



Factors affecting bank risk taking: Evidence from Japan [☆]

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Received 30 October 2001; accepted 22 July 2002

Abstract

Using recent data from Japan, this paper examines empirically the determinants of risk taking at commercial banks. We find that the implementation of the capital adequacy requirement reduced risk taking at commercial banks. The acceptance of retired government officials on banks' boards has an insignificant effect on bank risk. The relationship between the stable shareholders' ownership and bank risk is nonlinear; the risk decreases initially with the ownership by stable shareholders, and then increases as the asset substitution effect dominates the effect of managerial entrenchment on bank risk. The decline of franchise value increases bank risk.

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JEL classification: G21; G28; G30

Keywords: Bank risk taking; Capital adequacy requirement; Amakudari; Stable shareholders; Franchise value

1. Introduction

The Japanese banking industry undoubtedly faced the most difficult period during the 1990s since the banking crisis of 1927. Due to the bad loans problem, the bank

[☆] We have benefited from comments received from Shin'ya Okuda, Kanako Toi, Yuri Sasaki, Takashi Misumi, two anonymous referees, and seminar participants at Hitotsubashi University, Nagoya City University, Japanese Bankers' Association, Institute of Statistical Research, and 2001 Japan Society of Monetary Economics Meeting at Keio University. We are also grateful to Sanae Ono for providing a part of the data used in this paper. The usual disclaimer applies.

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stock price index declined from the historical high of 1324 in the year-end 1990 to 207 in the year-end 1999. To overcome the financial crisis and to establish a sound banking system, the regulatory authorities have taken various remedies throughout the 1990s, such as the implementation of the capital adequacy requirement in 1993, the prompt corrective action rules in 1998, and the capital injection of 7.5 trillion yen of tax payers' money to 15 major banks in 1999. However, the estimate of non-performing loans still stands at 38 trillion yen, or 7.6% of GDP as of February 1999 (Hoshi and Kashyap, 1999), and as of this writing, a widespread doubt that the Japanese banking industry will recover in the near future still exists.

These developments raise many questions concerning the nature of bank risk taking. Did the regulatory change in the 1990s, such as the implementation of the capital adequacy requirement, reduce bank risk? How does the ownership structure and the constituency of banks' board members affect bank risk? Are franchise values related to bank risk? These are all relevant issues, but they have yet to be fully explored by academia.¹

The purpose of this paper is to address these questions. We empirically investigate the relationship between bank risk and some quantifiable factors that may affect risk taking behavior at commercial banks using stock price data from 1990 through 1999. First, we examine the effect of the capital adequacy requirement on bank risk taking. Regulatory authorities in Japan implemented the capital adequacy requirement in 1993 expecting that banks would maintain sufficient bank capitals to reduce the chance of becoming insolvent. We investigate whether the capital requirement provided the desired outcome.

Secondly, we examine the relationship between bank risk and the acceptance of retired high-ranked Ministry of Finance and Bank of Japan officials on banks' board of directors, which is often referred as *amakudari* practices in Japan. Banks may accept *amakudari* officers on their boards and provide well-paid job opportunities expecting that the acceptance would reduce the intensity of monitoring by regulatory authorities, which in turn increases the chance of bank failure, and hence bank risk. On the other hand, *amakudari* officers may play the role of catalysts who smooth the information flow between regulatory authorities and bank managers (Schaede, 1995). Regulators would then obtain more precise risk-relevant information from banks with *amakudari* officers, which in turn provides these banks with incentives to reduce the level of bank risk. Therefore, the effect of banks' acceptance of *amakudari* officers on bank risk is an empirical question.

Thirdly, this paper examines the relationship between the ownership by stable shareholders and bank risk, where stable shareholders are defined as investors who do not engage in short-term stock trading, but hold stocks for a long-term.

¹ In the US, some authors explored the link between managerial ownership and risk taking at commercial banks (e.g. Saunders et al., 1990; Chen et al., 1998; Gorton and Rosen, 1995; Anderson and Fraser, 2000), while others explored the link between bank size and bank risk (e.g. Demsetz and Strahan, 1997). There are few existing works on risk taking at Japanese banks, Horiuchi and Shimizu (2001) being the only exception to our knowledge. They examined the link between the acceptance of retired government officials on banks' board of directors and accounting bank risk measures.

Since the ownership by stable shareholders may adversely affect the disciplinary role of capital market, it can enhance managerial entrenchment. Bank managers may then become more risk averse than investors expect them to be in order to protect their firm-specific human capital. If so, the ownership by stable shareholders should be negatively associated with the magnitude of bank risk. However, if a bank manager's preference is aligned with the interest of shareholders of the bank, the manager may have incentives to take risks in order to maximize the value of the investors' equity call options. The ownership by stable shareholders should then be positively associated with the level of bank risk taking. We empirically assess these conflicting explanations of risk taking at commercial banks.

Lastly, this paper studies the relationship between franchise values and bank risk taking behavior. The existing literature on this topic argues that the franchise value of banks is negatively associated with bank risk (e.g. Keely, 1990; Gorton and Rosen, 1995), and that the recent debacle of the Japanese banking industry can be partly attributable to the decline of franchise value (Weisbrod et al., 1992). We examine whether our evidence is consistent with this view.

