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# Dynamic Capital Structure of Japanese Firms:

## How Far Has the Reduction of Excess Leverage Progressed in Japan?

Shinichi Nishioka*

Naohiko Baba**
naohiko.baba@boj.or.jp

Bank of Japan
2-1-1 Nihonbashi Hongoku-cho, Chuo-ku, Tokyo 103-8660

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* Financial Markets Department (currently, Personnel and Corporate Affairs Department)

** Financial Markets Department

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Shinichi Nishioka* and Naohiko Baba**

**Abstract**

This paper investigates the dynamics of capital structure of Japanese firms since the early 1990s to shed light on how far the reduction of excess leverage has progressed so far in Japan. Our main findings are as follows. First, the trade-off theory provides an appropriate framework to assess this issue after controlling for various variables as proxies for other hypotheses including governance structure, the pecking order theory, and market timing hypothesis. Among such variables, profitability as a proxy for the pecking order theory has significant explanatory power. Second, governance structure significantly influences the speed at which firms adjust their leverage ratios toward optimal ones. In particular, the higher the shareholding ratio of overseas investors, the more quickly market-value leverage ratios adjust. Third, implied excess leverage ratios show a marked contrast between the firms in good credit standing and others. Reduction of excess leverage by highly-rated firms has substantially progressed so far, while others still have a long way to go.

*Keywords*: Capital Structure, Leverage, Trade-off Theory, Pecking Order, Corporate Governance, Market Timing, Panel Data, Dynamic GMM

*JEL* classification: C23, G32

*Financial Markets Department (currently, Personnel and Corporate Affairs Department)
**Financial Markets Department *e*-mail: naohiko.baba@boj.or.jp

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## 1. Introduction

Japanese firms have continued to reduce their interest-bearing liabilities since the late 1990s. Many researchers assert that Japanese firms have done so due to lack of promising investment opportunities as well as firms' restructuring efforts toward the reestablishment of creditworthiness after the bursting of the bubble economy in the early 1990s. How long Japanese firms will continue to do so is among the most important issues relevant to decision-making bodies of both monetary policy and bank management in Japan. Theoretically, this issue should be examined under the framework of optimal capital structure, which searches for the optimal mix of debt and capital in each firm. This paper attempts to address the issue by empirically assessing the relative position of Japanese firms' actual debt-equity (leverage) ratios versus their optimal ones.

The modern theory of capital structure started with the seminal paper of Modigliani and Miller [1958]. Under the MM theorem, the choice between equity and debt is irrelevant to the value of the firm. Put differently, the theorem indicates the direction that other hypotheses on capital structure should take by showing under what conditions capital structure is irrelevant. Such hypotheses include the trade-off theory, the pecking order theory, market timing hypothesis, among others.

So far, many attempts have been made to empirically investigate how the capital structure of U.S. firms is determined. These attempts resulted in poor performance in its purest form of the trade-off theory, with only tax shields and default probabilities as explanatory variables. Following these empirical findings, a series of studies initiated by Jensen and Meckling [1976] emphasize the role of conflicts of interest among various stakeholders such as shareholders, debt holders, and managers. This line of research shows the importance of controlling for governance structure in empirically exploring the determinants of capital structure.

In the case of Japanese firms, however, little research has been conducted so far.

Notable exceptions are Prowse [1990], Rajan and Zingales [1998], and Hirota [1999]. First, Prowse [1990] finds that leverage ratios of U.S. firms are negatively correlated with proxy variables for agency costs, whereas those of Japanese firms do not show such tendency. His interpretation is that agency problems are mitigated by financial institutions' active monitoring in Japan. In contrast, Rajan and Zingales [1995] show that Japan and the United States have a very similar pattern in terms of the explanatory power and directions of variables. Finally, Hirota [1999] finds that the capital structure of Japanese firms is significantly influenced by some "real" factors as well as institutional factors. Specifically, significant real factors include profitability and firm size, while institutional factors include the share of borrowings from main banks in total liabilities and whether or not the firm belongs to any *keiretsu* groups.[1] He analyzes the latest period of these studies (from 1977 to 1992), so the analysis of post-bubble period is still missing.

Motivated by the above discussion, this paper attempts to investigate the determinants of capital structure of Japanese firms using a panel data set comprising about 700 firms listed on the first section of the Tokyo Stock Exchange since the early 1990s. Theoretically, we adopt the trade-off theory as a basic framework, controlling for various effects implied by alternative hypotheses including governance structure, the pecking order theory, and market timing hypothesis. Empirically, we employ a partial adjustment mechanism as in Banerjee et al. [2000] to consider transaction costs, and therefore lags, in adjusting toward an optimum as emphasized by Myers [1984].[2] Using this specification enables us to cope with a possible criticism that the observed leverage ratios are not necessarily the optimal ones. Also, in our model, the coefficient of adjustment speed toward optimal leverage ratios is specified as a function of shareholding ratios by investor category, such as overseas investors and large investors as proxies for governance structure.

[1] *Keiretsu* groups are industrial groups in which firms are closely linked through reciprocal shareholdings, participation in presidential clubs, among others.
[2] Banerjee et al. [2000] use conventional methodologies of panel analysis like fixed effects model to estimate their dynamic model, which does not necessarily assure consistency and unbiasedness. We will discuss this issue in section 3.

The rest of the paper is organized as follows. Section 2 briefly reviews the theories of capital structure. Section 3 specifies the model and empirically examines it. Section 4 investigates how far the reduction of excess leverage has progressed so far in Japan by computing each sample firm's excess leverage ratios from the estimation results. Section 5 concludes the paper.

## 2. Theories of Capital Structure

### 2.1 The Trade-off Theory

In perfect and efficient markets, Modigliani and Miller [1958] show that capital structure is irrelevant to the cost of capital, and thus firm value (MM theorem). The trade-off theory argues for the existence of an optimal capital structure by adding various imperfections to capital markets assumed by the MM theorem, but retaining the assumptions of market efficiency and symmetric information. Major imperfections that lead to an optimal capital structure are as follows. First, higher taxes on dividends lead to more leverage, as suggested by Modigliani and Miller [1958] and Miller and Scholes [1978]. Second, higher costs of financial distress lead to more equity. These two imperfections constitute the trade-off between benefits and costs from borrowing.

