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The Relationship between Pay Ratio and Firm Value / Performance

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Abstract

This study examines the relationship between pay ratio (the pay gap between executives and employees), firm value, and firm performance. It uses statistical and empirical analyses to determine the economic impact of an increase in pay ratio. We posited two hypotheses: first, that the pay ratio reflects a firm's capacity to attract high-caliber management talent, and second, that the expansion of this ratio is primarily a consequence of executives augmenting their authority and elevating their compensation. To test these hypotheses, we employed a multiple regression analysis to examine the impact of an increased pay ratio on the subsequent year's Tobin's q and Return on Assets (ROA). We found that Tobin's q and ROA increased with the pay ratio of Japanese firms. This implies that the expansion of the pay ratio positively impacts firm value and performance in Japan, supporting the hypothesis that the pay ratio reflects a firm's ability to attract competent executives. Additionally, the managerial competence index increased as the pay ratio increased, confirming that firms acquired competent executives.

Keywords: pay ratio, managerial ability score, firm value, firm performance, executive compensation

1. INTRODUCTION

This study aims to empirically examine the impact of the executive[1]-employee pay gap on firm value and performance. Specifically, we focus on the pay ratio (executive pay divided by employee pay), an indicator of the pay gap between executives and employees, and examine its effect on Tobin's q and Return on Assets (ROA). According to the Japanese Corporate Statistics Survey for FY2010 and FY2020, the compensation per executive increased by approximately 17%, whereas the salary per employee increased by only 3.4%; this indicates that employee salaries did not increase proportionately to executive compensation. In January 2022, Toyo Keizai Online published a list of the top 500 firms with a large annual salary gap between employees and executives; the number of firms with an annual salary gap of 10 to 20 times between employees and executives increased from 101 in FY 2014 to 165 in FY 2020, representing an increase of 63% over the past seven years.

Clarifying whether such compensation disparities are positive or insignificant for firm performance will provide important insights into the determination of management compensation. In particular, elucidating the relationship between this pay gap and firm value and performance is useful because shareholders, as owners of firms, expect executives to improve firm performance and increase firm value[2]. Therefore, we will examine the effects of the expansion of the pay ratio by organizing our analysis into two hypotheses: first, that it reflects the ability of firms to acquire competent executives; second, that the pay ratio is expanding as a result of executives using their power to raise executive compensation. This study is expected to make a practical contribution to the field of executive

[1] In this study, "executive" refers to both directors and executive officers.

[2] In the U.S., the growing prevalence of pay ratios led to the enactment of the Dodd-Frank Act in 2010, which requires all listed firms to disclose the pay ratio of management to median employee compensation (Anginer et al., 2020). Due to the high level of public interest in this regulation, various studies on pay ratios have been conducted, particularly in the U.S. These include studies examining investor reactions to corporate disclosures of high pay ratios (Kelly & Seow, 2016), the relationship between compensation inequality measurement and firm performance (Rouen, 2020; Luo et al., 2020), the impact of compensation inequality on employee attitudes and productivity (Bailey, 2019), and whether compensation disparities are caused by efficient contracts or managerial power (Vo & Canil, 2019).

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compensation by demonstrating some of the effects of pay ratio expansion on corporate performance. The remainder of this paper is organized as follows: Section 2 reviews previous studies, Section 3 develops the hypotheses, Section 4 describes the research design, Section 5 discusses the empirical results, and Section 6 presents robustness tests. Finally, Section 7 summarizes the findings and concludes the study.

2. PRIOR LITERATURE

Empirical analyses conducted on U.S. listed firms have reported that the higher the pay ratio, the higher the firm value (Tobin's q) (Faleye et al., 2013; Fischer & Lindermoyer, 2020; Cheng et al., 2017). It has also been reported that a higher pay ratio increases corporate performance (ROA) (Faleye et al., 2013; Cheng et al., 2017). Cheng et al. (2017) argue that high pay ratios result from market competition for scarce managerial talent. Moreover, firms with higher pay ratios exhibit higher firm value and superior performance since executives perform better.