The empirical evidence in this paper is summarized as follows: The implementation of the capital adequacy requirement reduces risk taking at commercial banks as desired by regulatory authorities. The acceptance of amakudari officers on banks' boards has an insignificant effect on bank risk. The relationship between the ownership by stable shareholders and bank risk is nonlinear; the risk decreases initially with the ownership by stable shareholders, and then increases as the asset substitution effect dominates the effect of managerial entrenchment on bank risk. Finally, the decline of franchise values increases risk taking behavior at commercial banks.

The remainder of this paper is organized as follows. Section 2 states test hypotheses regarding the determinants of bank risk taking. Section 3 describes the sample selection and presents empirical methodology. Section 4 examines the determinants of bank risk taking. Section 5 summarizes the findings of this paper.

2. Hypotheses

2.1. Capital adequacy requirement

The Basle Accord, which was agreed upon in 1988 among the G-10 countries, requires banks to maintain a certain level of capital for risk-weighted assets. In Japan, the capital requirements were put into force in fiscal 1993, expecting that the implementation would enhance the stability of commercial banks' management.

The impact of capital requirements on risk taking at commercial banks, however, is theoretically ambiguous. Since the capital requirements restrict the risk-return frontier of a bank, the forced reduction in leverage may induce the bank to reconfigure the composition of its portfolio of risk assets; thus, leading possibly to an increase in risk taking behavior (Kohen and Santomero, 1980; Kim and Santomero, 1988).

Contrarily, Furlong and Keely (1989) and Keely and Furlong (1990) show that capital requirements may decrease bank risk since the option value of deposit insur-

ance is decreasing in a bank's leverage. Therefore, the effect of capital adequacy requirements on bank risk is an empirical question.

Hypothesis 1. The implementation of the capital adequacy requirement does not affect the level of bank risk.

2.2. Amakudari

The acceptance of retired high-ranked Ministry of Finance and Bank of Japan officials on the banks' board of directors is often referred to as the practice of amakudari in Japan. The officers of regulatory authorities may have incentives to rigorously monitor bank management, regardless of the presence of amakudari officers at the bank, since their performance as monitors can be positively associated with the chance that they obtain positions at banks' boards when they retire (Aoki et al., 1994). If so, the acceptance of amakudari officers may reduce the risk level of the banking industry as a whole, but may not be related to the level of individual bank risk. Furthermore, amakudari officers may play the role of catalysts who smooth the information flow between regulatory authorities and bank managers (Schaede, 1995). Regulators would then obtain more precise risk-relevant information from banks with amakudari officers, which in turn provides these banks with incentives to reduce the level of bank risk. Therefore, the acceptance of amakudari officers may be negatively associated with the level of bank risk.

To the contrary, banks may accept amakudari officers on their boards and provide them with well-paid job opportunities expecting that the acceptance would reduce the intensity of monitoring by regulatory authorities, which in turn increases the chance of bank failure, hence bank risk. Thus the effect of banks' acceptance of amakudari officers on bank risk is an empirical question.

Using the capital-to-asset ratio and the non-performing loans-to-asset ratio as risk measures, Horiuchi and Shimizu (2001) examined the relationship between the acceptance of amakudari officers and the level of bank risk. They found that the acceptance of amakudari officers is negatively associated with the capital-to-asset ratio, and that it is positively associated with the non-performing loans-to-asset ratio. Their results indicate that the board participation of amakudari officers increases the level of bank risk. To check the robustness of their results, we use market (stock price) data rather than accounting (book) data for the estimation of bank risk, and examine the relationship between the acceptance of amakudari officers and the level of bank risk.

Hypothesis 2. The acceptance of amakudari officers does not affect the level of bank risk.

2.3. Stable shareholders

It is well-documented that a substantial portion of firms' equities in Japan are owned by stable shareholders (those who do not engage in short-term stock trading) in order to minimize the influence of impatient investors. Since the ownership

by stable shareholders may adversely affect the disciplinary role of the capital market, it may enhance managerial entrenchment. Bank managers may become more risk averse than investors expect them to be in order to protect their firm-specific human capital. If a bank manager also has equities in the bank, it induces her to protect firm-specific financial capital; hence, managerial ownership provides a second reason to act in a risk-averse fashion.² Furthermore, if bank managers obtain private benefits (e.g. perks, social status) from controlling the bank, they may behave in a risk averse manner. Therefore, the ownership by stable shareholders should be negatively associated with the level of bank risk.

It is also generally believed that Japanese firms are controlled by stable shareholders (Kang et al., 1999). If a bank manager's preference is aligned with the interest of shareholders of the bank, that manager may have incentives to take risks in order to maximize the value of the investors' equity call options. Then, the ownership by stable shareholders should be positively associated with the level of bank risk taking.

We empirically assess these conflicting explanations for commercial banks.

Hypothesis 3. The ownership by stable shareholders does not affect the level of bank risk.

Note that in Japan, the ownership by stable shareholders has potentially the same effects on bank risk taking as does the ownership by bank managers in the US (e.g. Gorton and Rosen, 1995; Chen et al., 1998; Anderson and Fraser, 2000). Since the existing literature on managerial ownership–bank risk relationship indicates that the relationship is non-linear, we examine whether the ownership by stable shareholders and bank risk are non-linearly related.

