date 2, with no refinancing at date 1. The face value r^L of this debt is set so that lenders who lend K can get expected return of R^2K. Under the assumption that $qX < R^2K$, the equilibrium with long-term debt is, if any, a pooling equilibrium, realizing that debt is repaid with probability $f+(1-f)q$. Thus, as long as $r^L \leqq X$, the face value of a long-term debt is given by [4]

$$(2) \qquad r^L = \frac{R^2(K-W)}{f+(1-f)q}.$$

The lower is f, the higher is the promised interest r^L, owing to the higher default rate of type B's.

Recall that at date 1, each lender might receive information about some of type G borrowers. However, the information, if any, does not influence the face value of long-term debt and does not lead to liquidation because long-term lenders have no such rights.[5] Therefore, the payoff of a type G borrower with long-term debt is

$$(3) \qquad \Pi^L g = X + C - r^L$$
$$= X + C - \frac{R^2(K-W)}{f+(1-f)q}.$$

On the other hand, the expected payoff of a type B borrower with long-term debt is

$$(4) \qquad \Pi^L b = q(X + C - r^L)$$
$$= q(X + C) - q\frac{R^2(K-W)}{f+(1-f)q}.$$

Because $[f+(1-f)q]\,X > qR^2(K-W)$ and $qC > R^2W$, it always holds that $\Pi^L g > \Pi^L b > R^2W$. Thus, both $\Pi^L g$ and $\Pi^L b$ are always greater than riskless returns of internal fund W.

(ii) Short-term debt

Short-term debt is debt financed at date 0, maturing at date 1 with face value r^1. The date 1 repayment comes either from refinancing at date 1 or from the proceeds of liquidation at that date. If debt is refinanced at date 1, the issued debt matures at date 2. The refinanced short-term debt at date 1 has different face values depending on the realization of date 1 information.

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[4] If $r^L > X$, borrowers cannot issue long-term debt, because they cannot provide lenders with an expected return of R^2K. Because $R^2(K-W) \leqq [f+(1-f)q]X$, we can rule out this possibility in the following analysis.

[5] When C is small, renegotiation between lenders and borrowers may be possible. However, since C is large (that is, $qC > R^2W$), we can rule out this possibility.

When lenders receive no information at date 1, we denote its face value by r^A. When lenders receive the information at date 1, we denote its face value by r^B for the borrower who revealed their type as type G and r^C for the borrower who did not reveal his type.

Each face value of short-term debt issued at date 1 is set so that lenders at date 1 get an expected return of R per unit invested given the information about a borrower at that date. Since any types of projects produce no cash flow at date 1, the amount that must be raised at date 1 is equal to r^1, that is, the face value of short-term debt issued at date 0.

When lenders receive no information at date 1, the prior of all at date 1 is still that the borrower is type G with probability f and type B with probability 1-f. Under our assumptions, all of these borrowers can always refinance to pay the full face value of their date 0 debt. Since they pay r^1 at date 1, the face value of debt issued at date 1 is

(5) $r^A = r^1 R/[f+(1-f)q]$,

because a new debt maturing at date 2 is repaid with probability $f+(1-f)q$.

Even when lenders receive the information at date 1, the face value of debt issued at date 1 is easily determined for borrowers who reveal their type. That is, short-term borrowers who reveal their type are type G with probability one. Thus, the borrowers can always refinance to pay the full face value of their date 0 debt r^1. Noting that a new debt maturing at date 2 is repaid with probability 1, the face value of debt issued at date 1 satisfies

(6) $r^B = r^1 R$.

However, when lenders receive the information at date 1, the determination of the face value of debt issued at date 1 is more complicated for borrowers who did not reveal their types. This is because the borrowers might not be able to refinance to pay the full face value of their date 0 debt. When the borrower cannot repay in full at date 1, date 0 short-term lenders have the control rights to force liquidation. In this case, lenders choose either liquidation or renegotiation so as to maximize their repayment.

If debt were issued by borrowers who did not reveal their types at date 1, it would be repaid at date 2 with probability $g+(1-g)q$. This implies that the debt maturing at date 1 cannot be repaid in full by a new debt issue unless

(7) $[g+(1-g)q]\ X/R > r^1$

because X is the most a borrower can pay.

When (7) does not hold, date 0 short-term lenders choose either renegotiation or liquidation so as to maximize their repayment. Since liquidation yields L, the lenders choose liquidation at date 1 if

(8) $[g + (1-g)q]\, X/R < L.$

On the other hand, the lenders choose renegotiation at date 1 if

(9) $L < [g + (1-g)q]\, X/R < r^{I}.$

When renegotiation is chosen, the borrowers can always refinance short-term debt at date 1. We denote the face value of this short-term debt by r^{C}. In general, this face value generally depends on the "bargaining power" between lenders and borrowers. In the following analysis, we define $\mu \in [0, 1]$ as the share of the unallocated surplus that the lenders get after bargaining. We also assume that μ is exogenously given. Then, because $[g + (1-g)q]\, X/R$ is the largest and L is the least expected returns that the renegotiated lenders can get after bargaining, it holds that

(10) $r^{C} = \mu X + (1-\mu)\, R L/[g + (1-g)q].$

The payoff of borrowers with short-term debt depends on whether debt maturing at data 1 is paid in full or not and on whether either renegotiation or liquidation is chosen. The next section considers the expected payoff of short-term borrowers for three alternative cases.

4. The Expected Payoff of Borrowers with Short-term Debt

Case I. Liquidation

At date 1, lenders receive information of borrowers with probability s and do not with probability $1-s$. In the latter case, debt maturing at date 1 is always repaid in full. Even in the former case, debt maturing at date 1 is repaid in full by a type G borrower who reveal his type. However, when lenders receive the information, the borrowers who did not reveal their types may not repay their debt maturing at date 1 in full by a new debt issue. In particular, if (8) holds, their projects are liquidated at date 1 for L We first consider short-term debt in this case.