### 2.2 Other Hypotheses on Capital Structure[3]

#### 2.2.1 Agency Costs and Governance Structure

Initiated by Jensen and Meckling [1976], researchers have been devoted significant efforts to models where capital structure is influenced by agency costs stemming from conflicts of interest, which the simple trade-off theory assumes away. Jensen and Meckling [1976]

[3] For a comprehensive survey on the determinants of capital structure, see Harris and Raviv [1991], for instance.

identify two types of conflicts. First, conflicts of interest can arise between shareholders and managers since managers hold less than 100 percent of the residual claims. Consequently, they do not capture the entire gain from their profit-enhancing activities, but instead bear the entire cost of these activities. For instance, managers can invest less effort in managing firm resources and may be able to transfer firm resources to their personal benefit by consuming "perquisites." This inefficiency is reduced as the fraction of the firm's equity owned by managers increases. Put differently, shareholders monitor the efforts exerted by managers to mitigate the inefficiency. Generally speaking, the larger the shareholding ratio of large investors, the more effective their monitoring. This leads to less chance for conflicts of interest. Also, in the recent Japanese case, many stock market observers argue that overseas investors are much more conscious about monitoring managers' efforts toward maximizing firm value than are domestic Japanese investors.[4]

Second, conflicts of interest can arise between debt holders and equity holders since debt contracts give equity holders incentives to invest sub-optimally. Specifically, debt contracts provide that if an investment yields large returns, well above the face value of the debt, equity holders capture most of the returns. If, however, the investment fails, debt holders bear the costs due to limited liability. As a result, equity holders may benefit from investing in highly risky projects, even if they decrease firm value.

### 2.2.2 The Pecking Order Theory

The pecking order theory initiated by Myers [1984] predicts no well-defined target debt-equity mix.[5] Myers and Majluf [1984] show that outside investors discount a firm's equity

[4] For a long time, reciprocal shareholdings were dominant in Japan. This is where a small number of banks were major shareholders of a large number of firms, which in turn owned bank shares. Based on this structure, banks played a major role in corporate governance by providing discipline and support to firms' management through monitoring. The cross-shareholding ratio, however, has substantially and steadily declined since the early 1990s. NLI Research Institute, for instance, estimated that the ratio declined to 7.4 percent as of FY 2002 from 18.0 percent as of FY 1990 on a value basis. This has lowered banks' influence on corporate governance.

[5] To be more precise, if there is an optimum, the cost of deviating from the optimum is insignificant

price when managers issue equity instead of debt. To avoid such a discount, managers hesitate to use equity if possible. Specifically, they first use up internal funds. Then if external finance is needed, they issue the safest security. That is, they start with debt, next possibly use hybrid securities such as convertible bonds, then equity as a last resort. In this theory, there is no well-defined optimal leverage ratio, since there are two kinds of equity, internal and external, one at the top of the pecking order and one at the bottom. This theory suggests that in the absence of promising investment opportunities, firms tend to retain profits to build up internal funds with a view to avoiding the need to raise external finance in the future.

### 2.2.3 Market Timing Hypothesis

"Equity market timing" refers to the practice of issuing equities at high prices and repurchasing them at low prices to exploit temporary fluctuations in the costs of equity relative to the costs of other fund-raising measures. In the efficient and integrated capital markets assumed by the MM theorem, the costs of different forms of capital do not vary independently and thus no gain can be obtained from opportunistically switching between debt and equity. Also, according to the trade-off theory, when equity prices rise, market value of leverage ratios fall and firms try to raise leverage ratios by increasing debt and/or repurchasing equity. Thus, the market timing hypothesis predicts the opposite direction of the trade-off theory. In practice, many market participants point out that firms tend to issue equities instead of debts when market value is high, relative to book value and past market values, and tend to repurchase them when market value is low. In a recent paper, Baker and Wurgler [2002] show that current capital structure is strongly related to historical market values in the United States. This suggests that capital structure is the cumulative outcome of the past attempts to time the equity market, contrary to what the trade-off theory predicts.

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when compared to the cost of raising external finance.

# 3. Empirical Analysis

## 3.1 Model Specification

We assume that each firm only partially adjusts its leverage ratio toward an optimal one in each period. Since the optimal leverage ratio cannot be observed directly, however, we need to devise model specifications in which the determination of the optimal leverage ratio is implicitly involved.

First, we implicitly specify the optimal leverage ratio as follows:

$$d_{it}^{*} = \beta_0 + \beta_1 x_{1it} + \beta_2 x_{2it} + \cdots + \beta_K x_{Kit}, \qquad i = 1 \cdots I, \quad t = 1 \cdots T \tag{1}$$

where $d_{it}^{*}$ denotes the optimal leverage ratio of the $i$-th firm in period $t$ and $x_{kit}$ denotes the $k$-th variable that determines the optimal leverage ratio of the $i$-th firm in period $t$.[6] The trade-off theory states that $x_{kit}$ includes such proxy variables for equity cost, tax shield, and default probability. The preceding discussion suggests, however, that we need to include variables that capture the effects of alternative hypotheses.

Next, we introduce a partial-adjustment process to explicitly consider a lagged response toward an optimum.[7] The rationale behind this assumption is that firms face various transaction costs ranging from legal and investment banking fees to maintaining the relationships with banks, which keep them from immediately adjusting their leverage ratios to optimal ones. Specifically, we use the following specification:

$$d_{it} - d_{it-1} = \lambda_{it}\left(d_{it}^{*} - d_{it-1}\right),$$

where $\lambda_{it}$ denotes the coefficient of adjustment speed of the $i$-th firm in period $t$. This specification enables us to derive excess leverage ratios defined as the difference between

[6] Most empirical studies directly estimate equation (1) by regarding actual leverage ratios as optimal ones. It is natural to think, however, that the former differs from the latter. Therefore, such a specification does not enable us to derive any implications about firms' optimal leverage ratios and the adjustment process toward them.