However, the results of these previous studies conducted in the U.S. may have been influenced by country-specific practices. For example, the U.S. tends to differ in its approach to managerial promotion, with many "Wandervogel" types who move from company to company in search of higher executive compensation, as well as internal promotions. In contrast, in Japan, most promotions are internal (Tanigawa, 2016). However, the impact of the expansion of the pay ratio on firm value and performance in an environment such as Japan, where most executives are promoted internally to management, remains unclear. Therefore, this study uniquely focuses on Japanese-listed firms to determine the impact of pay ratio expansion on firm value and performance. We anticipate that our findings will make a significant contribution to the existing literature by shedding light on the relationship between pay ratio and a measure of managerial ability in a robustness test, a perspective that has not been explored in previous studies.

3. HYPOTHESES DEVELOPMENT

We develop hypotheses based on two theories: (1) the theory of attracting competent executives, which posits that high compensation attracts capable executives, and (2) the managerial power theory, which argues that high compensation results from executives' exercise of power.

3.1 Theory of Attracting Competent Executives

Cheng et al. (2017) argue that the pay ratio reflects a firm's ability to attract rare talent with the superior capabilities needed to successfully manage large, complex firms. In other words, a firm with a high pay ratio has a strong ability to attract competent executives. Moreover, in today's large and increasingly complex firms, the impact of one employee on the firm as a whole is negligible. From the standpoint of efficient contracting, the pay gap between executives and employees will inevitably widen. As mentioned earlier, this hypothesis may not hold true in Japan since the method of management promotion in Japan is mostly through internal promotions. However, a firm with a high pay ratio and the ability to attract talented individuals may appeal to employees intending to become executives; there is a route for talented individuals to join the firm as employees and become executives through internal promotions. In this case, the firm can demonstrate its ability to attract talented executives and employees.

From the above discussion, it can be argued that firms with higher pay ratios successfully attract talented executives. Such firms may exhibit higher firm value and performance. Therefore, we formulate the following hypothesis:

H1: A higher pay ratio tends to increase firm value and performance.

3.2 Managerial power theory

Cheng et al. (2017) argue that high pay ratios reflect managerial rent extraction in firms with weak corporate governance. Bebchuk and Fried (2003) also reported that managerial pay increases when the board is relatively weak or ineffective in monitoring management. From the above discussion, a higher pay ratio may have no relation to higher firm value or firm performance, since a higher pay ratio does not indicate the acquisition of superior executives, but only the result of executives increasing their own power and compensation. Therefore, we propose the following hypothesis:

H2: There is no relationship between pay ratio and firm value or performance.

4. RESEARCH DESIGN

4.1 Regression model

In testing the hypotheses, we follow Cheng et al. (2017) and use two variables indicating firm value ($Tobins'q_{\ t+1}$) and firm performance ($ROA_{\ t+1}$) as the objective variables. We employ multiple regression analysis using the natural logarithm of the ratio of average executive compensation (directors and executive officers) to average employee pay ($ln(Pay\ ratio)$) and variables set to control for firm characteristics as explanatory variables. Most prior studies in the U.S. use CEO compensation rather than average executive compensation (e.g., Cheng et al., 2017; Faleye et al., 2013), In Japan, however, the disclosure cases are limited because Japanese securities reports require the disclosure of individual executive compensation only for those whose compensation is 100 million yen or more. We use the average executive compensation to cover listed Japanese firms more comprehensively. The control variables follow those used by Cheng et al. (2017) in their empirical analyses of U.S. firms. These variables have also been employed in previous studies on Japanese firms (Huga & Tatsumoto, 2018; Teshima, 2000; Suzuki, 2013), confirming their appropriateness for the Japanese context. Table 1 summarizes the variables used for validation. We also included year and industry dummies to control for time (Year) and industry effects (Industry). F-tests and Hausman tests were conducted to identify the appropriate regression model, and the results supported the fixed-effects model.

$$\begin{aligned} Tobin's\ q_{\ i,t+1} \quad &= \alpha + \beta_1\, ln(Pay\ Ratio)_{\ i,t} + \beta_2\, Tobin's\ q_{\ i,t} + \beta_3\, ROA_{\ i,t} \\ &+ \beta_4\, ln(Sales)_{\ i,t} + \beta_5\, Leverage_{\ i,t} + \beta_6\, R\&D_{\ i,t} \\ &+ \beta_7\, CapitalExpenditure_{\ i,t} + \beta_8\, ln(FirmAge)_{\ i,t} + \beta_9\, Market\ Share_{\ i,t} \\ &+ \beta_{10}\, Business\ Segment\ Concentration_{\ i,t} + Year + Industry + \varepsilon_{\ i,t} \end{aligned} \quad (1)$$