Since the conditional probability that a type G borrower reveals his type is fe when lenders receive the information at date 1, the expected return of a date 0 short-term lender is written as

(11) $(1-s)\, r^{1} + sfe\, r^{1} + s(1-fe)L$

$$= [(1-s)+sfe]\, r^1 + s(1-fe)L.$$

Equating this to the one-period riskless return $R(K-W)$ implies that

$$(12) \quad r^1 = \frac{R(K-W) - s(1-fe)L}{(1-s) + sfe},$$

so that (5) and (6) lead to

$$(13a) \quad r^A = \frac{[R(K-W) - s(1-fe)L]R}{[(1-s) + sfe][f + (1-f)q]},$$

$$(13b) \quad r^B = \frac{[R(K-W) - s(1-fe)L]R}{(1-s) + sfe}.$$

The payoff of a type G borrower with short-term debt is

(14a) $X + C - r^A$ when lenders receive no information at date 1,

(14b) $X + C - r^B$ when a type G borrower reveals his type at date 1,

(14c) 0 when his project is liquidated at date 1.

Since all type G borrowers are identical at date 0, the expected payoff of a type G borrower with short-term debt at date 0 is

$$(15) \quad \Pi^s g = (1-s)(X + C - r^A) + se(X + C - r^B)$$
$$= [(1-s)+se](X + C) - AR[R(K-W) - s(1-fe)L].$$

where $A \equiv \dfrac{(1-s) + se[f + (1-f)q]}{[(1-s) + sfe][f + (1-f)q]}$.

Similarly, the expected payoff of a type B borrower with short-term debt at date 0 is written as

$$(16) \quad \Pi^s b = (1-s)q(X + C - r^A)$$
$$= (1-s)q\{(X + C) - \frac{R[R(K-W) - s(1-fe)L]}{[(1-s) + sfe][f + (1-f)q]}\}.$$

In the following analysis, we assume that $\Pi^s b > R^2W$. This assumption ensures the existence of a pooling equilibrium when a liquidation risk is present. A necessary condition for this assumption to hold is that $s < 1$. Thus, a pooling equilibrium with a liquidation risk exists only if all borrowers cannot send information to lenders.

Case II. Renegotiation

When (9) holds, lenders choose renegotiation even if debt maturing at date 1 cannot be repaid in full. In this case, the expected return of the date 0 short-term lenders from renegotiation is $\mu\,[g+(1-g)q]\,X/R + (1-\mu)L$. Thus, noting that the date 0 short-term lenders will have renegotiation with probability $s(1-fe)$, the expected return of the date 0 short-term lenders is

$$(17)\qquad [(1-s)+sfe]\,r^1 + s(1-fe)\,\{\mu\,[g+(1-g)q]\,X/R + (1-\mu)L\}.$$

Equating this to the one-period riskless return $R(K-W)$ implies that

$$(18)\qquad r^1 = \frac{R(K-W) - s(1-fe)\{\mu[g+(1-g)q]X/R + (1-\mu)L\}}{(1-s) + sfe},$$

so that

$$(19a)\qquad r^A = \frac{R^2(K-W) - s(1-fe)\{\mu[g+(1-g)q]X + (1-\mu)RL\}}{[(1-s) + sfe][f+(1-f)q]},$$

$$(19b)\qquad r^B = \frac{R^2(K-W) - s(1-fe)\{\mu[g+(1-g)q]X + (1-\mu)RL\}}{(1-s) + sfe}.$$

Therefore, recalling that $r^C = \mu X + (1-\mu)\,R\,L/[g+(1-g)q]$, the expected payoff of a type G borrower with short-term debt at date 0 is

$$(20)\qquad \Pi^s g = (1-s)(X + C - r^A) + se(X + C - r^B) + s(1-e)(X + C - r^C)$$
$$= B\,X + C - AR^2(K-W) + (1-\mu)DRL.$$

where $B \equiv 1-\mu\,s(1-e)+\mu\,s(1-fe)[g+(1-g)q]A$ and $D \equiv s[(1-fe)A - (1-e)/[g+(1-g)q]]$.

Similarly, at date 0, the expected payoff of a type B borrower with short-term debt is

$$(21)\qquad \Pi^s b = (1-s)q(X + C - r^A) + sq(X + C - r^C)$$
$$= \{1-\mu\,[g+(1-g)q]H - (1-\mu)sq\}X + qC + \frac{(1-s)qR^2(K-W)}{[(1-s) + sfe][f+(1-f)q]} + (1-\mu)HL.$$

where $H \equiv \dfrac{qs(1-s)(1-fe)}{[(1-s) + sfe][f + (1-f)q]}$.

Because $qC > R^2W$, $X > r^A$, and $X > r^C$, it holds that $\Pi^s b > R^2W$. Thus, a pooling equilibrium always exists when renegotiation is possible for short-term borrowers.

Case III. No loss of control right

When (7) holds, the debt maturing at date 1 is always repaid in full by a new debt issue. In this case, the return of a date 0 short-term lender is R, that is, $r^1 = R$. Thus, it holds that:

(22a) $r^A = R^2(K-W)/[f+(1-f)q]$,

(22b) $r^B = R^2(K-W)$,

(22c) $r^C = R^2(K-W)/[g+(1-g)q]$.

The expected payoff of a type G borrower with short-term debt at date 0 is

$$(23)\quad \Pi^s g = (1-s)(X + C - r^A) + se(X + C - r^B) + s(1-e)(X + C - r^C)$$
$$= X + C - R^2(K-W)[\frac{(1-s)}{f + (1-f)q} + se + \frac{s(1-e)}{g + (1-g)q}].$$

Similarly, at date 0, the expected payoff of a type B borrower with short-term debt is

$$(24)\quad \Pi^s b = (1-s)q(X + C - r^A) + sq(X + C - r^C)$$
$$= qX + qC - R^2(K-W)q[\frac{(1-s)}{f + (1-f)q} + \frac{s}{g + (1-g)q}].$$

Because $qC > R^2W$, $\Pi^s b > R^2W$. Thus, a pooling equilibrium always exists when short-term borrowers never lose their control right.