[7] A similar specification appears in Banerjee et al. [2000]. Myers [1984] emphasizes the importance of costs in adjusting leverage ratios.

actual and optimal leverage ratios as follows:

$$d_{it} - d_{it}^{*} = (1 - \lambda_{it})(d_{it-1} - d_{it}^{*}). \tag{2}$$

Also, we specify the coefficient of adjustment speed as follows:

$$\lambda_{it} = \gamma_0 + \gamma_1 z_{1it} + \gamma_2 z_{2it} + \cdots + \gamma_L z_{Lit}, \tag{3}$$

where $z_{lit}$ denotes the $l$-th variable that influences the coefficient of adjustment of the $i$-th firm in period $t$. From equations (1) and (3), equation (2) can be rewritten as

$$\begin{aligned} d_{it} - (\beta_0 + \beta_1 x_{1it} + \cdots + \beta_K x_{Kit}) = [1 - (\gamma_0 + \gamma_1 z_{1it} + \cdots + \gamma_L z_{Lit})] \\ \times [d_{it-1} - (\beta_0 + \beta_1 x_{1it} + \cdots + \beta_K x_{Kit})] + \eta_i + \varepsilon_{it}. \end{aligned} \tag{4}$$

Notice, here, that we add $\eta_i$, the constant term of the $i$-th firm, and $\varepsilon_{it}$, the error term for the $i$-th firm in period $t$. We estimate equation (4) by Generalized Methods of Moment (GMM) proposed by Hansen [1982] after taking the first-order difference since the right hand side of equation (4) includes the lagged dependent variable.[8] We used one- and two-period lagged independent variables, except for dummy variables, as instrumental variables. To assess an overall fitting of the model, we employ Hansen's [1982] test of over-identifying restrictions (the OI test). The OI test is based on the property that *J*-statistics, loss function of GMM multiplied by the number of observations, follows the chi-square distribution with the degree of freedom equal to the number of orthogonal conditions minus the number of estimated parameters. *J*-statistics are significant when the model specification is inappropriate in terms of a model's overall fitting. Also, for comparison, we directly estimate equation (1) by substituting observed leverage ratios for optimal ones, as frequently employed in preceding studies.

[8] Since the lagged dependent variables are correlated with the error term, parameters estimated by the conventional panel data methodologies, such as a fixed effects model, lack desirable properties such as consistency and unbiasedness. We can avoid these biases by using GMM after taking the first-order difference. For details, see Baltagi [2001]. The dynamic GMM employed in this paper is proposed by Arellano and Bond [1991].

### 3.2 Choice of Variables

#### 3.2.1 Determinants of Optimal Leverage Ratios

First, we define the leverage ratio $d_{it}$ as total debt divided by the sum of total debt and (i) the market value of equity, the product of the stock price and the number of outstanding shares and (ii) the book value of equity. Total debt is defined as the sum of short-term and long-term loans, commercial paper, corporate bonds, and convertible bonds. Next, we use the following variables as independent variables in equation (1). Expected signs are shown in parentheses.

(i) Equity cost (+): beta of the Capital Asset Pricing Model (CAPM) computed from daily stock returns in the past three years.

(ii) Debt cost (-): interest expenses multiplied by 1 minus the corporate tax rate.[9]

(iii) Volatility of firm value (-): standard deviation of daily stock returns in the past three years.

(iv) Ratio of tangible assets (+): the ratio of tangible assets to total assets. Tangible assets include plant, property, and equipment.

(v) Firm size (+/-): the logarithm of the market value of total assets.

(vi) Profitability (+/-): the ratio of pre-tax profits to total assets

(vii) Market-to-book ratio (+/-): the ratio of market value to book value of equity

(viii) Time dummies: from 1993 to 2003 (FY: fiscal year).

(ix) Industry dummies: construction, electricity and gas, transportation, information and communication, wholesale, retail, finance, real estate and service.

[9] It reflects the deductibility of interest payments. The corporate tax rate was 50 percent until FY 1998 and has been 40 percent ever since.

CAPM states that equity cost for the $i$-th firm is derived as the formula $r_f + \beta_i \times (r_M - r_f)$, where $r_f$ denotes the risk-free interest rate and $r_M$ denotes the market portfolio return. Beta $\beta$ completely captures the differences in equity costs among firms. Thus, we use beta as a proxy for equity cost.[10] The expected sign of beta is positive since the higher the beta (equity risk premium), the higher the optimal leverage ratio. On the other hand, the expected sign of debt cost is negative since the higher the debt cost, the lower the optimal leverage ratio. The volatility of firm value is used as a proxy for default risk premium. The default probability models as in Merton [1974] state that a higher volatility results in a higher default probability, so the expected sign is negative.

Rajan and Zingales [1995] show that the ratio of tangible assets, firm size, and profitability were significant in explaining corporate capital structure in developed countries. Tangible assets may be used as collateral and are therefore associated with higher leverage. Firm size may increase leverage if large firms are less likely to enter financial distress.[11] Alternatively, firm size can be interpreted as a proxy for the degree of informational asymmetry. Based on this hypothesis, a larger firm is associated with a lower degree of informational asymmetry between equity and debt holders, which lowers leverage. Finally, profitability is associated with the availability of internal funds and thus, less leverage as suggested by the pecking order hypothesis. Another hypothesis is that profitable firms face more free cash flow problems, in which case effective governance might call for more leverage, as suggested by Jensen [1986]. Consequently, the total effects of firm size and profitability should be assessed empirically.

The market-to-book ratio is used as a proxy for investment opportunities. Firms with high market-to-book ratios tend to grow quickly. This variable often appears in under-investment as emphasized by Myers [1977] and Stulz [1990]: highly leveraged firms tend to

[10] Many studies use dividend yield as a proxy for equity cost. In theory, however, dividend yield corresponds to equity cost only in the case of steady state where stock price will not change.
[11] In general, large firms are less likely to be in financial distress since their assets tend to be more diversified.

pass up promising projects. Thus, firms with high market-to-book ratios tend to lower leverage. The market timing hypothesis also indicates a negative sign because firms with high market-to-book ratios have an incentive to take advantage of high/low equity prices to issue/repurchase equities. On the other hand, the default probability theory by Merton [1974] implies a positive sign since a higher market-to-book ratio shows a higher expected growth rate of firm value. The total effects from these factors should be judged empirically.

### 3.2.2 Coefficient of Adjustment Speed

The following variables are used as $\lambda_{it}$ in equation (3) to capture the structure of corporate governance. Expected signs are shown in parentheses.

(i) Shareholding ratio of financial institutions[12] (+/-)

(ii) Shareholding ratio of overseas investors (+)

(iii) Shareholding ratio of the ten largest investors (+)

The use of each ratio is based on our hypothesis that the speed at which actual leverage ratios are adjusted toward optimal ones depends on the structure of corporate governance. Each ratio is supposed to reflect the degree to which each investor category is involved in corporate governance. The hypothesis regarding the ratios of overseas and large investors is straightforward: they are much more sensitive to the maximization of firm value than are other investors. Thus, the higher the ratio of overseas and large investors, the higher the adjustment speed.

It should be noted, however, that the coefficient sign on the shareholding ratio of financial institutions cannot be determined *a priori*. In our dataset, financial institutions

[12] Financial institutions consist of long-term banks, city banks, regional banks, trust banks, investment trusts, pension funds, insurance companies, among others.

include institutional investors such as life insurance companies and pension funds, as well as debt holders like banks. If we assume that there are conflicts of interest between debt and equity holders, then the stronger the governance of banks as debt holders, the lower the adjustment speed. This is because debt holders are less sensitive to the maximization of firm value than are equity holders. Thus, the sign should be negative. Institutional investors, however, put priority on the equity holders' perspective. Thus, if the governance of institutional investors dominates over that of banks, the sign should be positive.

