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Management Forecasts, Idiosyncratic Risk, and the Information Environment☆

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ABSTRACT

Management forecasts are an important source of information for the Japanese stock market. In this paper, we use management forecast error as a proxy for disclosure quality to investigate the relationship between disclosure quality and idiosyncratic risk. We find that management forecast error is positively related to idiosyncratic risk, suggesting that high-quality public information reduces idiosyncratic risk. Furthermore, we present evidence that management forecast error is less positively related to idiosyncratic risk in relatively good information environments.

1. Introduction

Studies (e.g., Campbell, Lettau, Malkiel, & Xu, 2001; Morck, Yeung, & Yu, 2000) have identified an increase in the level of average stock return volatility. This paper uses management forecast error as a proxy for disclosure quality to investigate the relationship between disclosure quality and idiosyncratic risk. Japan's stock exchanges ask firms to forecast the following year's key accounting figures. Although not all firms are required to provide these forecasts, most listed firms do.[1] Ota (2010) suggests that management forecasts have higher correlation with and incremental explanatory power for stock prices than realized income, indicating that management forecasts represent an important information source for Japanese stock markets.

This study contributes to the literature in two ways. First, we investigate the relationship between the quality of disclosed information and firm risk. Rajgopal and Venkatachalam (2011) argue that good information reduces firm risk: the higher the quality of accruals, as proposed by Dechow and Dichev (2002), the lower a firm's idiosyncratic risk. Okuda and Kitagawa (2011) investigate the relationship between five earnings quality measures (e.g., accruals quality, earnings predictability, and earnings smoothness) and idiosyncratic risk during a period of accounting standard reform in Japan. They find that the higher a firm's quality of earnings, the lower its idiosyncratic risk, which is consistent with the findings of Rajgopal and Venkatachalam (2011). Contrariwise, Hutton, Marcus, and Tehranian (2009) find that financial statement opacity measured by discretionary accruals is positively

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[1] In Iwasaki et al. (2012), for example, 95.42% of listed companies covered during the sample period (1997–2009) reported management forecasts.

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associated with stock return synchronicity because firms with high synchronicity have less idiosyncratic information in their stock price. Datta, Datta, and Singh (2014) show that the relationship between financial statement opacity and idiosyncratic risk is not found if they use the performance-matched discretionary accruals developed by Kothari, Leone, and Wasley (2005) and the two-way clustered standard error proposed by Petersen (2009). Therefore, the effect of financial information transparency on idiosyncratic risk remains as an empirical question. Unlike these studies, we consider management forecast accuracy as a proxy for the quality of the disclosed information and examine the relationship between management forecast error and idiosyncratic risk.

Second, we examine how the effects of management forecast error differ according to the quality of the information environment. Botosan (1997) finds that for firms in a poor information environment, greater disclosure is associated with a lower cost of capital. Aman (2011) finds an interactive effect between forecast credibility and media coverage of earnings performance. This study uses firm size and analyst following as proxies for a firm's information environment.

Our analyses indicate that management forecast error is positively related to idiosyncratic risk, suggesting that high-quality disclosed information reduces idiosyncratic risk, which is consistent with Rajgopal and Venkatachalam (2011). We further show that management forecast errors are less positively related to idiosyncratic risks for larger firms and firms with analyst following, suggesting that management forecast accuracy is less important for firms with good information environments.

Our research motivation is similar to that of Aman (2011). However, our analyses are distinctly different from those of Aman (2011). First, we do not use R2, but instead use the variance of the residual from a regression of a firm's stock returns. Li, Rajgopal, and Venkatachalam (2014) found that these are not interchangeable. They found that idiosyncratic return volatility increases with poorer earnings quality in a within-country setting, and that after controlling for beta, a scaled idiosyncratic volatility measure also increases with poorer earnings quality.

Our research motivation is also similar to that of Abdel-Khalik (2008). His paper analyzes the relationship between analysts' forecasts dispersion and idiosyncratic volatility. Compared to it, our paper focuses on management forecasts. There are two merits of focusing management forecasts in Japan. First, almost all firms provide these forecasts. Second, as Ota (2010) finds, financial analysts in Japan heavily depend on management forecasts in formulating their own forecasts.

Third, we do not focus on management forecast bias, but on management forecast accuracy. Some managers may want to boost or reduce their forecasts, which results in management forecast bias becoming positive or negative. Owing to such management intentions, these instances do not serve as appropriate proxies for disclosure quality. In comparison, management forecast accuracy decreases not only when managements intentionally increase or decrease management forecasts, but also when they are less able to forecast their earnings. This latter is appropriate as a proxy for disclosure quality.

The rest of this study proceeds as follows. In Section 2, we discuss the hypothesis development; in Section 3, we discuss the research design; in Section 4, we describe the sample selection and descriptive statistics; and in Section 5, we present the results. The final section concludes the study and suggests future research possibilities.