5. The Maturity Choice By Type G borrowers

If the funds were available, a type G borrower would pay to retain control. However, when the funds are not available, there exists a liquidity risk of loss of control. If the liquidity risk is present, then long-term debt can be preferred by type G borrowers. In fact, when there exists a possibility of liquidation, subtracting (15) from (3) leads to:

$$(25)\qquad \Pi^L g - \Pi^s g = s(1\text{-}e)(X + C) - A\ R\ s(1\text{-}fe)L + \frac{se(1-f)}{[f+(1-f)q](1-s+sfe)} R^2(K\text{-}W).$$

The above result indicates that if projects can be liquidated at date 1 for L, long-term debt is preferred by type G borrowers if

$$(26)\qquad (1\text{-}e)(X + C) + \frac{e(1-f)q}{[f+(1-f)q](1-s+sfe)} R^2(K\text{-}W) > A\,R\,(1\text{-}fe)L.$$

Therefore, long-term debt tends to be preferred by type G borrowers if X (the successful output), C (the control rent), and K-W (the amount of external debt) are large and if L (the liquidation value) is small.

This result, however, needs to be modified if there exists no possibility of liquidation. For example, when renegotiation is chosen, (3) and (20) lead to

$$(27)\qquad \Pi^L g - \Pi^s g = -\ (B\text{-}1)\ X + \frac{se(1-f)q}{[f+(1-f)q](1-s+sfe)} R^2(K\text{-}W) - (1\text{-}\mu)DRL.$$

Thus, long-term debt is preferred by type G borrowers if

$$(28)\qquad \frac{se(1-f)q}{[f+(1-f)q](1-s+sfe)} R(K\text{-}W) > (B-1)X + (1\text{-}\mu)DRL.$$

The condition (28) implies that as in the case where a liquidation risk is present, long-term debt tends to be preferred by type G borrowers if K-W is large. However, since

$$B-1 = \frac{\mu se(1-f)q\{1+s[f+(1-f)q]\}}{[f+(1-f)q](1-s+sfe)},$$

it also implies that short-term debt is preferred if X is large unless $\mu = 0$. In addition, C has no effect on the maturity choice.

Finally, when debt maturing at date 1 is always repaid in full by a new debt issue, (3) and (23) lead to

$$(29) \qquad \Pi^L g - \Pi^s g = -\frac{(1-s)}{f+(1-f)q} R^2(K-W) < 0.$$

Equation (29) implies that short-term debt is always preferred by type G borrowers. This result arises because short-term debt lowers a good borrower's expected financing cost through a possible information arrival at date 1. Thus, when external debt is riskless, long-term debt is never preferred by type G borrowers.

6. The Maturity Choice by All Borrowers

In our model, choosing a maturity that only type B borrowers would prefer would reveal that the borrower was type B. In this case, no loan would be made to him because $qX < R^2(K-W)$. However, because type B's expected payoff is positive, it is not a desirable outcome for the type B borrower. Thus, the maturity of debt that is preferred by type G borrowers is also chosen by type B borrowers, and the results in the last section can be generalized as follows.

Proposition (i) When $[g+(1-g)q]\,X/R < L$, there exists a chance of liquidation at date 1. In this case, long-term debt is preferred by all borrowers if (26) holds. (ii) When $L < [g+(1-g)q]\,X/R < R$, lenders choose renegotiation at date 1. In this case, long-term debt is preferred by all borrowers if (28) holds. (iii) When $[g+(1-g)q]\,X/R > R$, debt maturing at date 1 is always repaid in full by a new debt issue. In this case, long-term debt is never preferred by all borrowers.

Proof. When debt maturity at date 1 is always repaid in full, $r^1 = R$. Thus, the conditions (7) and (9) are rewritten as $[g+(1-g)q]\,X/R > R$ and $L < [g+(1-g)q]\,X/R < R$. Therefore, noting that the maturity of debt that is preferred by type G borrowers is chosen by all borrowers, the results in the last section leads to the proposition. [Q.E.D.]

In previous studies such as Rajan (1992), it was shown that the choice between long-term debt and short-term debt is irrelevant when there exists a chance of renegotiation. This is because there exists only a single type of borrowers in their models. However, in our model, there exist two types of borrowers. Thus, although the expected profits are always zero for date 0 lenders, the choice between long-term debt and short-term debt can affect the share of the surplus between type G and type B borrowers. Therefore, the choice between long-term debt and short-term debt is not irrelevant for all borrowers even when there exists a chance of renegotiation.

In general, unless X is large enough, there exists a chance of liquidation or renegotiation at date

1. Thus, the condition (26) and (28) imply that long-term debt is preferred when $K\text{-}W$ is large. In other words, to the extent that external debt is risky debt, our theoretical results predict that the firm chooses long-term debt as the total amount of external debt increases.

However, even if external debt is risky debt, the effects of X and C on the maturity choice depend on whether a liquidation risk is present or not. When a liquidation risk is present, the condition (26) implies that long-term debt is preferred when X and C are large. This is because the firm can avoid the liquidation risk of losing X and C when long-term debt is chosen. On the other hand, when there exists a chance of renegotiation, the condition (28) implies that long-term debt is preferred when X is small. This is because larger value of X makes short-term debt less riskly and reduces its interest rate payments. However, the maturity choice of debt does not depend on the value of C when there exists a chance of renegotiation. Therefore, if the firm chooses long-term debt when its average revenue and the manager's non-assignable control rent are large, the model implies that there exists a chance of liquidation for the firm. In the following sections, we will explore the validity of these theoretical hypotheses by using Japan's panel data after the 1970s.