$$\begin{aligned} ROA_{\ i,t+1} \quad &= \alpha + \beta_1\, ln(Pay\ Ratio)_{\ i,t} + \beta_2\, Tobin's\ q_{\ i,t} + \beta_3\, ROA_{\ i,t} \\ &+ \beta_4\, ln(Sales)_{\ i,t} + \beta_5\, Leverage_{\ i,t} + \beta_6\, R\&D_{\ i,t} \\ &+ \beta_7\, CapitalExpenditure_{\ i,t} + \beta_8\, ln(FirmAge)_{\ i,t} + \beta_9\, Market\ Share_{\ i,t} \\ &+ \beta_{10}\, Business\ Segment\ Concentration_{\ i,t} + Year + Industry + \varepsilon_{\ i,t} \end{aligned} \quad (2)$$

Table 1. Variable Definitions

Variables	Definitions
$Tobin's\ q$	Tobin's q is the market value of equity divided by the book value of total assets.
ROA	Return on Assets (ROA) is ordinary income divided by total assets.
$In(Pay\ Ratio)$	Natural logarithm of internal directors' and executive officers' per capita compensation divided by employees' per capita salary.
$ln(Sales)$	Natural logarithm of sales.
$Leverage$	Fixed assets at the end of the period divided by total assets at the end of the period.
RD	Research and development expenses divided by total assets at the end of the period.
$Capital\ Expenditure$	Capital expenditures divided by total assets at the end of the period.
$ln(Firm\ Age)$	Natural logarithm of firm age.
$Market\ Share$	Sales divided by total sales in the same industry.
$Business\ Segment\ Concentration$	Herfindahl Index by segment at the firm level based on segment sales If no segment is disclosed, the concentration is set to "1".

4.2 Data

We sample observations of listed Japanese firms that meet the selection criteria below. The analysis period for this study is approximately six years, from November 2013 to December 2019. The data used are obtained from the NEEDS Nikkei Financial Data DVD Edition, NEEDS-Cges Corporate Governance Evaluation System, and Nikkei Value Search provided by Nikkei Inc.

1. Listed on the Japanese stock market (including delisted firms)
2. With a 12-month fiscal year-end
3. Non-financial (excluding banks, securities firms, and insurance firms)
4. For which all data required for the analysis are available

The financial data used are from consolidated financial statements; accounting figures from individual financial statements are used for firms with unavailable consolidated financial statements. To eliminate the influence of outlier values, we performed winsorization using the upper and lower 1% values for each variable, except for the binary variables.

4.3 Basic statistic

Table 2 presents the descriptive statistics of the variables used in this study[3]. There are slight differences in the number of observed values due to the varying availability of data for each of the objective variables, $Tobin's\ q_{\ t+1}$ and $ROA_{\ t+1}$. Table 3 shows the correlation coefficients between variables. There was no significant correlation between $Pay\ Ratio$ and $Tobins'q_{\ t+1}$ but there was a significant positive correlation between $Pay\ Ratio$ and $ROA_{\ t+1}$ (0.222). Therefore, the results support Hypothesis 1 only for ROA, which represents firm performance. The variance inflation factor (VIF) was calculated to assess the multicollinearity among variables, and it was lower than 10, a standard threshold value generally considered indicative of multicollinearity in all estimations. Consequently, the likelihood that correlations between variables will pose a serious problem in regression estimation is not considered significant.

Table 2. Summary statistics

variable	n	mean	SD	min	Q1	median	Q3	max
Tobin's q t+1	9244	1.284	0.953	0.467	0.864	1.016	1.307	12.814
ROA t+1	9346	0.049	0.057	-0.367	0.025	0.046	0.074	0.279
ln(Pay Ratio)	9346	1.317	0.574	-0.404	0.978	1.336	1.677	2.899
Tobin's q	9346	1.303	0.950	0.494	0.880	1.031	1.321	10.891
ROA	9346	0.051	0.055	-0.346	0.026	0.047	0.075	0.303
ln(Sales)	9346	10.876	1.808	5.802	9.582	10.737	12.105	14.974
Leverage	9346	0.128	0.119	0.000	0.036	0.095	0.185	0.575
R&D	9346	0.011	0.021	0.000	0.000	0.002	0.014	0.273
Capital Expenditure	9346	0.043	0.038	0.000	0.017	0.033	0.056	0.240
ln(Firm Age)	9346	3.836	0.761	-0.708	3.538	4.128	4.319	4.927
Market Share	9346	0.012	0.029	0.000	0.000	0.002	0.008	0.160
Business Segment Concentration	9346	0.579	0.216	0.198	0.407	0.540	0.743	1.000
MAscore	7947	-0.008	0.077	-0.332	-0.053	-0.008	0.038	0.286

Summary statistics also include variables used in the robustness tests conducted in Section 6.