2. Hypothesis development

Theoretical support for a negative association between disclosure level and idiosyncratic risk is found not only in the accounting literature but also in the financial literature. For example, Diamond and Verrecchia (1991) show that improving disclosure reduces stock market volatility. Easley and O'Hara (2004) employ a model indicating that a firm's disclosure policy can influence its idiosyncratic risk.

In response to these studies, Rajgopal and Venkatachalam (2011) use the quality of earnings as a proxy for the quality of disclosed information and find that it is negatively associated with lower idiosyncratic risk. Okuda and Kitagawa (2011) also show that the higher a Japanese firm's quality of earnings, the lower its idiosyncratic risk.

In addition to financial reporting, management forecasts are also a major channel of disclosed information. The Tokyo Stock Exchange and other Japanese stock exchanges ask that firms forecast the following year's key accounting figures. Although not all firms are forced to provide their forecasts, virtually all listed firms do. Management forecasts have thus attracted both practical and academic attention. Ota (2010) suggests that management forecasts have the highest correlation with and incremental explanatory power for stock prices.

These arguments lead to our first hypothesis:

Hypothesis I. Management forecast errors are positively correlated with idiosyncratic risks.

Next, we turn to the interaction between the information environment and disclosed information. Analytical models in accounting usually assume that information noise can be reduced by signals (e. g. Christensen & Feltham, 2003 Chap.3). This assumption suggests that the effect of one signal is reduced if the other signals are more correlated with "true" value of the firm. This means that on the one hand, a poor information environment suggests that there is little alternative information to predict a firm's future cash flow other than accounting information. Therefore, high-quality accounting information could reduce investor noise. On the other hand, if the information environment is rich, investors can easily access other information sources and reduce their uncertainty. In such a situation, investors may pay less attention to disclosed information.

There are several studies that find that the information environment is related to the amount, type and quality of disclosed information. Botosan (1997) finds that the association between the cost of equity capital and disclosure levels is less significant for firms that attract a greater number of analysts. Moreover, Aman (2011) finds an interactive effect between forecast credibility and media coverage of earnings performance, suggesting that the information environment affects the impact of management forecasts on the stock market. Thus, we develop Hypothesis II, which predicts that management forecast errors are less positively correlated with idiosyncratic return volatility when firms face a better information environment.

To examine Hypothesis II, we adopt two common proxies for information environment. The first measure is firm size. Research suggests that size can be a proxy for the amount of prior information available about a firm (e.g., Atiase, 1985; Bushman, 1989; Collins, Kothari, & Rayburn, 1987; Freeman, 1987; Grant, 1980). For example, Atiase (1985) and Freeman (1987) have shown that the relationship between management forecast accuracy and stock returns is weak in large firms. We thus assume that larger firms have a better information environment.

The second measure is analyst following. Because analysts play a significant role as intermediaries between firms and external parties, analyst following is commonly considered as a proxy for the quality of the information environment (Atiase, 1985; Bushman, 1989; Collins et al., 1987; Freeman, 1987; Lobo & Mahmoud, 1989; O'Brien & Bushman, 1990). More recently, Frankel and Li (2004) find that increased analyst following is associated with reduced profitability of insider trades and reduced insider purchases. We thus assume that information environment gets better when one or more analysts actively track and publish opinions on the firms.

Using these two proxies,[2] we examine testable Hypotheses IIa and IIb.

Hypothesis II. Management forecast errors are less positively correlated with idiosyncratic return volatility when firms face a better information environment.

Hypothesis IIa. Management forecast errors are less positively correlated with idiosyncratic return volatility when firms are relatively large.

Hypothesis IIb. Management forecast errors are less positively correlated with idiosyncratic return volatility when one or more analysts actively track and publish opinions on the firms.

3. Research design

3.1. Idiosyncratic risk

First, we describe the procedure for measuring the two main variables, idiosyncratic risk and management forecast error. Although some related literature (e.g., Foerster, Sapp, & Shi, 2010) uses the market model, we use the three-factor model in Fama and French (1993) to measure idiosyncratic return volatility. This measure is the same as that of Rajgopal and Venkatachalam (2011). More specifically, we measure excess returns as the residual from a regression of Eq. (1):

$$RET_{i,m} - R_{f,m} = \alpha_i + \beta_{RMRF,i}\left(R_{M,m} - R_{f,m}\right) + \beta_{SMB,i}SMB_m + \beta_{HML,i}HML_m + \varepsilon_{i,m} \quad (1)$$

where $RET_{i,\ m}$ corresponds to the daily stock return for firm i in month m, $R_{f,\ m}$ is the risk-free rate in month m,[3] and ($R_{M,\ m} - R_{f,\ m}$) is the value-weighted excess market returns in month m.[4] SMB_m is the size factor spread portfolio in month m, and HML_m is the book-to-price ratio factor spread portfolio in month m.