7. Data and the Estimation Method

The purpose of the following sections is to investigate what type of firms have chosen long-term loans in Japan after the 1970's. If a liquidation risk is present, our theoretical model predicts that long-term debt is chosen (a)when the firm's average revenue is large, (b)when the firm's manager has his own non-assignable control rent, and (c)when the firm has large amount of external debt. On the other hand, if there exists a chance of renegotiation, our theoretical model predicts that long-term debt is chosen (d)when the firm's average revenue is small and (e)when the firm has large amount of external debt.

We empirically investigate these theoretical hypotheses by using Japan's panel data for five industries: iron and steel, chemicals, non-ferrous metals, electric and electronic equipment, and transportation equipment.[6] We chose these five industries partly because they provide a large number of firm's data as a sample and partly because they were or have been leading industries in Japan.

We use financial data for a sample of firms which have been listed in the first and second sections of the Tokyo Stock Exchange from the period 1970 through 1996. Our sample in

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[6] The number of firms in our sample is 50 for iron and steel industry, 125 for chemicals industry, 74 for non-ferrous metals industry, 186 for electric and electronic equipment industry, and 73 for transportation equipment industry.

principle includes firms listed continuously during the sample period. However, it excludes the data of a firm whose external borrowing was zero because it violates the assumption of our theoretical model (i.e., K-W > 0). It also excludes firms which ceased listing in the Stock Exchange due to bankruptcy and other reasons.[7] The financial data of the firms are obtained from the Nikkei-Needs Company data sources.

In the following analysis, we define long-term debt as bank borrowing whose term to maturity is over one year. We then calculate each company's long-term debt ratio by dividing the amount of the long-term borrowing by the amount of total bank borrowing.

We regress the long-term debt ratio on the constant term and three explanatory variables: debt/asset ratio, profit/asset ratio, and normalized stock price. Among these three explanatory variables, debt/asset ratio, which is calculated by dividing bank borrowings by the total assets, is included as a proxy of the amount of external debt, K-W. Since long-term debt is preferred when K-W is large if external debt is not riskless, the coefficient of the total borrowing/total asset ratio is expected to be positive.

The profit/asset ratio, which is calculated by dividing operating profit by the total assets, is included as a proxy of the firm's revenue, X. Our model implies that long-term debt is chosen when X is large if a liquidation risk is present and that long-term debt is chosen when X is small if there exists a chance of renegotiation. Thus, we expect that the coefficient of the profit/asset ratio is positive if a liquidity risk is present but is negative if there exists a chance of renegotiation.

We use the normalized stock price as an explanatory variable in order to approximate how small the manager's non-assignable control rent is. To the extent that stockholders can observe the size of the manager's control rents, the control rent reduces the firm's stock price. Thus, the stock price, which is normzlized by dividing the adjusted stock price by the value of net worth, is inversely correlated with the size of the manager's control rent, C. Because long-term debt is chosen when C is large if a liquidation risk is present, we can expect that the coefficient of the normalized stock price is positive if a liquidation risk is present. However, without any liquidation risk, the coefficient of the normalized stock price is expected not to be significantly different from zero.

Since operating profits fluctuate in the short-run, we use the average of operating profits per total assets during past three years. For other explanatory variables, we use the values of a year before. We use these lagged values partly because we need to avoid the simultaneous bias and partly because the firm's maturity choice is made based on past information. In the regressions, we estimate both fixed effect and random effect models. We also calculate the statistic of Hausman and Taylor (1981) to test the consistency of the random effect model.

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[7] However, it includes firms which ceased listing in the Stock Exchange due to mergers and acquisitions by other firms.

8. Basic Estimation Results

Table 2 reports our empirical results for five industries where we include all data of companies listed in both the first and the second sections of the Tokyo Stock Exchange. In the table, we can easily see that the coefficient of the debt/asset ratio is positive and statistically significant in both fixed and random effect models for all industries. This indicates that Japanese firms tend to prefer long-term debt to short-term debt when their external debt is large.

In addition, except for the industry of electric and electronic equipment, the coefficient of the profit/asset ratio is positive and that of the normalized stock price is negative. In particular, estimated coefficients are statistically significant in most cases. Therefore, except for electric and electronic equipment industry, we can conclude that our estimated coefficients are highly consistent with our theoretical hypotheses where a liquidation risk is present.

On the other hand, in electric and electronic equipment industry, the coefficient of the profit/asset ratio is significantly negative and the normalized stock price is not significantly different from zero. This is consistent with our theoretical model where there exists a chance of renegotiation. Therefore, in electric and electronic equipment industry, we can support the hypotheses for the case where there exists a chance of renegotiation.

The basic results are essentially the same even if we split sampled companies into those listed in the first section and those listed in the second section of the Tokyo Stock Exchange. In particular, as we can see in Table 3-(ii), the estimated coefficients based only on the company data listed in the second section are similar to those in Table 2.

Even when we estimate the same equation based only on the company data listed in the first section, the estimated coefficients are similar to those in Table 2 for three industries: chemicals, non-ferrous metals, and electric and electronic equipment (see Table 3-(ii)). However, for transportation industry, the coefficient of the profit/asset ratio is significantly negative which is inconsistent with our hypothesis. In addition, for iron and steel industry, the coefficient of the normalized stock price takes a wrong sign, although it is not significant. These inconsistent results may have arisen because some companies listed in the first section are so large that our model of asymmetric information is less appropriate to describe their borrowing behavior.

9. The Use of Other Explanatory Variables

In the last section, we used the debt/asset ratio as a proxy of the amount of K-W, and found that it has a positive effect on the long-term debt ratio for all five industries. The purpose of this section is to see some robustness of these regression results by replacing the debt/asset ratio by other explanatory variables. Specifically, we use tangible fixed asset to capture the size of the firm's projects, K. We also use either net cash flow or net worth as a proxy of the firm's internal funds, W. [8]

To avoid heteroskedasticity, we make all of these variables divided by total assets. As long as external debt is riskless, our theoretical result predicts that the coefficient of the normalized tangible fixed asset is positive but the coefficients of the normalized net cash flow and the normalized net worth are negative in the regressions.