Table 3. Correlation coefficients

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Tobin's q t+1	(1)	**1.000**											
ROA t+1	(2)	**0.025**	**1.000**										
ln(Pay ratio)	(3)	0.010	**0.222**	**1.000**									
Tobin's q	(4)	**0.059**	**0.163**	0.018	**1.000**								
ROA	(5)	**0.033**	**0.733**	**0.258**	**0.217**	**1.000**							
ln(Sales)	(6)	**-0.066**	**0.158**	**0.433**	**-0.227**	**0.161**	**1.000**						
Leverage	(7)	-0.006	**-0.176**	**0.049**	**-0.043**	**-0.204**	**0.075**	**1.000**					
R&D	(8)	-0.016	**-0.048**	**0.094**	**0.128**	**-0.090**	**0.053**	**-0.156**	**1.000**				
Capital Expenditure	(9)	-0.000	**-0.022**	**0.106**	**0.119**	-0.000	-0.012	**0.186**	0.011	**1.000**			
ln(Firm Age)	(10)	**-0.094**	**-0.032**	**0.092**	**-0.345**	**-0.058**	**0.292**	**-0.105**	**0.101**	**-0.087**	**1.000**		
Market Share	(11)	**-0.052**	-0.003	**0.266**	**-0.069**	-0.004	**0.592**	**0.213**	**0.031**	**0.053**	**0.157**	**1.000**	
Business Segment Concentration	(12)	**0.034**	-0.003	**-0.057**	**0.055**	0.006	**-0.211**	-0.013	**-0.052**	0.003	**-0.108**	**-0.143**	**1.000**

Correlations are presented in bold when they are statistically significant at the 5% level with a p-value ($p < 0.05$).
Correlations are conducted using a sample size of 9,244.

5. RESULTS

Table 4 presents the estimation results for equations (1) and (2). In the subsequent regression estimation, heteroskedasticity and serial correlation of residuals are considered. Standard errors corrected for annual clusters are used (Liang & Zeger, 1986; Arellano, 1987). The variable of interest is $ln(Pay\ Ratio)$. Hypothesis 1 predicts a positive sign for its coefficient, while Hypothesis 2 predicts a non-significant result.

[3] The distribution plots for each variable are presented in Appendix A.

Table 4. Pay ratio and firm performance

	Predict	Tobin's q t +1	ROA t +1
ln(Pay Ratio)	(?) (?)	0.031 ***	0.003 ***
		(0.010)	(0.001)
Tobin's q	(+) (+)	0.793 ***	0.002
		(0.027)	(0.001)
ROA	(+) (+)	-0.198	0.717 ***
		(0.244)	(0.031)
ln(Sales)	(+) (+)	-0.019 ***	0.002 ***
		(0.005)	(0.000)
Leverage	(−) (−)	0.048	-0.015 ***
		(0.056)	(0.005)
R&D	(+) (−)	2.399 ***	0.008
		(0.558)	(0.047)
Capital Expenditure	(+) (−)	0.128	-0.037 **
		(0.181)	(0.016)
ln(Firm Age)	(?) (?)	-0.030 ***	-0.001
		(0.009)	(0.001)
Market Share	(+) (+)	0.501 **	-0.077 ***
		(0.220)	(0.017)
Business Segment Concentration	(+) (+)	-0.019	0.001
		(0.025)	(0.002)
observations		9244	9346
R squared		0.708	0.546

*** p < 0.01; ** p < 0.05; * p < 0.1. standard error in brackets.

The estimation results show that $ln(Pay\ Ratio)$ is positive and significant at the 1% level for both $Tobin's\ q_{t+1}$ and ROA_{t+1}. Therefore, even when controlling for other factors, the expansion of the pay ratio positively impacts firm value and performance. This supports Hypothesis 1, which posits that the expansion of the pay ratio attracts competent executives and that these competent executives increase firm value and performance. These results are consistent with the previous U.S. study discussed in Section 2. The predicted and actual results were examined for the control variables to confirm the validity of the analysis results.