2.4. Franchise value

Franchise value is defined as the value that would be foregone in the event of a closure. In banking, the franchise value arises from regulatory restrictions on entry and competition. Since bank owners have much to lose if the bank becomes insolvent, a bank with high franchise value may have an incentive to avoid risky business strategies. For example, even if the deposit insurance induces banks to take on risks in order to maximize the option value (Merton, 1977), banks with high franchise value would not increase the amount of risk.³ Therefore, the franchise value can help reduce excessive risk taking.

If the franchise value of banks declines through deregulation and increased competition, banks may be induced to take risks. Keely (1990) argues that the decline of franchise value during the 1960s and 1970s in the US may have reduced banks'

² The ownership by bank managers, however, is very low in Japan. For example, in 1998, the average managerial holdings in our sample was only 0.24%, while in the US, the average managerial holdings was about 10% during the 1987–1994 period (Anderson and Fraser, 2000).

³ Hibara (2001) provides evidence that the deposit insurance scheme increased incentives for risk taking at commercial banks during the 1990s in Japan.

incentive to act prudently during the 1980s. Weisbrod et al. (1992) argue that the recent debacle of the banking industry in Japan can be partly attributable to the decline of franchise values due to a reduction in corporate demand in bank liquidity. We examine whether the evidence is consistent with these views in Japan.

Hypothesis 4. Franchise values do not affect the level of bank risk.

3. Empirical analyses

3.1. Sample selection and data

We use a panel data of Japanese regional banks covering the period from fiscal 1990 through fiscal 1999. Since capital market risk measures are used as the risk metrics, sample banks must be listed on a stock exchange. There were 54 regional banks listed on the Tokyo Stock Exchange (TSE) during the sample period. We exclude banks whose equities are traded infrequently on the TSE; in particular, following Anderson and Fraser (2000), we exclude banks whose equities are not traded for 75 days or more in any year during the sample period. Six banks are discarded by this criterion, which leaves us with 48 regional banks.

The data on daily stock returns were collected from “Kabuka CD-ROM 2001” compiled by Toyo Keizai Data Bank. The information on the acceptance of amakudari officers is from the “Kigyo Keiretsu Soran (Annual Report on Keiretsu)” published by Toyo Keizai. The data on stable shareholders were collected from the “Kaisha Shikiho (Quarterly Report on Listed Firms)” published by Toyo Keizai, where stable shareholders are defined as interested small shareholders (such as bank managers) and top 10 shareholders who hold shares for a long term. The data on TOPIX (TSE value-weighted stock price index) and the yield of ten-year government bond were hand-collected from the Nihon Keizai Shinbun, the Japanese counterpart of the Wall Street Journal. The rest of the data necessary for the following analyses was collected from the NIKKEI QUICK database.

3.2. Methodology

We estimate the following regression model using panel data techniques:

$$\begin{aligned} \text{RISK}_i = & \alpha_0 + \alpha_1 \text{CAPREQ}_i + \alpha_2 \text{AMAKUDARI}_i + \alpha_3 \text{HOLDINGS}_i \\ & + \alpha_4 (\text{HOLDINGS}_i)^2 + \alpha_5 \text{FRANCHISE}_i + \alpha_6 \text{ASSET}_i \\ & + \alpha_7 \text{FREQUENCY}_i + \epsilon_i. \end{aligned} \quad (1)$$

The dependent variable is the measure for the level of bank risk. We use five alternative capital market risk measures: total risk, firm-specific risk, systematic risk, market risk, and interest rate risk. The total risk is defined as the standard deviation of a bank’s daily stock returns for each fiscal year measured in percentage points. To estimate the rest of the risk measures, we use the following two-index model as a return generating process:

$$R_{it} = \beta_0 + \beta_1 R_{Mt} + \beta_2 R_{It} + e_{it}, \quad (2)$$

where R_{it} is the daily stock return of bank i at date t ; R_{Mt} is the daily stock return of TOPIX at date t ; R_{It} is the daily changes in the yield of ten-year government bond at date t ; and e_{it} is the residual of the two-index model.⁴ With this, the firm-specific risk is defined as the standard deviation of the residual of Eq. (2) for each bank, and the systematic risk is measured as the difference between the total risk and the firm-specific risk. The market risk and the interest rate risk are given by β_1 and β_2 respectively.

In addition to the five capital market risk measures, we use a metric for insolvency risk developed by Boyd et al. (1993) since policymakers are more concerned about bank failures rather than the volatility of bank stock returns. The insolvency risk (“Z-score” hereafter) is a statistic indicating the probability of bankruptcy. The Z-score for each fiscal year is calculated as follows:

$$Z = \frac{\sum_{j=1}^{12} \pi_j/A_j + \sum_{j=1}^{12} E_j/A_j}{S_r},$$

where π_j is the estimated market value of total profits; E_j is the market value of total equity (i.e. share price multiplied by the number of outstanding shares); A_j is the market value of total assets (the subscript j denotes the month); S_r is the estimated standard deviation of π_j/A_j .⁵ The market values of total equity and total assets are averaged monthly. The estimated market value of total profits is

$$\pi_j = c_j P_j - c_{j-1} P_{j-1},$$

where c_j is the number of outstanding shares adjusted for stock splits, and P_j is the share price of the last business day of month j . The market value of total assets is

$$A_j = E_j + L,$$

where L is the book value of total debt at the end of each fiscal year.⁶ Since the Z-score is negatively associated with the insolvency risk, we define the downside risk as being the negative value of the Z-score.