We obtained the data from each firm's annual financial statement through the AMSUS (Asset Management Support System) database provided by Quick Corp. The sample period is from FY 1992 to FY 2003, and we restricted sample firms to those listed on the first section of the Tokyo Stock Market that continued to disclose financial statements throughout this period. We ended up with a balanced panel data set consisting of 691 firms.

Table 1 shows some summary statistics of the data. We show both market and book values in the table for leverage ratio, profitability, firm size, and the ratio of tangible asset whose denominators are total assets. Figure 1-1 shows simple averages of leverage ratios by credit rating.[13] Note that the leverage ratio of highly-rated firms is lower than that of lower-rated firms. This result is apparently inconsistent with the simple trade-off theory. It can be consistently interpreted, however, if we note the following points: (i) highly-rated firms can access the equity market more easily than others due to the lower degree of informational asymmetry between managers and investors, and (ii) credit rating companies tend to put great importance on the leverage ratio in determining credit ratings. This is commonly observed in developed countries as reported in Rajan and Zingales [1995].

[13] The credit ratings used in this paper are from Rating and Investment Information, Inc (R&I). We used the ratings as of FY 1998 as the data before, too, due to lack of the credit ratings before FY 1998. The number of firms by credit rating is in the table below.

| | FY 1998 | FY 1999 | FY 2000 | FY 2001 | FY 2002 | FY 2003 |
|---|---|---|---|---|---|---|
| A or higher | 245 | 238 | 189 | 184 | 168 | 163 |
| Below A | 129 | 136 | 144 | 148 | 144 | 134 |
| No ratings | 317 | 317 | 358 | 359 | 379 | 394 |

Figure 1-2 shows simple averages of some explanatory variables by credit rating. Beta and volatility of highly-rated firms are lower, while the level and the trend of debt cost are very similar across credit ratings. Also, the shareholding ratio of overseas investors of highly-rated firms rose recently.

### 3.3 Estimation Results

#### 3.3.1 Empirical Results on a Market-Value Basis

Table 2-1 reports GMM estimation results on a market-value basis.[14] We tested five specifications to assess the robustness of estimation results. The OI test accepts specifications 1 to 4 that adopts a partial adjustment mechanism, while it rejects specification 5 without it. This result suggests the appropriateness of the partial adjustment mechanism in terms of an overall fitting of the model. Now, let us take a closer look at estimated coefficient in turn.

First, equity and debt costs have expected signs and are significant in most cases. Volatility of firm value as a proxy for default probability has a significantly negative sign as expected in all cases. The robust estimation results of these three variables indicate the empirical validity of the trade-off theory as a basic framework.

Second, let us look at the control variables proposed by Rajan and Zingales [1995]. Profitability has a significantly negative sign in all cases. This means that profitability should be interpreted as a proxy for the availability of internal funds as suggested by the pecking order theory, not as a proxy for free cash flow problems. Firm size has a negative sign, which means that it represents the degree of informational asymmetry, rather than default probability. Also, the ratio of tangible assets has a negative sign in all cases. This is

[14] Estimation results of industrial dummies are not reported due to space limitations. The industries with dummy coefficients significant at the 10 percent level are service (negative sign) and construction (positive sign) on a market-value basis and construction (negative sign) and transportation (positive sign) on a book-value basis.

predicted by the hypothesis that firms with high tangible asset ratios tend to raise leverage due to the abundance of assets they can easily put up as collateral.

Third, the sign of the market-to-book ratio is negative in all cases, although insignificant in some cases. This result implies that the negative effects implied by both under-investment and market timing hypotheses are somewhat dominant, although those effects are almost cancelled out by the positive effect from a decline in the default probability in some cases.

Finally, all of the coefficients of adjustment speed $\lambda_{it}$ are significantly positive. The significantly positive coefficient on the shareholding ratio of financial institutions implies that institutional investors such as pension funds and insurance companies have more influence on corporate governance as equity holders than do debt holders like banks. The significantly positive coefficients on the shareholding ratio of overseas and large investors are as predicted by our hypothesis that these categories of investors have more incentives to maximize firm value by strengthening corporate governance through effective monitoring as equity holders.

### 3.3.2 Empirical Results on a Book-Value Basis

Table 2-2 reports GMM estimation results based on a book-value basis. As in the case of a market-value basis, the OI test rejects specification 5 without a partial adjustment mechanism, accepting all other specifications with it. Also, equity and debt costs, and volatility of firm value have expected signs and are significant in most cases. This result indicates the validity of the trade-off theory in the case of the book-value basis, as well.

The results of the control variables differ in some respects from a market-value basis. First, the coefficients on firm size and the ratio of tangible assets are both significant, but their signs differ. Specifically, firm size has a positive sign, which suggests that firm size

can be interpreted as a proxy for default probability, not as a proxy for the degree of informational asymmetry. Next, the ratio of tangible assets has a negative sign, which is not predicted by the hypothesis of the availability of collateral. Matsuura [2002] reports a similar result in this respect. Also, the coefficient of the market-to-book ratio is instable and insignificant. On the other hand, profitability has a significantly negative coefficient, as expected by the pecking order theory as in the case of a market-value basis.

Unlike the results based on a market-value basis, the coefficients of adjustment speed $\lambda_{it}$ have a significantly negative sign for the shareholding ratio of overseas investors, while the signs for both financial institutions and large investors are significantly positive, as in the case of a market-value basis. This might reflect the tendency of overseas investors to have a stronger preference for current value accounting than domestic Japanese investors.