For $Tobin's\ q_t$ and ROA_t, a positive sign was expected for both equations (1) and (2). This is because firms with higher firm value and performance in the current period are expected to have a more positive impact on these measures in the following period. The results for the lag variables corresponding to the objective variables were similar. However, the results for ROA_t in equation (1) and $Tobin's\ q_t$ in equation (2) were not significant.

For $ln(Sales)_t$, a positive sign was expected for both equations (1) and (2), as firms with higher sales in the current period are expected to have a more positive impact on firm value and performance in the following period. The results for equation (2) are consistent with this expectation. However, contrary to expectations, the results of equation (1) show a negative impact. This unexpected result may be attributed to the fact that firm value includes expectations beyond firm performance, specifically shareholder expectations.

$Leverage_t$ was expected to be negative for both equations because larger debt is considered to have a negative impact on firm performance due to increased interest expense burden. The equation (2) results were consistent with this expectation, but no significant results were obtained for equation (1).

$R\&D_t$ was expected to have a positive sign for equation (1) and a negative sign for equation (2). This is because R&D-related expenditures are expected to impact firm performance in the short term negatively but positively impact future performance. The equation (1) results are consistent with this expectation, but no significant results were obtained for equation (2).

$Capital\ Expenditure_t$ was expected to have a positive sign for equation (1) and a negative sign for equation (2). This is because it involves purchasing fixed assets with the expectation of future cash flows, but it may negatively impact short-term firm performance due to increased depreciation expenses. The results for equation (2) were consistent with this prediction; however, no significant results were obtained for equation (1).

For $ln(Firm\ Age)$, it was expected that the results of both equations (1) and (2) would not be significant, as firm age itself is considered neutral to firm value and performance. The results for equation (2) were consistent with

this expectation. However, for equation (1), the results showed that younger firms positively impact firm value. This may indicate that newer firms have higher future expectations.

$Maket\ Share$ was expected to have a positive sign for both equations, as it is generally associated with better firm value and performance. The results for equation (1) are consistent with this expectation. However, for equation (2), an increase in market share has a negative impact on firm performance. This could be because firms with high market shares often require large capital investments, leading to larger total assets and, consequently, smaller ROA.

$Business\ Segment\ Concentration$ is a diversification indicator where 1 represents a single-segment firm, and lower values indicate a higher degree of diversification. It was expected to have a positive sign in both equations (1) and (2). This is because diversified firms are known to have lower Tobin's q and ROA compared to single-segment firms (Lang & Stulz, 1994; Berger & Ofek, 1995). However, no significant results were obtained for either equation. In summary, the results are generally in line with expectations, and the analysis results are deemed reasonable.

6. ROBUSTNESS TEST

The analysis in the previous section indicated that expanding the pay ratio has a positive impact on the value and performance of listed Japanese firms. Although this positively impacts a firm's ability to secure highly sought-after managerial talent, the model equation does not directly include a variable that proxies managerial ability. Therefore, we confirmed the robustness of our results by conducting additional tests. These tests utilized the Managerial Ability score ($MAscore$) (Demerjian et al., 2012), a proxy for managerial abilities.

Specifically, $MAscore$[4] was calculated according to the method of Demerjian et al. (2012), the average value of $ln(Pay\ Ratio)$ per quartile was obtained, and the relationship between $ln(Pay\ Ratio)$ and $MAscore$ was analyzed.

Fig. 1 presents the results of the robustness test[5]. Pay ratio rank 1 is the $ln(Pay\ Ratio)$ group in the first quartile or lower. Pay ratio rank 2 is the $ln(Pay\ Ratio)$ group in the second quartile above the first quartile. Pay ratio rank 3 is the $ln(Pay\ Ratio)$ group in the third quartile above the second quartile, and Pay ratio rank 4 is the $ln(Pay\ Ratio)$ group in the fourth quartile and above.

The vertical axis represents the mean value of $MAscore$. The horizontal line in the center is the average of all $MAscore$ samples. As the Pay ratio rank increases, the mean value of $MAscore$ also increases. The Pay ratio ranks 1 and 2 of the low $ln(Pay\ Ratio)$ group are below the $MAscore$ sample average, In contrast, the Pay ratio ranks 3 and 4 of the high $ln(Pay\ Ratio)$ group are above the $MAscore$ sample average.