The independent variables of Eq. (1) are defined as follows:

CAPREQ: A dummy variable that takes the value one if the observation is from 1993 through 1999, zero if otherwise.

AMAKUDARI: A dummy variable that takes the value one if the bank accepts an amakudari official(s) from the Ministry of Finance, zero if otherwise.

HOLDINGS: The fraction of the bank’s shares owned by stable shareholders.

⁴ We did not orthogonalize the interest rate and market return series since such adjustments can bias results (Giliberto, 1985). We have also estimated the two-index model using two alternative interest rates: The yield of three-month government bond and the ten-year redemption yield of government bond. The results are qualitatively similar, hence they are not presented in this paper.

⁵ See Appendix A for the relationship between the insolvency risk and Z-score.

⁶ Since the monthly data for the book value of total debt is not available, we use annual data assuming that the total debt remains the same throughout the year. Furthermore, since the book values do not necessarily approximate the market values, Z-score is a limited proxy for the insolvency risk.

(HOLDINGS)²: The square value of HOLDINGS.

FRANCHISE: Franchise value as measured by Keely's Q (Keely, 1990): the sum of the market value of equity plus the book value of liabilities divided by the book value of assets.

ASSET: The natural log of the book value of total assets (millions of yen).⁷

FREQUENCY: The average daily volume of shares divided by the total number of outstanding shares.

CAPREQ, AMAKUDARI, HOLDINGS and (HOLDINGS)², and FRANCHISE are used to test Hypotheses 1–4 respectively, while ASSET and FREQUENCY are used to control for other factors that may affect the level of bank risk. Since larger banks are more capable of diversifying risk (Demsetz and Strahan, 1997), the bank size should be negatively associated with its risk level. Furthermore, since larger banks have better access to capital markets, they may have more flexibility to cope with unexpected liquidity shortfalls. Thus, bank size should be negatively associated with bank risk.

As in Anderson and Fraser (2000), we use the frequency of trading, FREQUENCY, as a proxy for the speed at which new information is reflected in stock prices. Since the speed can be positively associated with the variance of assets, liabilities and off-balance sheet portfolios (Demsetz and Strahan, 1997), we expect the coefficient of FREQUENCY to be positive.

We also estimate Eq. (1) defining AMAKUDARI as being a dummy variable that takes the value one if the bank accepts an amakudari official(s) from the BOJ, zero if otherwise.⁸

4. Empirical results

4.1. Descriptive statistics

Three sets of data are reported in Table 1: the full sample of the 1990–1999 period, the subsample of the 1990–1992 period, and the subsample of the 1993–1999 period. The 1990–1992 and the 1993–1999 periods represent periods prior and subsequent to the implementation of the capital adequacy requirement.

Table 1 indicates that the values of all the risk measures, except the market risk, were higher during the 1990–1992 period than during the 1993–1999 period. The dif-

⁷ Japanese banks carried many assets such as lands and equities in firms at historical cost. Banks also carried loans at face value, which they should have written down or written off. Therefore, ASSET may be biased towards zero relative to the market value.

⁸ Some researchers argue that the rapid decline of real estate prices during the 1990s affected bank health seriously (Ueda, 2000; Hoshi, 2001). The effect was particularly relevant for banks located in the three largest cities: Tokyo, Osaka and Nagoya. In order to exclude the effect of the decline of real estate prices on bank risk, we discarded one bank located in Tokyo from our sample, and re-estimated Eq. (1) (no other banks in our sample are located in the three cities). The results, however, remained qualitatively the same.

Table 1
Descriptive statistics of the sample^a

	1990–1992, N = 144	1993–1999, N = 336	Test statistics	1990–1999, N = 480
Total risk (%)				
Average	2.17	1.98	-2.91***	2.03
Standard deviation	0.65	0.66		0.66
Firm specific risk (%)				
Average	1.98	1.82	-2.89***	1.87
Standard deviation	0.57	0.37		0.60
Systematic risk (%)				
Average	0.18	0.16	-1.62	0.17
Standard deviation	0.14	0.02		0.13
Market risk				
Average	0.61	0.64	1.21	0.63
Standard deviation	0.28	0.30		0.30
Interest rate risk				
Average	0.05	-0.01	-2.99***	0.01
Standard deviation	0.06	0.01		0.14
Downside risk (Z-score)				
Average	14.64	18.79	5.72***	17.55
Standard deviation	6.63	8.63		8.30
Shares owned by stable shareholders (%)				
Average	25.92	26.54	1.45	26.35
Standard deviation	4.34	4.25		4.28
Franchise value				
Average	1.03	1.02	-9.34***	1.02
Standard deviation	0.02	0.02		0.02
Total assets (billion yen)				
Average	3618	3677	0.25	3659
Standard deviation	2417	2165		2241
Frequency of trading (%)				
Average	0.03	0.04	3.03***	0.03
Standard deviation	0.01	0.01		0.03

*** Significant at the 1% level.

^a Test statistics are *t*-tests for difference of means.

ference in means are significant for the total risk, the firm specific risk, the interest rate risk, and the downside risk.⁹

Table 1 also shows that the franchise value is lower during the 1993–1999 period than the 1990–1992 period, and the difference is significant. This result is consistent with the view that the franchise values of Japanese banks declined during the 1990s.