## 4. Deriving Excess Leverage Ratios of Japanese Firms

In this section, we examine excess leverage ratios of Japanese firms, defined as the difference between actual and optimal leverage ratios. From equation (2), excess leverage ratios can be computed as follows:

$$d_{it} - d_{it}^{*} = (1 - \lambda_{it})(d_{it-1} - d_{it}^{*}).$$

We computed the ratios by substituting the estimated values of $\lambda_{it}$ and $d_{it}^{*}$ derived from specification 1 into the right-hand side of the above equation. Figure 2 shows simple averages of the excess leverage ratios by credit rating.[15] The average excess leverage ratio of

[15] The table below shows the excess leverage ratios by industry. The figures are simple averages between FY 1992 and FY 2003, and those in parentheses are the ratios as of FY 2003. (%)

| | Manufacturing | Construction | Electricity and gas | Transportation | Information and communication |
|---|---|---|---|---|---|
| Market Value | 4.2 (5.8) | 22.3 (22.0) | 52.9 (48.3) | 15.8 (17.1) | 7.9 (9.7) |
| Book Value | 1.9 (3.0) | 1.3 (4.0) | 42.0 (44.9) | 0.7 (1.3) | -2.9 (-3.1) |
| | Wholesale | Retail | Finance | Real estate | Service |
| Market Value | 1.9 (4.9) | 0.8 (3.9) | 3.5 (6.3) | -6.1 (-4.1) | 25.2 (25.2) |
| Book Value | 3.6 (4.8) | 3.6 (5.6) | 7.3 (7.6) | 1.3 (1.6) | 0.2 (2.3) |

firms rated A or higher has been on a steady downtrend since the early 1990s on a market-value basis. On the book-value basis, it declined sharply around 1998, almost reaching neutral territory recently. On the other hand, the average excess leverage ratio of firms with credit ratings of below A rose until around 2000 and has been stable on a market-value basis ever since. The ratio on a book-value basis also rose toward the year 2000 and has been on a downtrend. The average excess leverage ratio of firms with no credit ratings shows a fluctuation similar to that of firms with ratings of below A on a market-value basis, while on a book-value basis, it has been on an uptrend since the early 1990s.

Figure 3 shows the transition of distributions of excess leverage ratios by credit rating from FY1992 to FY 2003. The distribution of firms with ratings of A or higher has moved leftward since 1992, lowering the share of firms with excess leverage. In contrast, as for firms with ratings of below A and no ratings, the distribution shapes have not significantly changed, particularly on a market-value basis.

To summarize, we can confirm a marked contrast between highly-rated firms and others in terms of the progress of reduction in excess leverage. Firms in good credit standing have continued to reduce leverage using free cash flow generated by cost-reducing measures since the early 1990s as part of their restructuring efforts. They have now almost reached the final stage, while firms in lower credit standing will continue to struggle hard to reduce their excess debt burden. This finding is consistent with views shared by many market practitioners including bank loan officers.

Finally, Figure 4 shows simple averages of coefficients of adjustment speed by credit rating implied by the empirical results from specification 1. The coefficient of adjustment speed for firms with high credit ratings is higher on level, and recently, the differences from the coefficients for other categories of firms have tended to widen on both a market-value and a book-value basis. Other noteworthy points here are the influence of overseas investors on the coefficients on a market-value basis, as well as that of large investors on a book-value basis. The adjustment coefficients seem to have moved

almost in tandem with the ratios of overseas and large investors, respectively (see also Figure 1-2). This result is consistent with views shared by stock market practitioners and analysts that overseas investors are much more conscious than domestic Japanese investors about maximizing firm value in which they invest.

## 5. Concluding Remarks

In this paper, we empirically examined the determinants of capital structure of Japanese firms since the early 1990s using a panel data set consisting of about 700 firms listed on the first section of the Tokyo Stock Exchange. We employed a partial adjustment mechanism to consider transaction costs in adjusting toward an optimum, which is specified as a function of governance structure in each firm.

Our main findings are summarized as follows. First, the trade-off theory provides an appropriate framework to assess the capital structure of Japanese firms since the early 1990s, after controlling for various effects implied by other hypotheses such as the pecking order theory, governance structure, and market timing hypothesis. Second, among these control variables, profitability has high explanatory power as a proxy for the pecking order theory. Third, the specification with a partial adjustment mechanism shows better performance in terms of an overall fitting than the one without it. Fourth, governance structure significantly influences the speed at which firms adjust their leverage ratios toward optimal ones. Particularly, a rise in the shareholding ratio of overseas investors leads to a rise in the adjustment speed on a market-value basis. Finally, excess leverage ratios derived by the estimation results show a marked contrast between firms in good credit standing and others regarding the degree of progress in reduction of excess leverage. Specifically, firms in good credit standing have almost reached the final stage of reduction in leverage, while firms in lower credit standing will continue to struggle hard to reduce their debt burden.

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## Table 1: Summary Statistics

| | Mean | | | | Variance | | | |
|---|---|---|---|---|---|---|---|---|
| | All samples | | | | All samples | | | |
| | | A or higher | Below A | No ratings | | A or higher | Below A | No ratings |
| Leverage ratio (market value) | 0.435 | 0.375 | 0.507 | 0.446 | 0.067 | 0.046 | 0.063 | 0.078 |
| Leverage ratio (book value) | 0.475 | 0.453 | 0.532 | 0.467 | 0.066 | 0.049 | 0.056 | 0.079 |
| Equity cost | 1.053 | 0.941 | 1.048 | 1.129 | 0.415 | 0.222 | 0.239 | 0.599 |
| Debt cost | 0.022 | 0.021 | 0.017 | 0.024 | 0.034 | 0.002 | 0.000 | 0.068 |
| Volatility of firm value | 0.110 | 0.096 | 0.108 | 0.119 | 0.002 | 0.001 | 0.002 | 0.003 |
| Tangible assets (market value) | 0.521 | 0.425 | 0.623 | 0.544 | 2.009 | 0.111 | 3.230 | 2.763 |
| Tangible assets (book value) | 0.480 | 0.504 | 0.512 | 0.452 | 0.055 | 0.065 | 0.052 | 0.048 |
| Firm size (market value) | 11.799 | 12.783 | 12.022 | 11.061 | 2.233 | 1.760 | 1.861 | 1.491 |
| Firm size (book value) | 11.666 | 12.532 | 11.937 | 10.985 | 1.791 | 1.521 | 1.451 | 1.118 |
| Profitability (market value) | 0.049 | 0.034 | 0.036 | 0.063 | 0.320 | 0.008 | 0.055 | 0.632 |
| Profitability (book value) | 0.031 | 0.045 | 0.025 | 0.024 | 0.009 | 0.003 | 0.005 | 0.013 |
| Market-to-book ratio | 1.826 | 1.764 | 1.891 | 1.842 | 21.805 | 1.105 | 21.642 | 35.539 |
| Ratio of financial institutions | 0.380 | 0.447 | 0.390 | 0.331 | 0.021 | 0.018 | 0.016 | 0.020 |
| Ratio of overseas investors | 0.076 | 0.107 | 0.076 | 0.054 | 0.007 | 0.007 | 0.007 | 0.005 |
| Ratio of large investors | 0.434 | 0.415 | 0.415 | 0.455 | 0.017 | 0.015 | 0.015 | 0.018 |

*Notes*: 1. The sample period is from FY 1992 to FY 2003.
2. Tangible assets is the ratio of tangible assets to total assets.
3. Firm size is the logarithm of total assets.