Table 4 reports our empirical results for five industries where we include all company data listed in both the first and the second sections of the Tokyo Stock Exchange. In the table, the coefficients of the normalized net cash flow and the normalized net worth are negative in all cases. This implies that as our model predicts, Japanese firms tend to prefer short-term loans to long-term loans when they have large amount of internal funds, W.

In addition, the estimated coefficients of the other explanatory variables are also consistent with our theoretical hypotheses in most cases. In particular, the coefficient of the normalized tangible fixed asset is positive except for the transportation equipment industry.

In the transportation equipment industry, the estimated coefficients are statistically significant and consistent with our theoretical models except for the normalized tangible fixed asset. However, the coefficient of the normalized tangible fixed asset is not consistent with our hypotheses. These less significant results may have occurred because the transportation equipment industry includes firms whose external borrowings were small (see Fukuda and Ji (1994)). Although our sample excludes firms whose external borrowings were zero during the sample period, some firms whose external borrowings were positive but small may violate the assumption of our theoretical model that $K-W > 0$.

10. Estimation Results Based on Different Sample Periods

As we explained in the introduction, government had a strong influence on long-term credit allocation to designated sectors during the high growth period. However, because of a series of changes in the industrial structure and financial liberalization, much of the compartmentalization between long-term and short-term funds have been erased in Japan during past decades. This

[8] Net cash flow = after-tax current income − reversal of surplus reserve + provision for surplus reserve + actual depreciation & amortization − dividends − bonus to directors. Net worth = paid-in capital + proceeds-new share + capital reserve + legal revenue reserve + other statutory reserve + total other surplus.

implies that our theoretical model which is based on the manager's "profit" maximization problem and the competitive final financial market should fit better for recent sample periods than for earlier sample periods.

The purpose of this section is to examine whether our theoretical hypotheses hold more significantly by the data after 1980 than before 1980. We split our sample periods before and after 1980 because Japan experienced a series of financial liberalization in the 1980s. Except for sample periods, the data source and estimation methods are the same as what we explained in section 7.

Table 5 reports our empirical results for five industries where we include all company data listed in both the first and the second sections of the Tokyo Stock Exchange. In the estimation based on the data after 1980, the results are essentially the same as those in section 8. That is, the coefficient of the debt/asset ratio is positive for all industries. Except for the industry of electric and electronic equipment, the coefficient of the profit/asset ratio is positive and that of the normalized stock price is negative, although the coefficient of the profit/asset ratio is less significant for industries of chemicals and transportation equipment.

However, based on the data before 1980, the estimated coefficients sometimes take wrong signs. In particular, when the fixed effect model is estimated, the coefficient of the debt/asset ratio turns out to be negative for three industries: iron and steel, chemicals, and non-ferrous metals. In addition, the coefficient of the profit/asset ratio turns out to be negative for the transportation industry. These estimated coefficients are not consistent with our theoretical hypotheses and imply that our theoretical model based on the manager's "profit" maximization problem does not fit well before financial liberalization in Japan.

11. Concluding Remarks

This paper investigated what type of firms choose long-term loans. Formulating the choice of loan's term structure by private firms, our theoretical results showed the conditions under which firms prefer long-term debt. In particular, we demonstrated that if a liquidation risk is present, the firm tends to choose long-term debt when it has large amount of external debt, when its average revenue is large, and when the manager has his own non-assignable control rent. We also showed that if there exists a chance of renegotiation, the firm tends to choose long-term debt when it has large amount of external debt and when its average revenue is small.

We empirically investigated these theoretical hypotheses by using Japan's panel data for five industries: iron and steel, chemicals, non-ferrous metals, electric and electronic equipment, and transportation equipment. Except for the electric and electronic equipment industry, the empirical results supported our hypotheses for the case where a liquidation risk is present. In particular, the results supported our hypotheses more significantly when we used the company data listed in the second section of the Tokyo Stock Exchange and the data after 1980.

In our empirical studies, we restricted firm's external funds to bank borrowings and did not include bond issues in the long-term funds. This is because until very recently, the bond market in Japan has not been well developed. However, during past two decades, large firms are turning more and more to the capital markets to raise funds for capital investment, which is in turn reducing their demand for bank loans. On the other hand, demand for long-term funding is up from other sectors, most notably smaller companies that need to finance capital investment and private individuals looking for housing loans. Allowing these structural changes in the financial markets would be a possible extension for our empirical research.

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Figure 1. Technological Environments of Borrowers