⁹ Hereafter, when we use the term *significant* or *insignificant*, we mean *statistical* significance unless we mention that it means *economic* significance.

Furthermore, Table 1 documents that the frequency of trading is higher during the 1993–999 period, and the difference is significant. Recall that the level of bank risk is generally lower during the 1993–1999 period. This may indicate that the positive effects of high trading frequency and low franchise value during the 1993–1999 period on bank risk may have been offset by the negative effect of the implementation of the capital adequacy requirement.

4.2. Regression results

Table 2 presents the results of the time-series cross-sectional (TSCS) regressions when amakudari is defined as the acceptance of retired MOF officials on banks'

Table 2
The results of TSCS regression: The acceptance of amakudari officers from the MOF^a

Variable	(1) Total risk/coefficient	(2) Firm specific risk/coefficient	(3) Systematic risk/coefficient	(4) Market risk/coefficient	(5) Interest rate risk/coefficient	(6) Downside risk/coefficient
CAPREQ	-0.28 (-4.30)*	-0.28 (-4.80)*	0.01 (0.38)	0.11 (3.66)*	-0.05 (-3.16)*	-3.67 (-4.11)*
AMAKUDARI (×10)	-0.35 (-0.36)	-0.33 (-0.37)	-0.02 (-0.11)	-0.05 (-0.11)	0.17 (1.24)	-5.18 (-0.39)
HOLDINGS	-0.23 (-1.61)	-0.21 (-1.60)	-0.02 (-0.69)	-0.19 (-2.98)*	-0.03 (-1.82)**	-1.06 (-0.55)
(HOLDINGS) ² (×1000)	3.99 (1.60)	3.54 (1.55)	0.45 (0.83)	3.37 (2.97)*	0.46 (1.73)**	10.77 (0.31)
FRANCHISE	-3.72 (-2.35)***	-4.16 (-2.88)*	0.44 (1.31)	1.88 (2.61)*	0.63 (1.83)**	-13.66 (-0.62)
ASSET	-1.28 (-2.59)*	-0.94 (-2.07)***	-0.34 (-3.25)*	-0.60 (-2.66)*	-0.04 (-3.11)*	-20.07 (-2.94)*
FREQUENCY	12.07 (9.38)*	12.59 (11.17)*	-0.52 (-1.97)***	-0.02 (-0.04)	0.75 (2.97)*	65.42 (3.84)*
Constant					0.36 (0.98)	
F-statistic	6.42*	6.41*	4.36*	6.13*	0.67	4.04*
Adjusted R ²	0.38	0.38	0.27	0.37	0.07	0.26
Observations	480	480	480	480	480	480

* Significant at the 1% level.

** Significant at the 10% level.

*** Significant at the 5% level.

^a *t*-ratios are in parentheses, *F*-statistic is for testing the hypothesis that all the coefficients except the constant term are zero. The coefficients of AMAKUDARI and (HOLDING)² are multiplied by 10 and 1000 respectively.

boards. For each risk measure, we test the null hypothesis that an individual effect does not exist using the F -test. The null hypothesis is rejected for all the risk measures except for the interest rate risk. Therefore, we estimate the regression equations using the OLS for the interest rate risk. As for the rest of the risk measures, we further test the null hypothesis that the individual effect is correlated with regressors using Hausman's specification test. The null hypothesis was rejected for all the risk measures, hence, the fixed effects model is used to estimate the regression equations. Adjusted R^2 s vary between 26% and 38% except for the interest rate risk. The equation for the interest rate risk, however, has low explanatory power: only 8% in adjusted R^2 terms.

Column 1 of Table 2 presents the regression results when the total risk is used as the dependent variable. It shows that the implementation of the capital requirement reduced the total risk by 0.28%. The coefficient of CAPREQ is negative and significant, suggesting that the implementation of the capital adequacy requirement reduced the total risk as desired by regulatory authorities. Note that the interpretation of the current result is not without ambiguities. An alternative interpretation may be that the collapse of a bubble economy in late 1980s and the subsequent bad loans problem completely changed banks' attitude towards risk, i.e. banks became very hesitant to make risky loans, which is often referred to as a *credit crunch*. Since the credit crunch was more of a problem after 1993 than before, the negative relationship between bank risk and CAPREQ can be attributed to the change in the banks' risk attitude. Nevertheless, the evidence herein is consistent with our claim that the implementation of capital requirement reduced bank risk.