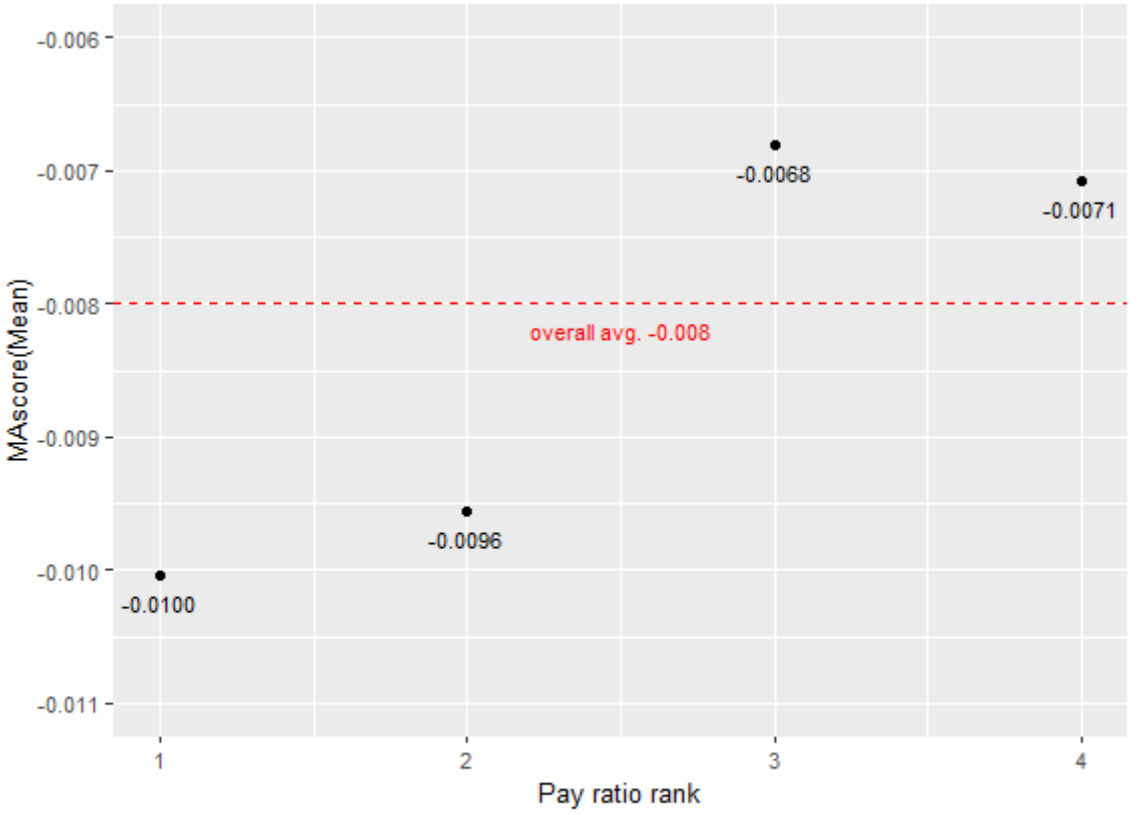
A closer examination of the $MAscore$ of the high $ln(Pay\ Ratio)$ group shows that it is about 29%[6] higher than that of the low $ln(Pay\ Ratio)$ group. This indicates that firms in the high $ln(Pay\ Ratio)$ group are more successful in having more capable executives.

This also supports Hypothesis 1 that an increase in pay ratio indicates the theory of firms' ability to secure highly sought-after managerial talent; it also confirms the robustness of the results of the analysis in this study.

[4] Regarding the calculation of $MAscore$, the method differs from that of Demerjian et al. (2012) in two main aspects. First, Demerjian et al. (2012) estimated the discounted present value of operating lease payments and used it as a variable, but this paper omits it. This omission is due to the fact that Japanese annual securities reports do not disclose information necessary for estimating the discounted present value of operating lease payments. Additionally, Chang et al. (2018) found that excluding this variable did not significantly change the results of their analysis. Second, while Demerjian et al. (2012) used the Almon Lag estimation to obtain the amortization rate for calculating R&D cost assets, this paper calculates the amortization rate as five years. This approach is adopted because the Almon lag estimation is overly restrictive in its assumptions and cannot avoid arbitrariness and lack of realism (Kuroda, 1979). Furthermore, Putra et al. (2021) also calculate the amortization rate as five years.