## Table 2-1 GMM Estimation Results: Market-Value Basis

| | | Specification 1 | Specification 2 | Specification 3 | Specification 4 | Specification 5 |
|---|---|---|---|---|---|---|
| $d_{it}^{*}$ | Constant | -2.2058<br>(2.2485) | 1.6597***<br>(0.2078) | -0.5938<br>(1.3437) | -3.0754<br>(2.9748) | 2.0883***<br>(0.0423) |
| | Equity cost | 0.0114***<br>(0.0014) | 0.0001<br>(0.0013) | | 0.0110***<br>(0.0014) | 0.0221***<br>(0.0040) |
| | Debt cost × (1-tax rate) | -0.0114***<br>(0.0007) | -0.0125***<br>(0.0006) | | -0.0115***<br>(0.0007) | -0.0200***<br>(0.0072) |
| | Volatility of firm value | -0.0053***<br>(0.0002) | | -0.0038***<br>(0.0003) | -0.0053***<br>(0.0002) | -0.0046***<br>(0.0005) |
| | Ratio of tangible assets | 0.0135***<br>(0.0004) | | 0.0127***<br>(0.0004) | 0.0134***<br>(0.0004) | 0.0274***<br>(0.0013) |
| | Firm size | -0.2066***<br>(0.0024) | -0.2288***<br>(0.0019) | -0.2088***<br>(0.0025) | -0.2062***<br>(0.0023) | -0.1497***<br>(0.0035) |
| | Profitability | -0.0282***<br>(0.0007) | -0.0217***<br>(0.0005) | -0.0297***<br>(0.0007) | -0.0281***<br>(0.0007) | -0.0400***<br>(0.0019) |
| | Market-to-book ratio | -0.0000<br>(0.0000) | -0.0000<br>(0.0000) | -0.0001*<br>(0.0000) | | -0.0004***<br>(0.0001) |
| $\lambda_{it}$ | Constant | 0.9665***<br>(0.0091) | 0.9057***<br>(0.0137) | 0.9509***<br>(0.0133) | 0.9700***<br>(0.0090) | |
| | Ratio of financial institutions | 0.0213*<br>(0.0110) | 0.0403***<br>(0.0148) | 0.0249*<br>(0.0130) | 0.0205*<br>(0.0115) | |
| | Ratio of overseas investors | 0.0758**<br>(0.0322) | 0.2010***<br>(0.0291) | 0.0983***<br>(0.0355) | 0.0664**<br>(0.0324) | |
| | Ratio of large investors | 0.0162*<br>(0.0087) | 0.1006***<br>(0.0195) | 0.0318**<br>(0.0155) | 0.0137*<br>(0.0081) | |
| | OI test | 199.411<br>[0.688] | 219.526<br>[0.346] | 194.466<br>[0.800] | 199.871<br>[0.698] | 189.171***<br>[0.003] |

*Notes*: 1. Figures in parentheses of estimated parameters show standard deviations and those in parentheses for the OI test show *p*-values. ***, **, and * denote the significance at the 1, 5, and 10 percent levels, respectively.
2. Error terms are corrected for heterosckedasticity and serial correlation by White [1980] and Newey and West [1987], respectively. The number of lags in error terms is assumed to be 3.
3. The OI test shows *J*-statistics by Hansen [1982]. *J*-statistics asymptotically follow a chi-square distribution.
4. One and two-period lags of explanatory variables are used as instrumental variables

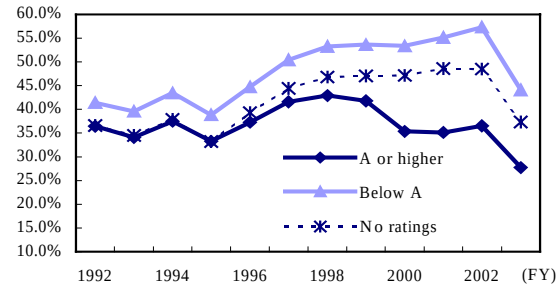
## Table 2-2 GMM Estimation Results: Book-Value Basis

| | | Specification 1 | Specification 2 | Specification 3 | Specification 4 | Specification 5 |
|---|---|---|---|---|---|---|
| $d_{it}^{*}$ | Constant | -0.9600*** (0.1203) | -1.3032*** (0.1050) | -0.9576*** (0.1231) | -0.9580*** (0.1197) | -0.2500*** (0.0734) |
| | Equity cost | 0.0023*** (0.0006) | 0.0006 (0.0006) | | 0.0023*** (0.0006) | 0.0067* (0.0035) |
| | Debt cost × (1-tax rate) | -0.0049*** (0.0005) | -0.0050*** (0.0004) | | -0.0048*** (0.0005) | -0.0123*** (0.0044) |
| | Volatility of firm value | -0.0011*** (0.0002) | | -0.0008*** (0.0002) | -0.0010*** (0.0002) | 0.0014*** (0.0004) |
| | Ratio of tangible assets | -0.1384*** (0.0216) | | -0.1347*** (0.0214) | -0.1317*** (0.0204) | -0.1890*** (0.0281) |
| | Firm size | 0.1237*** (0.0098) | 0.1494*** (0.0085) | 0.1233*** (0.0100) | 0.1235*** (0.0097) | 0.0646*** (0.0058) |
| | Profitability | -0.4030*** (0.0143) | -0.3776*** (0.0130) | -0.4088*** (0.0132) | -0.3987*** (0.0134) | -0.3219*** (0.0163) |
| | Market-to-book ratio | 0.0000 (0.0000) | -0.0000 (0.0000) | 0.0000 (0.0000) | | -0.0000 (0.0001) |
| $\lambda_{it}$ | Constant | 0.3913*** (0.0213) | 0.4694*** (0.0215) | 0.3930*** (0.0214) | 0.3985*** (0.0205) | |
| | Ratio of financial institutions | 0.7460*** (0.0536) | 0.6973*** (0.0531) | 0.7741*** (0.0484) | 0.7312*** (0.0515) | |
| | Ratio of overseas investors | -0.1266** (0.0642) | -0.1165** (0.0579) | -0.0999* (0.0602) | -0.1344** (0.0636) | |
| | Ratio of large investors | 0.4407*** (0.0471) | 0.3502*** (0.0459) | 0.4010*** (0.0326) | 0.4436*** (0.0475) | |
| | OI test | 213.400 [0.421] | 219.342 [0.350] | 212.905 [0.469] | 214.043 [0.428] | 180.375** [0.012] |