Column 1 also shows that the coefficient of AMAKUDARI is not significant, indicating that the potential risk-increasing and risk-reducing effects offset each other. We also estimated Eq. (1) using standardized coefficients to examine the impact of AMAKUDARI on the level of bank risk as compared to those of the rest of independent variables. The estimation result is as follows:

$$\begin{aligned} \text{RISK}_i = & -0.20\text{CAPREQ}_i + 0.11\text{AMAKUDARI}_i - 1.62\text{HOLDINGS}_i \\ & + 1.55(\text{HOLDINGS}_i)^2 - 0.14\text{FRANCHISE}_i - 1.07\text{ASSET}_i \\ & + 0.48\text{FREQUENCY}_i \end{aligned}$$

The coefficients of all the independent variables except AMAKUDARI are statistically significant at 1–10% levels. The result indicates that the impact of the acceptance of amakudari officers on bank risk is weaker than the rest of independent variables.¹⁰ The current results are contrary to the results obtained in Horiuchi and Shimizu (2001) who found a positive correlation between the board participation of amakudari officers and the level of bank risk.

The coefficients of HOLDINGS and (HOLDINGS)² are negative and positive respectively, and both coefficients are marginally significant. The results indicate that

¹⁰ Using standardized coefficients, we obtained qualitatively similar results for the rest of the specifications. Namely, we found that the coefficient of AMAKUDARI is the smallest for 8 out of 12 specifications, and the next to the smallest for four specifications.

the relationship between the ownership by stable shareholders and the level of bank risk is nonlinear; the risk decreases initially with the ownership by stable shareholders, and then starts to increase after a certain level of ownership. The results suggest that the negative effect of managerial entrenchment on bank risk dominates the positive asset substitution effect for stable shareholders with a relatively small ownership, and vice versa for stable shareholders with a relatively large ownership. However, Panel A of Table 4 shows that the value of HOLDINGS that minimizes the total risk is 28%, which is greater than the mean value of HOLDINGS (26%). In fact, 71% of the observations are below the value of HOLDINGS at the inflection point, indicating that the primary effect is to reduce the total risk.

The coefficient of FRANCHISE is -3.72 and significant, indicating that a 10% increase in the franchise value reduces the total risk by 0.37%. The negative correlation between the franchise value and the total risk suggests that the franchise value can help reduce excessive risk taking at commercial banks.

Column 2 presents the regression results when the firm-specific risk is used as the risk measure. The results are qualitatively similar to those obtained when the total risk is used as the risk measure. The coefficient of CAPREQ is negative and significant. The result indicates that the implementation of the capital adequacy requirement reduced the firm-specific risk by 0.28%. The coefficients of HOLDINGS and (HOLDINGS)² are negative and positive respectively, and both coefficients are marginally significant. Panel A of Table 4 shows that the value of HOLDINGS at the inflection point is 29%, and that 76% of the observations are below the inflection point. The result indicates that the primary effect is to reduce the firm-specific risk. The coefficient of FRANCHISE is -4.17 and significant, suggesting that a 10% increase in the franchise value reduces the firm-specific risk by 0.42%. The coefficient of AMAKUDARI is not significant as in the previous specification. Therefore, the board participation of retired MOF officials has insignificant effect on the firm-specific risk.

Column 3 presents the results when the systematic risk is used as the risk measure. The coefficient of AMAKUDARI is not significant as in the previous two specifications. The coefficients of CAPREQ, HOLDINGS, (HOLDINGS)², and FRANCHISE are also insignificant in this case.

Column 4 presents the results when the market risk, which also measures the systematic risk, is used as the risk metric. The coefficient of CAPREQ is positive and significant, indicating that the implementation of the capital adequacy requirement increased the market risk. Recall that the total risk and the firm-specific risk are negatively associated with CAPREQ. Therefore, the current result implies that the implementation of the capital adequacy requirement reduced the total risk since the reduction of the firm-specific risk more than offset the increase in the market risk. Since regulators are more concerned about the total risk than the market risk, the current result still indicates that the capital requirement provided the desired outcome to regulators. The result, however, is not of comfort to well-diversified investors since they can diversify away non-systematic risk, and their portfolio risk mostly depends on the level of undiversifiable market risk.

It still remains to be answered why the market risk is positively associated with CAPREQ while other risk measures are negatively associated with CAPREQ. A pos-

sible interpretation may be that during the 1993–1999 period, regulators made Japanese banks properly value and account for the loans and equities on their balance sheets, some of which are associated with the implementation of the capital adequacy requirement. For example, banks have been required to disclose risk management loans since 1997, which follows the Securities and Exchange Commissions standards in the US.¹¹ Therefore, it is natural that bank share prices were more sensitive to market value during the 1993–1999 period.

Furthermore, Column 4 shows that the coefficient of FRANCHISE is positive and significant. This result is contrary to those obtained when the total risk and the firm-specific risk are used as dependent variables. These results suggest that the negative impact on firm-specific risk more than offsets the positive impact on market risk. Therefore, the decline of franchise value reduces the level of total risk. Column 4 also reports that the coefficient of AMAKUDARI has insignificant effect on the market risk. The coefficients of HOLDINGS and (HOLDINGS)² are negative and positive respectively as in the case where total risk and firm-specific risk are used, and significant. Once again, Panel A of Table 4 shows that the inflection point (28%) is greater than the mean (26%), indicating that there are more data points to support the negative “managerial entrenchment” effect on bank risk.