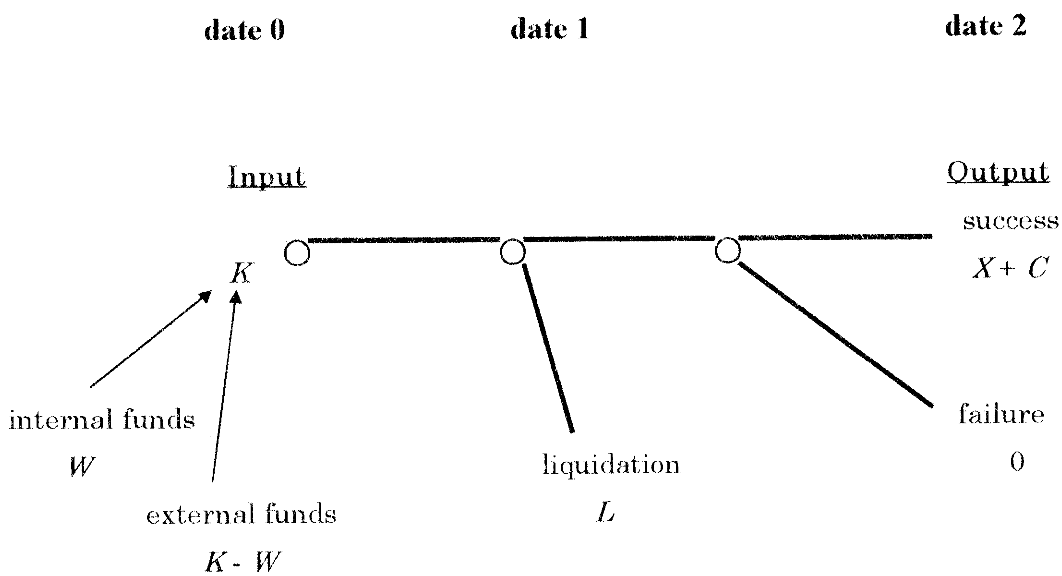

Figure 2. Information Structure for Lenders

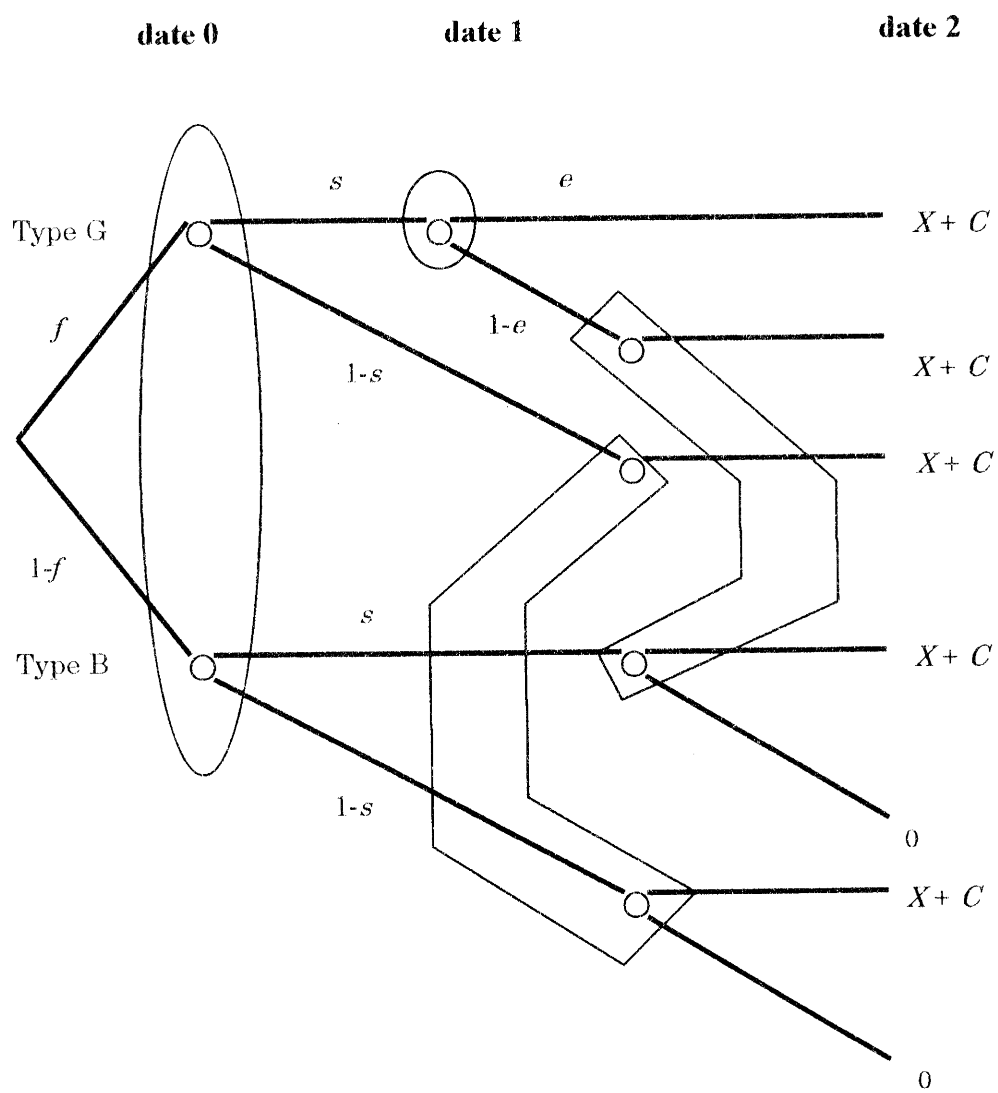

Table 1 Percentage Distribution of Outstanding Loans and Discounts By Maturity

(I) City Banks

End of Year	3 Month and Less	3 Month - 1 Year	More than 1 Year	Overdrafts
1955	76.2%	17.7%	5.1%	0.9%
1960	70.0%	22.4%	6.4%	1.2%
1965	53.7%	35.2%	10.0%	1.1%
1970	53.0%	32.2%	13.7%	1.1%
1975	40.4%	28.8%	29.3%	1.5%
1980	36.4%	28.1%	33.5%	2.0%
1985	21.5%	38.8%	32.7%	7.0%
1990	9.2%	19.6%	57.2%	14.0%
1994	7.1%	22.0%	55.0%	15.9%

(ii) Local Banks

End of Year	3 Month and Less	3 Month - 1 Year	More than 1 Year	Overdrafts
1955	78.5%	12.7%	7.6%	1.2%
1960	68.6%	22.2%	8.4%	0.8%
1965	53.5%	34.8%	11.1%	0.6%
1970	45.6%	35.3%	18.5%	0.5%
1975	36.3%	31.2%	31.7%	0.8%
1980	31.6%	30.0%	36.8%	1.5%
1985	22.3%	32.0%	40.1%	5.5%
1990	15.8%	20.8%	48.4%	14.9%
1994	10.4%	19.3%	54.5%	15.7%

(iii) Long-Term Credit Banks

End of Year	3 Month and Less	3 Month - 1 Year	More than 1 Year	Overdrafts
1955	5.3%	7.4%	87.3%	0.0%
1960	2.2%	4.3%	93.5%	0.0%
1965	1.9%	6.3%	91.7%	0.0%
1970	3.8%	2.6%	93.6%	0.0%
1975	4.5%	3.0%	92.5%	0.0%
1980	10.1%	5.8%	84.1%	0.0%
1985	12.5%	13.9%	70.9%	2.7%
1990	7.7%	11.3%	79.7%	1.3%
1994	13.6%	17.6%	67.6%	1.3%