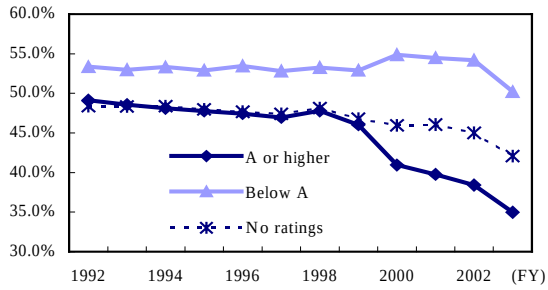
*Notes*: 1. Figures in parentheses of estimated parameters show standard deviations and those in parentheses for the OI test show *p*-values. ***, **, and * denote the significance at the 1, 5, and 10 percent levels, respectively.
2. Error terms are corrected for heterosckedasticity and serial correlation by White [1980] and Newey and West [1987], respectively. The number of lags in error terms is assumed to be 3.
3. The OI test shows *J*-statistics by Hansen [1982]. *J*-statistics asymptotically follow a chi-square distribution.
4. One and two-period lags of explanatory variables are used as instrumental variables

## Figure 1-1 Leverage Ratios by Credit Rating

**(i) Market-value basis**



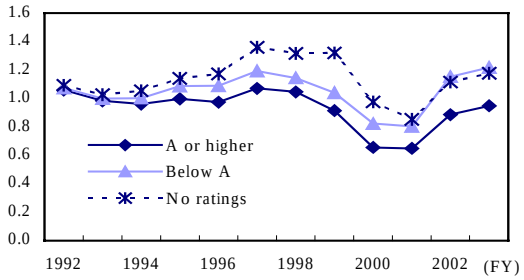

**(ii) Book-value basis**



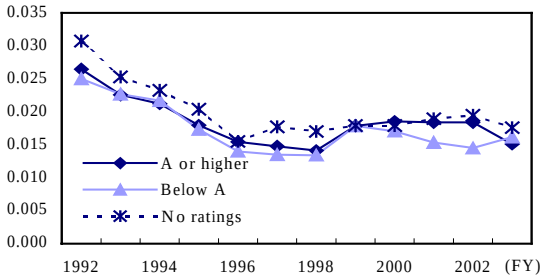

*Note*: Credit ratings are from R&I. Leverage ratios are simple averages by credit rating.

## Figure 1-2 Selected Variables by Credit Rating

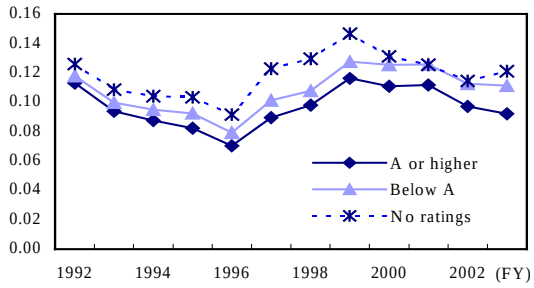
**(i) Equity cost**



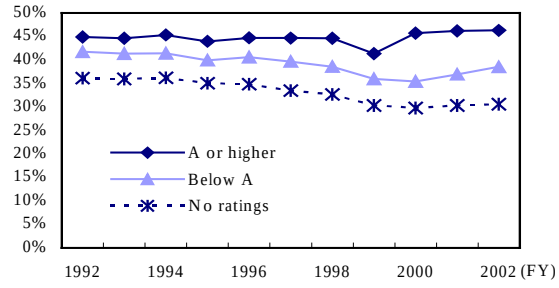

**(ii) Debt cost**



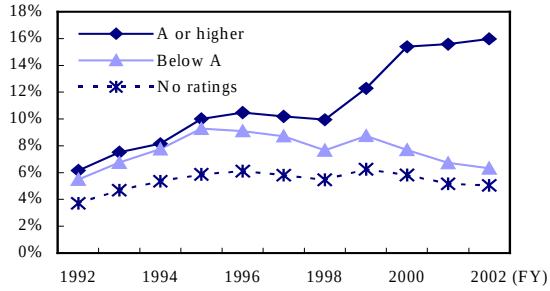

**(iii) Volatility of firm value**



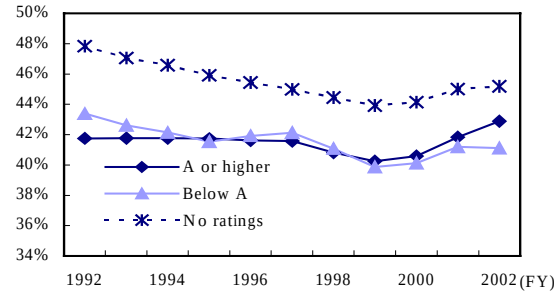

**(iv) Shareholding ratio of financial institutions**




**(v) Shareholding ratio of overseas investors**



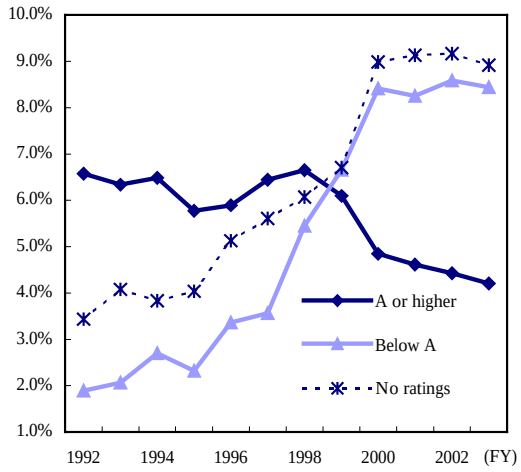

**(vi) Shareholding ratio of large investors**



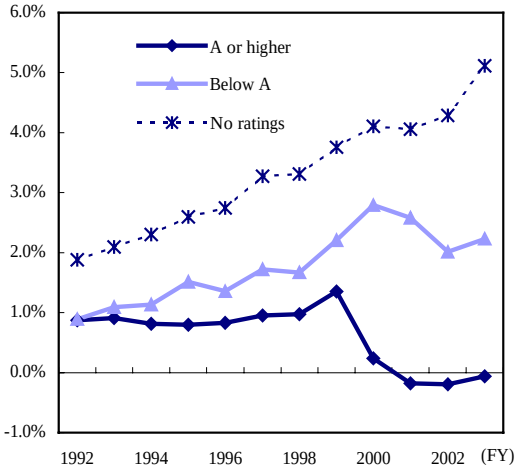

*Note*: Credit ratings are from R&I. Leverage ratios are simple averages by credit rating.