Column 5 presents the results when the interest rate risk is used as the risk measure. In this case, the coefficient of CAPREQ is -0.05 and significant, which indicates that the implementation of the capital adequacy requirement reduced interest rate risk by 0.05 . The impact on the interest rate risk, however, is not significant economically relative to other risk measures: the total risk, the firm-specific risk, and the market risk. The coefficients of HOLDINGS and (HOLDINGS)² are negative and positive respectively, and significant, indicating that the relationship between the ownership by stable shareholders and the interest rate risk is nonlinear. Panel A of Table 4 shows that the inflection point is greater than the mean, and that 58% of the observations are smaller than the inflection point. Therefore, the primary effect is to reduce the interest rate risk. The coefficient of FRANCHISE is positive and significant, suggesting that the franchise value is positively associated with the interest rate risk.

Column 6 presents the results when the downside risk ($-Z$ score) is used as the risk measure. The coefficient of CAPREQ is negative and significant. The coefficient of AMAKUDARI is insignificant statistically. These results suggest that the implementation of the capital adequacy requirement reduced the chance of bank failures, and that the acceptance of *amakudari* officers is not related to bank insolvency risk. The coefficient of FRANCHISE, HOLDINGS and (HOLDINGS)² are all insignificant, suggesting that franchise values and the stability of shareholder base are not associated with the insolvency risk.

In all six regressions, the majority of the coefficients of ASSET and FREQUENCY have the expected signs. The coefficients of ASSET are negative and

¹¹ The risk management loans are classified into four categories: loans to borrowers under bankruptcy procedure, past due loans (six months or more), past due loans in arrears by three to six months, and restructured loans with changes in loan terms.

Table 3

The results of TSCS regression: The acceptance of amakudari officers from the BOJ^a

Variable	(1) Total risk/coefficient	(2) Firm specific risk/coefficient	(3) Systematic risk/coefficient	(4) Market risk/coefficient	(5) Interest rate risk/coefficient	(6) Downside risk/coefficient
CAPREQ	-0.27 (-4.25)*	-0.28 (-4.75)*	0.01 (0.40)	0.11 (3.68)*	-0.05 (-3.23)*	-3.63 (-4.06)*
AMAKUDARI (×10)	1.46 (1.30)	1.35 (1.31)	1.16 (0.48)	0.19 (0.37)	0.16 (1.16)	17.55 (1.13)
HOLDINGS	-0.25 (-1.74)**	-0.22 (-1.73)**	-0.02 (-0.74)	-0.19 (-3.00)*	-0.03 (-1.76)**	-1.30 (-0.67)
(HOLDINGS) ² (×1000)	4.28 (1.71)**	3.81 (1.66)**	0.47 (0.87)	3.41 (2.99)*	0.44 (1.65)**	14.21 (0.41)
FRANCHISE	-3.72 (-2.37)***	-4.17 (-2.91)*	0.44 (1.32)	1.88 (2.63)*	0.63 (1.83)**	-13.09 (-0.64)
ASSET	-1.27 (-2.57)*	-0.93 (-2.06)***	-0.34 (-3.25)*	-0.60 (-2.66)*	-0.04 (-2.81)*	-19.92 (-2.93)*
FREQUENCY	12.01 (9.75)*	12.54 (11.14)*	-0.52 (-1.99)***	-0.03 (-0.05)	0.74 (2.92)*	64.79 (3.81)*
Constant					0.28 (0.75)	
F-statistic	6.47*	6.46*	4.37*	6.13*	0.67	4.07*
Adjusted R ²	0.38	0.38	0.28	0.37	0.08	0.26
Observations	480	480	480	480	480	480

* Significant at the 1% level.

** Significant at the 10% level.

*** Significant at the 5% level.

^a *t*-ratios are in parentheses. *F*-statistic is for testing the hypothesis that all the coefficients except the constant term are zero. The coefficients of AMAKUDARI and (HOLDING)² are multiplied by 10 and 1000 respectively.

significant, suggesting that large banks are more capable of managing risks than small banks. Since one unit of ASSET (the natural log of total assets in millions of yen) translates to approximately 1.7 millions of yen of total assets, the results indicate that one million increase in total assets reduces the total risk by 2.2, the firm-specific risk by 1.6, the systematic risk by 0.59, the market risk by 1.0, and the interest rate risk by 0.07. Therefore, the impact on the interest rate risk is weaker than the impact on other capital market risk measures.