[5] The industry-specific summary statistics for $MAscore$ are presented in Appendix B.

[6] The mean $MAscore$ of the low $ln(Pay\ Ratio)$ group is -0.0098, calculated as ((-0.01) + (-0.0096)) ÷ 2. For the high $ln(Pay\ Ratio)$ group, the mean $MAscore$ is -0.00695, calculated as ((-0.0068) + (-0.0071)) ÷ 2. The increase in $MAscore$ from the low to the high $ln(Pay\ Ratio)$ group is 29%, derived from ((-0.00695) - (-0.0098)) ÷ (-0.0098) = -0.29082.



(note)
Pay ratio rank1 is a sample of the Pay ratio that is below the first quartile.
Pay ratio rank2 is a sample of the Pay ratio that is above the 1st quartile and below the second quartile.
Pay ratio rank3 is a sample of the Pay ratio that is above the second quartile and below the third quartile.
Pay ratio rank4 is a sample of the Pay ratio that is above the third quartile.

Fig. 1

7. CONCLUSION

This study's objectives were to empirically examine the effects of pay ratio expansion on firm value and performance in Japan and whether these effects are affected by differences in managerial appointment practices. The results of the empirical analysis revealed that for Japanese listed firms as a whole, an increase in pay ratio increases firm value and performance; moreover, firms with higher pay ratios also have higher indicators of managerial ability. The above findings suggest that a high pay ratio in Japan tends to reflect the acquisition of competent executives, which supports the theory of firms' ability to secure highly sought-after managerial talent.

Moreover, analogous outcomes were observed in the U.S., characterized by a diverse executive appointment approach combining internal promotions and the "Wandervogel" (external recruitment) model, and Japan, where internal promotions predominantly prevail. This suggests that regardless of management promotion practices, firm value and performance tend to increase as the gap between management and employee pay increases. The results provide important insights into corporate compensation policies that enhance firm value and performance. However, this study provides only a partial picture of the economic impact of the expansion of pay ratios in Japan. Although this paper found that firms with high pay ratios attract competent executives who increase firm value and performance, further investigation is needed to determine through what channels executives increase firm value and performance.

Since executives do not conduct operations themselves but rather direct employees and conduct business activities through them, competent executives may enhance their firms' capabilities by taking the lead in human capital management. The relationship between pay ratio and human capital management is a topic for further study.