Sources) Bank of Japan, Economic Statistics Annual, various issues

Table 2 Determinants of the Long-Term Debt Ratio: Basic Results

(1) Fixed Effect Model

	iron & steel	chemicals	non-ferrous	transportation	electric
Debt/Asset Ratio	0.512 [5.842]**	0.616 [13.894]**	0.554 [9.422]**	0.905 [11.256]**	0.265 [6.758]**
Profit/Asset Ratio	1.050 [5.302]**	0.434 [2.605]**	1.553 [7.820]**	0.181 [0.827]	-0.487 [-4.570]**
Stock Price	-0.021 [-0.223]	-1.068 [-6.739]**	-0.531 [-4.038]**	-1.197 [-2.830]**	-0.000 [-0.014]

(2) Random Effect Model

	iron & steel	chemicals	non- ferrous	transportation	electric
Debt/Asset Ratio	0.505 [6.207]**	0.511 [12.476]**	0.512 [9.107]**	0.773 [10.228]**	0.176 [4.712]**
Profit/Asset Ratio	1.111 [5.684]**	0.699 [4.417]**	1.506 [7.682]**	0.358 [1.677]*	-0.357 [-3.441]**
Stock Price	-0.022 [-0.239]	-1.062 [-6.756]**	-0.514 [-3.952]**	-1.280 [-3.040]**	0.019 [0.288]
Hausman test (P-value)	4.389 [0.222]	41.152 [0.000]	11.749 [0.008]	29.153 [0.000]	64.717 [0.000]

Notes 1) t-values are in parentheses.
2) * = significant at 5% level, ** = significant at 2.5% level.

Table 3 Determinants of the Long-Term Debt Ratio: The first and the second sections

(i) The first section in the Tokyo Stock Exchange

(1) Fixed Effect Model

	iron & steel	chemicals	non- ferrous	transportation	electric
Debt/Asset Ratio	0.503 [5.029]**	0.613 [12.500]**	0.659 [8.852]**	0.702 [7.745]**	0.047 [0.950]
Profit/Asset Ratio	1.132 [4.152]**	0.331 [1.782]*	1.659 [6.066]**	-0.615 [-2.389]**	-0.685 [-5.141]**
Stock Price	0.013 [0.130]	-0.825 [-5.023]**	-0.519 [-3.661]**	-1.294 [-2.481]**	-0.028 [-0.308]

(2) Random Effect Model

	iron & steel	chemicals	non- ferrous	transportation	electric
Debt/Asset Ratio	0.479 [5.246]**	0.502 [10.984]**	0.598 [8.482]**	0.591 [6.845]**	-0.059 [-1.274]
Profit/Asset Ratio	1.194 [4.445]**	0.609 [3.452]**	1.642 [6.113]**	-0.463 [-1.838]*	-0.504 [-3.905]**
Stock Price	0.010 [0.098]	-0.828 [-5.079]**	-0.510 [-3.623]**	-1.350 [-2.596]**	-0.009 [-0.106]
Hausman test (P-value)	2.179 [0.536]	42.823 [0.000]	10.772 [0.013]	18.549 [0.000]	50.909 [0.000]

Table 3 Determinants of the Long-Term Debt Ratio: The first and the second sections

(ii) The second section in the Tokyo Stock Exchange

(1) Fixed Effect Model

	iron & steel	chemicals	non- ferrous	transportation	electric
Debt/Asset Ratio	0.546 [2.822]**	0.658 [6.510]**	0.359 [3.754]**	1.524 [9.572]**	0.728 [12.053]**
Profit/Asset Ratio	0.973 [3.401]**	0.722 [1.956]**	1.277 [4.411]**	1.920 [4.957]**	-0.091 [-0.556]
Stock Price	-0.352 [-1.253]	-3.057 [-6.007]**	-0.709 [-1.950]*	-1.305 [-1.935]*	-0.052 [-0.558]

(2) Random Effect Model

	iron & steel	chemicals	non- ferrous	transportation	electric
Debt/Asset Ratio	0.592 [3.254]**	0.565 [6.377]**	0.345 [3.717]**	1.312 [9.019]**	0.670 [11.553]**
Profit/Asset Ratio	1.023 [3.638]**	0.963 [2.765]**	1.218 [4.250]**	2.202 [5.900]**	-0.089 [-0.551]
Stock Price	-0.343 [-1.228]	-3.039 [-6.015]**	-0.648 [-1.792]*	-1.447 [-2.169]**	-0.032 [-0.349]
Hausman test (P-value)	1.018 [0.797]	4.326 [0.228]	5.522 [0.137]	3.060 [0.382]	13.800 [0.003]

Notes 1) t-values are in parentheses.
2) * = significant at 5% level, ** = significant at 2.5% level.

Table 4 Determinants of the Long-Term Debt Ratio: Net Worth and Net Cash Flow

(A) Net Worth

(1) Fixed Effect Model

	iron & steel	chemicals	non- ferrous	transportation	electric
Fixed Asset	0.624 [5.355]**	0.164 [2.109]**	0.311 [2.937]**	-0.655 [-6.384]**	0.083 [0.839]
Net Worth	-0.453 [-5.211]**	-0.624 [-14.034]**	-0.612 [-9.897]**	-0.827 [-10.331]**	-0.271 [-6.800]**
Profit/Asset Ratio	1.046 [5.376]**	0.429 [2.576]**	1.614 [8.11]**	0.004 [0.020]	-0.485 [-4.559]**
Stock Price	-0.013 [-0.139]	-1.057 [-6.675]**	-0.505 [-3.842]**	-1.516 [-3.620]**	-0.002 [-0.026]

(2) Random Effect Model

	iron & steel	chemicals	non- ferrous	transportation	electric
Fixed Asset	0.612 [5.901]**	0.192 [2.634]**	0.285 [2.87]**	-0.560 [-5.802]**	0.225 [2.491]**
Net Worth	-0.431 [-5.353]**	-0.517 [-12.608]**	-0.564 [-9.577]**	-0.722 [-9.604]**	-0.186 [-4.931]**
Profit/Asset Ratio	1.077 [5.615]**	0.703 [4.449]**	1.552 [7.919]**	0.204 [0.965]	-0.346 [-3.336]**
Stock Price	-0.019 [-0.210]	-1.05 [-6.685]**	-0.489 [-3.766]**	-1.574 [-3.773]**	0.018 [0.272]
Hausman test (P-value)	2.413 [0.660]	45.139 [0.000]	13.566 [0.009]	36.099 [0.000]	81.889 [0.000]

Notes 1) t-values are in parentheses.