The coefficient of FREQUENCY is positive and significant for the total risk, the firm-specific risk, the interest rate risk, and the downside risk, suggesting that banks whose shares are more frequently traded are exposed to a higher level of risk. In particular, a 1% increase in the frequency of trading increases total risk by 12.07, the firm-specific risk by 12.59, and the interest rate risk by 0.75. Therefore, although

Table 4
The value of HOLDINGS that minimizes the risk level

	Inflection point (%)	Observations below the inflection point (%)
<i>Panel A: The acceptance of amakudari officers from the MOF^a</i>		
Total risk	28	71
Firm-specific risk	29	76
Systematic risk	26	52
Market risk	28	67
Interest rate risk	27	58
Downside risk	49	100
<i>Panel B: The acceptance of amakudari officers from the BOJ</i>		
Total risk	29	72
Firm-specific risk	30	77
Systematic risk	22	13
Market risk	29	76
Interest rate risk	33	90
Downside risk	46	100

^aThe inflection point refers to the value of HOLDINGS that minimizes the level of risk. The observations below the inflection point refers to the proportion (percentage point) of observations whose value of HOLDINGS is less than the value of HOLDINGS at the inflection point.

the coefficient of FREQUENCY is statistically significant for the interest rate risk, it is not necessarily significant economically. As for the systematic risk, the coefficient is negative and significant, but not necessarily significant economically.

Table 3 presents the results of TSCS regressions when amakudari is defined as the acceptance of retired BOJ officials on banks' boards. As in the previous regressions where amakudari is defined as the acceptance of retired MOF officials, the fixed effects model is used for all the risk measures except for the interest rate risk based on the results of the *F*-test and Hausman's specification test. We use the OLS when the interest rate risk is used as the risk measure. Adjusted *R*²s vary between 26% and 38% except for the interest rate risk. The equation for the interest rate risk, however, has low explanatory power: only 7% in adjusted *R*² terms.

It turns out that none of the coefficients of AMAKUDARI is significant. Therefore, the board participation of retired BOJ officials is not related to the cross-sectional differences in the level of bank risk. The results for the rest of the independent variables are almost the same as those reported in Table 2. First, the implementation of capital requirement reduced all the risk measures except for the interest rate risk. Second, the relationship between the ownership by stable shareholders and bank risk is nonlinear. Namely, the risk decreases initially with the proportion of stable shareholders, and then increases as the asset substitution effect dominates the effect of managerial entrenchment on bank risk. The value of HOLDINGS that minimizes the bank risk is greater than the mean value of HOLDINGS, indicating that the primary effect of the ownership by stable shareholders is to reduce bank risk. But this risk-reducing effect is diminishing (see Panel B of Table 4).

Third, the total risk and the firm-specific risk are decreasing in bank franchise value, while the market risk and the interest rate risk are increasing in bank franchise

value. Forth, bank risk is positively associated with bank size. Lastly, all the risk measures except for the market risk and the interest rate risk are positively associated with the frequency of trading.

5. Concluding remarks

This paper examined empirically the determinants of risk taking at commercial banks using Japanese data from 1990 through 1999. To summarize, the overall results suggest that:

- (1) The implementation of the capital adequacy requirement reduced risk taking at commercial banks.
- (2) The acceptance of retired MOF and BOJ officials on banks' boards has an insignificant effect on the risk level of an individual bank.
- (3) The relationship between the ownership by stable shareholders and bank risk is nonlinear; the risk decreases initially with the proportion of stable shareholders, and then increases as the asset substitution effect dominates the effect of managerial entrenchment on bank risk. The primary effect, however, is the risk-reducing managerial entrenchment effect.
- (4) The decline of franchise values increases bank risk.

There still remains at least two questions. First, although we found no significant relationship between the board participation of retired MOF and BOJ officials and the risk taking at an individual bank, it is still unanswered whether board participation of amakudari officers decreases the risk level of the banking industry as a whole. As discussed in Section 2.2, the officers of regulatory authorities may have incentives to rigorously monitor bank management, regardless of the presence of amakudari officers at the bank, since their performance as monitors can be positively associated with the chance that they obtain positions at banks' boards when they retire. If so, the acceptance of amakudari officers may reduce the risk level of the banking industry as a whole.

Second, although the evidence suggests that the ownership by stable shareholders and the level of bank risk is nonlinearly related, a theory that explains the relationship is yet to be developed. The development of such a model is particularly relevant today since the ownership by stable shareholders can be interpreted as a warning flag for regulatory authorities. These issues remain for our future research.

Appendix A

This appendix explains the relationship between Z -score and bank insolvency risk. The following explanation is based on Boyd et al. (1993).

We define bankruptcy as the situation where losses exceed equity in market values, namely $\tilde{\pi} < -E$, where $\tilde{\pi}$ is the market value of total profits and E is the market

value of total equity. Let $r \equiv \tilde{\pi}/A$, $k \equiv -E/A$ (A is the market value of total assets), and $\Phi(r)$ be the probability density function of r . Then, the probability of bankruptcy can be expressed as

$$p(\tilde{\pi} < -E) = p(\tilde{r} < k) = \int_{-\infty}^k \Phi(r) dr,$$

where $p(\cdot)$ is a probability. Furthermore, let ρ be the true mean of \tilde{r} , σ be the true standard deviation of \tilde{r} , and define $z \equiv (k - \rho)/\sigma$. Assuming that r is normally distributed, we obtain

$$p(\tilde{r} < k) = \int_{-\infty}^z N(0, 1) dz,$$

where z is the number of standard deviations below the mean by which profits must fall in order to eliminate equity. Since z is a negative number, we use $-z$, or Z -score given in Section 3.2, as the metric for default risk. Since $p(\tilde{r} < k)$ is decreasing in z , Z -score is negatively associated with the probability of defaulting.

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