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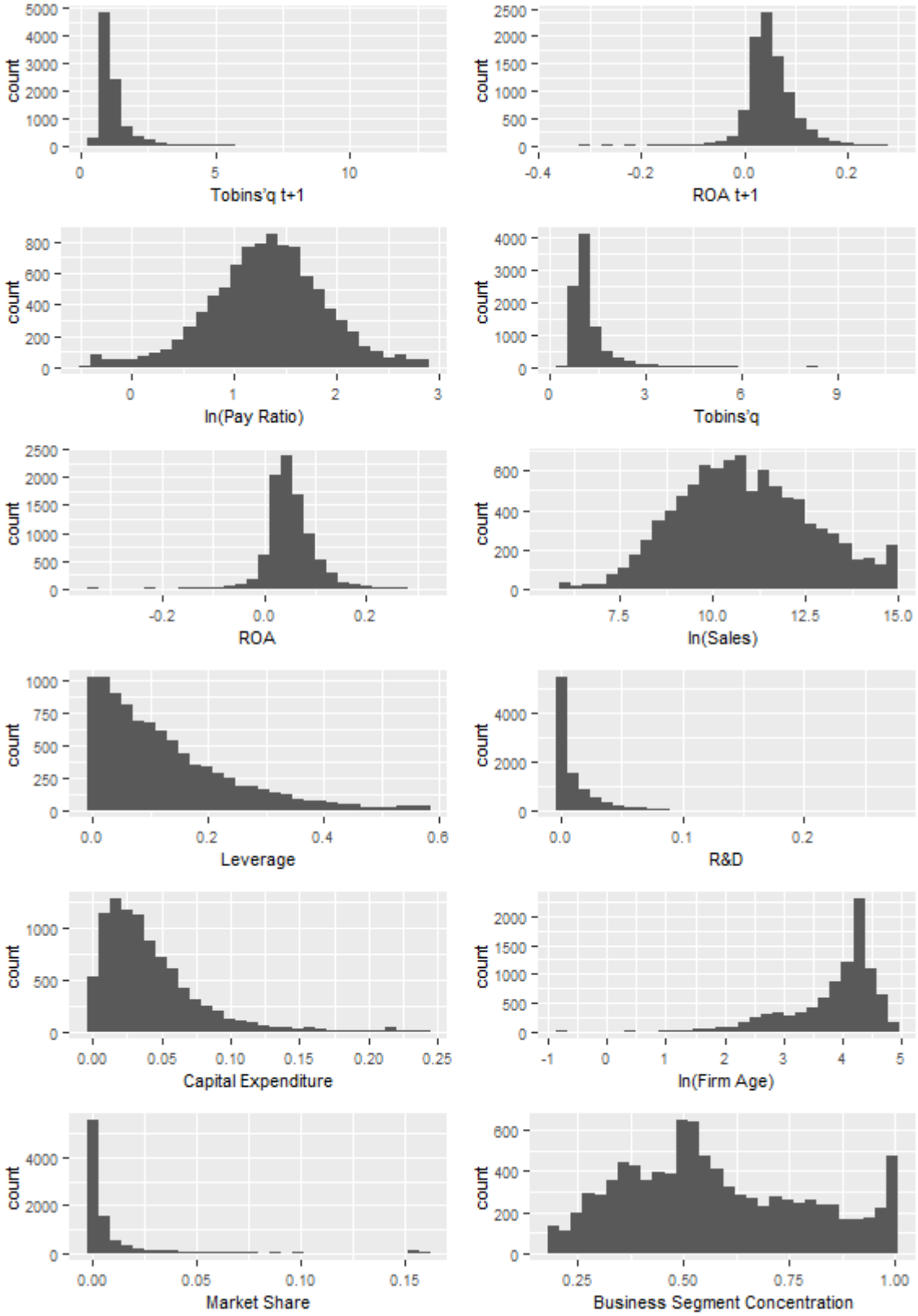
Appendix A. Histogram of variables



Appendix B. Summary statistics of MA scores by industry

Industry name	**n**	**mean**	**SD**	**min**	**Q1**	**median**	**Q3**	**max**
Chemicals	903	-0.002	0.065	-0.215	-0.050	-0.008	0.047	0.134
Construction	508	-0.003	0.034	-0.094	-0.028	-0.005	0.022	0.083
Machinery	980	-0.004	0.073	-0.250	-0.052	-0.008	0.048	0.171
Automobiles	328	-0.004	0.037	-0.175	-0.027	-0.004	0.025	0.071
Electronic Equipment	1100	-0.004	0.082	-0.296	-0.062	-0.010	0.059	0.198
Non-ferrous Metal Products	491	-0.007	0.053	-0.157	-0.046	-0.009	0.031	0.137
Food Products	495	-0.008	0.045	-0.310	-0.040	-0.007	0.025	0.101
Trading Companies	377	-0.008	0.043	-0.144	-0.027	-0.001	0.020	0.082
Iron and Steel	179	-0.009	0.036	-0.107	-0.035	-0.004	0.020	0.073
Other Manufacturing	384	-0.009	0.069	-0.318	-0.058	0.002	0.045	0.142
Services	1117	-0.011	0.114	-0.306	-0.098	-0.010	0.073	0.286
Pulp and Paper	108	-0.011	0.028	-0.075	-0.034	-0.011	0.008	0.051
Textiles	173	-0.015	0.051	-0.151	-0.053	-0.011	0.022	0.117
Rubber	94	-0.015	0.032	-0.110	-0.032	-0.012	0.004	0.079
Ceramics	258	-0.023	0.118	-0.332	-0.108	-0.035	0.075	0.235
Precision Instruments	212	-0.030	0.086	-0.302	-0.092	-0.036	0.028	0.181
Pharmaceutical	240	-0.036	0.131	-0.326	-0.141	-0.032	0.067	0.231

This study employs the Nikkei industry classification system. The limited number of industries results from following Demerjian et al. (2012) in the calculation of MA scores, whereby industries with fewer than 100 sample observations were excluded.