2) * = significant at 5% level, ** = significant at 2.5% level.

Table 4 Determinants of the Long-Term Debt Ratio: Net Worth and Net Cash Flow

(B) Net Cash Flow

(1) Fixed Effect Model

	iron & steel	chemicals	non- ferrous	transportation	electric
Fixed Asset	0.685 [5.795]**	0.127 [1.524]	-0.005 [-0.051]	-0.656 [-6.000]**	0.003 [0.261]
Net Cash Flow	-3.192 [-1.325]	-0.759 [-2.985]**	-0.572 [-2.381]**	-1.595 [-5.203]	-0.552 [-4.412]**
Profit/Asset Ratio	0.813 [3.99]**	1.131 [5.934]**	1.207 [5.778]**	0.870 [3.402]**	-0.234 [-1.901]*
Stock Price	-0.02 [-0.213]	-0.885 [-5.345]**	-0.472 [-3.451]**	-0.610 [-1.367]	0.100 [1.477]

(2) Random Effect Model

	iron & steel	chemicals	non- ferrous	transportation	electric
Fixed Asset	0.687 [6.572]**	0.184 [2.367]**	0.016 [0.165]	-0.514 [-4.942]**	0.192 [2.136]**
Net Cash Flow	-0.357 [-1.494]	-0.699 [-2.808]**	-0.413 [-1.759]*	-1.343 [-4.484]**	-0.506 [-4.087]**
Profit/Asset Ratio	0.841 [4.19]**	1.16 [6.273]**	1.112 [5.401]**	0.909 [3.624]**	-0.125 [-1.041]
Stock Price	-0.016 [-0.171]	-0.859 [-5.247]**	-0.433 [-3.204]**	-0.785 [-1.772]*	0.099 [1.469]
Hausman test (P-value)	2.986 [0.560]	7.246 [0.124]	21.533 [0.000]	29.488 [0.000]	49.773 [0.000]

Notes 1) t-values are in parentheses.
2) * = significant at 5% level, ** = significant at 2.5% level.

Table 5 Determinants of the Long-Term Debt Ratio: Before and After 1980

(I) Before 1980

(1) Fixed Effect Model

	iron & steel	chemicals	non- ferrous	transportation	electric
Debt/Asset Ratio	-0.065 [-0.451]	-0.153 [-1.575]	-0.101 [-1.042]	0.143 [0.955]	0.102 [1.031]
Profit/Asset Ratio	0.098 [0.504]	0.559 [2.957]**	0.559 [2.563]**	-0.643 [-1.708]*	0.734 [3.769]**
Stock Price	0.07 [1.208]	0.201 [1.476]	-0.103 [-0.565]	-1.112 [-2.295]**	0.022 [0.187]

(2) Random Effect Model

	iron & steel	chemicals	non- ferrous	transportation	electric
Debt/Asset Ratio	0.131 [1.047]	-0.141 [-1.737]*	-0.037 [-0.404]	0.124 [0.927]	0.098 [1.125]
Profit/Asset Ratio	0.243 [1.320]	0.536 [2.975]**	0.636 [3.017]**	-0.397 [-1.120]	0.733 [3.916]**
Stock Price	0.079 [1.372]	0.184 [1.369]	-0.075 [-0.414]	-1.126 [-2.346]**	0.032 [0.270]
Hausman test (P-value)	10.084 [0.018]	0.867 [0.834]	4.178 [0.243]	4.019 [0.259]	1.330 [0.722]

Notes 1) t-values are in parentheses.
2) * = significant at 5% level, ** = significant at 2.5% level.

Table 5 Determinants of the Long-Term Debt Ratio: Before and After 1980

(ii) After 1980

(1) Fixed Effect Model

	iron & steel	chemicals	non- ferrous	transportation	electric
Debt/Asset Ratio	0.295 [2.642]**	0.514 [8.823]**	0.272 [3.299]**	0.716 [6.182]**	0.460 [8.098]**
Profit/Asset Ratio	1.235 [4.311]**	-0.115 [-0.481]	1.078 [4.113]**	0.237 [0.846]	-0.828 [-6.065]**
Stock Price	-0.146 [-0.698]	-0.996 [-4.279]**	-0.165 [-1.152]	-1.048 [-2.020]**	-0.000 [-0.011]

(2) Random Effect Model

	iron & steel	chemicals	non- ferrous	transportation	electric
Debt/Asset Ratio	0.287 [2.873]**	0.380 [7.272]**	0.222 [2.946]**	0.525 [5.054]**	0.230 [4.455]**
Profit/Asset Ratio	1.373 [4.964]**	0.152 [0.677]	1.055 [4.105]**	0.343 [1.251]	-0.564 [-4.308]**
Stock Price	-0.141 [-0.698]	-0.986 [-4.326]**	-0.141 [-0.994]	-1.201 [-2.336]**	0.050 [0.715]
Hausman test (P-value)	4.245 [0.236]	32.588 [0.000]	6.198 [0.102]	17.680 [0.001]	103.76 [0.000]

Notes 1) t-values are in parentheses.
2) * = significant at 5% level, ** = significant at 2.5% level.