## Figure 2 Excess Leverage Ratios by Credit Rating

**(i) Market-value basis**




**(ii) Book-value basis**

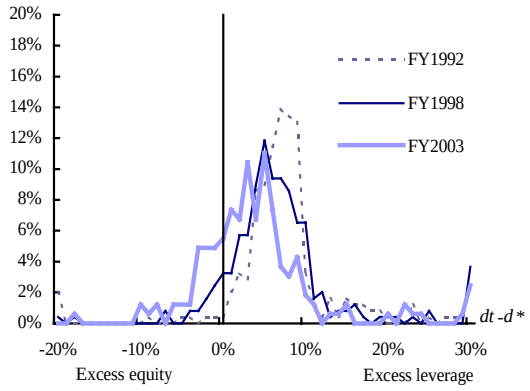



*Note*: Credit ratings are from R&I. Leverage ratios are simple averages by credit rating.

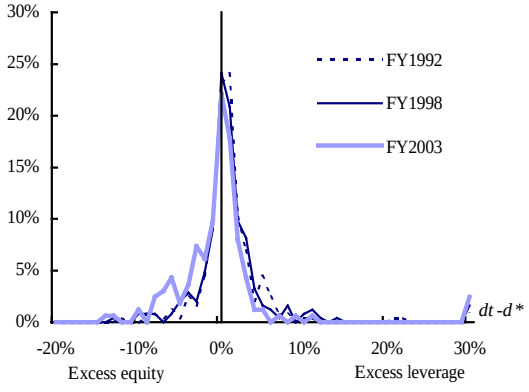
## Figure 3 Distributions of Excess Leverage Ratios

**(i) A or higher**

**Market-value basis**

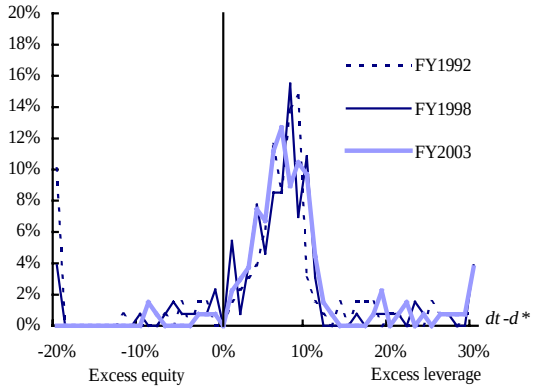



**Book-value basis**

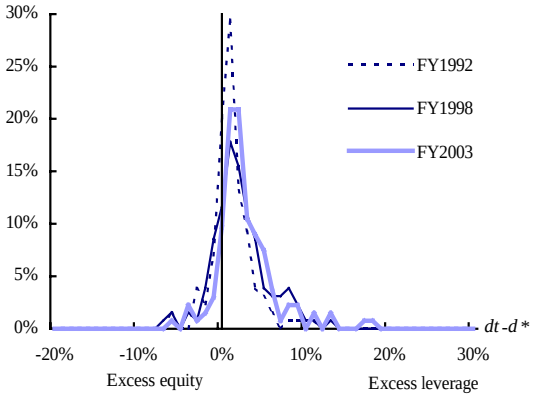



**(ii) Below A**

**Market-value basis**

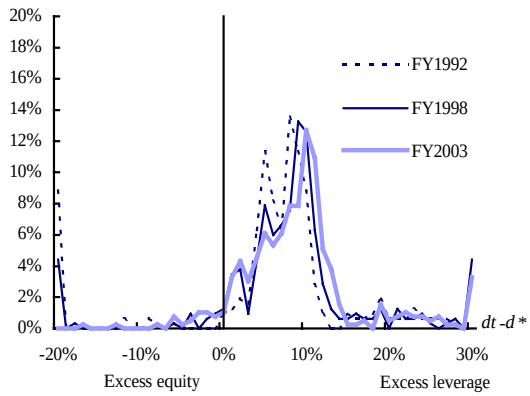



**Book-value basis**

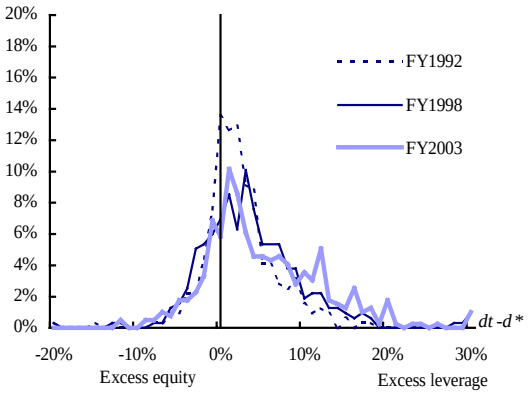



**(iii) No ratings**

**Market-value basis**



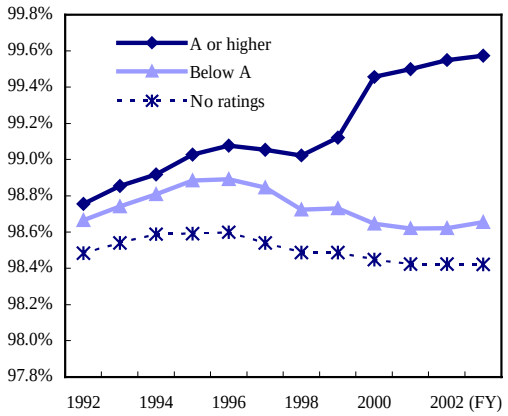

**Book-value basis**



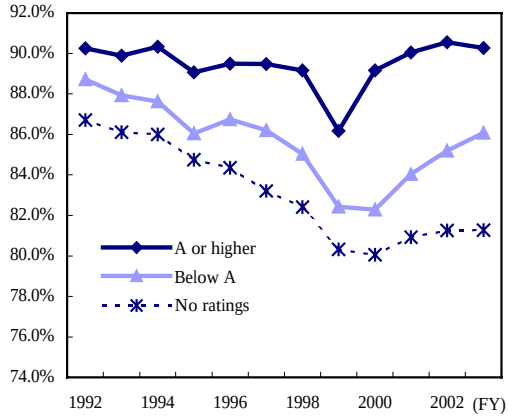

*Note*: The vertical axis shows the percentage share of the number of firms.

## Figure 4 Coefficient of Adjustment Speed

**(i) Market-value basis**




**(ii) Book-value basis**




*Note*: Credit ratings are from R&I. Leverage ratios are simple averages by credit rating.