We estimate Eq. (1) for each year using daily data covering from July 1 at year t to June 30 at year $t + 1$. We define the idiosyncratic return volatility (*RMSE*) as the sample standard deviation of the excess returns.[5]

3.2. Management forecast error

As previously mentioned, our study examines the association between management forecast accuracy and idiosyncratic risk. Thus, we first calculate the total management forecast error variable, defined as the composite measure of the sales forecast error, ordinary income (i.e., earnings before extraordinary items, special items, and taxes) forecast error, and net income forecast error. These forecast errors are defined as initial management forecasts for year t minus actual number for year t divided by total assets for year $t - 1$.[6]

[2] Note that these two measures are not intended to be mutually exclusive. In fact, Collins et al. (1987) and Bushman (1989) suggest that the number of analysts following a firm is positively related to the firm's market value.

[3] We define the risk-free rate as the government bond yield over ten years.

[4] We define the market return as the rate of change in the Tokyo Stock Price Index (TOPIX).

[5] Our measures for idiosyncratic risk are different from those of Aman (2011) in some regards. First, Aman (2011) uses a return generation model in which the daily return for each firm is explained by the daily market portfolio (the rate of change in the TOPIX) and the industry average return, whereas we use the three-factor model in Fama and French (1993). Second, Aman (2011) calculates the idiosyncratic risk as one minus R-squared in the return generation model and as log-transformed. In contrast, we calculate idiosyncratic risk as the standard deviation of the residual in the three-factor model.

[6] We also used another standardized management forecast error. First, the mean value was subtracted from each management forecast error by year, and then the difference between the management forecast error and the mean was divided by the standard deviation. However, our conclusions did not change.

Table 1
Principal component analysis result.

Panel A: Total variance explained

Component	Eigenvalue	Difference in eigenvalue	Variance explained (%)	Cumulative variance (%)
*Comp*1	1.960	1.359	0.654	0.654
*Comp*2	0.601	0.162	0.200	0.854
*Comp*3	0.439		0.146	1.000

Panel B: Principal components (eigenvectors)

Variable	*Comp*1	*Comp*2	*Comp*3	*Unexplained*
$AMFE\_SLS_t$	0.544	0.829	0.131	0.000
AMFE_OI	0.601	-0.275	-0.751	0.000
AMFE_NI	0.586	-0.487	0.648	0.000

Table 1 presents the principal component analysis of management forecast errors. $AMFE\_SLS_t$ = absolute value of management forecast error of sales (= [initial management forecasts of sales for year *t* minus actual sales for year *t*] / total assets for year *t* − 1). $AMFE\_OI_t$ = absolute value of management forecast error of ordinary income (= [initial management forecasts of ordinary income for year *t* minus the actual ordinary income for year *t*] / total assets for year *t* − 1). $AMFE\_NI_t$ = absolute value of management forecast error of net income (= [initial management forecasts of net income for year *t* minus the actual net income for year *t*] / total assets for year *t* − 1).

Next, we turn to discuss management forecast errors. We focus on (1) sales forecast errors for year *t* (MFE_SLS_t), (2) ordinary income forecast errors for year *t* (MFE_OI_t), and (3) net income forecast errors for year *t* (MFE_NI_t). These forecast errors may have some information but are much correlated with each other. To capture the various effects of management forecast errors in a single measure, we conduct a principal component analysis on three variables. Table 1 provides the results of the principal component analysis. Panel A shows that the first principal components have eigenvalues greater than one and account for approximately 65% of the total variance. Panel B reports the first components, all of which have positive signs, as expected. Thus, we define the first principal component as the composite measure of management forecast errors (*MFE*).

We use the absolute value of the composite measure of management forecast errors (*AMFE*) to examine the association between management forecast accuracy and idiosyncratic risk. We use the absolute value because both highly optimistic and pessimistic management forecasts can be interpreted as firm-specific risks for investors. Although our main concern is the accuracy measure (*AMFE*), we also focus on the absolute value of three specific management forecast errors, i.e., sales forecast errors (*AMFE_SLS*), ordinary income forecast errors (*AMFE_OI*), and net income forecast errors (*AMFE_NI*), to check the robustness of our results.[7]

3.3. The relationship between residual management forecast error and idiosyncratic risk

To test Hypothesis I on the relationship between management forecast error and ex-post idiosyncratic risk, we estimate Eq. (2) as follows:

$$\begin{aligned}RMSE_{i,t} = {} & \gamma_0 + \gamma_1 AMFE_{i,t-1} + \gamma_2 SIZE_{i,t-1} + \gamma_3 ROA_{i,t-1} + \gamma_4 GROWTH_{i,t-1} + \gamma_5 LOSS_{i,t-1} \\ & + \gamma_6 LEV_{i,t-1} + \gamma_7 INST_{i,t-1} + \gamma_8 CROSS_{i,t-1} + \gamma_9 FOREIGN_{i,t-1} \\ & + \gamma_{10} AQ_{i,t-1} + \gamma_{11} SMOOTH_{i,t-1} + \gamma_{12} PREDICT_{i,t-1} + \gamma_{13} CFOVOL_{i,t-1} \\ & + Year\ \ Dummy + Industry\ \ Dummy + \varepsilon\end{aligned} \tag{2}$$

The dependent variable is $RMSE_t$, which is defined as idiosyncratic return volatility based on the three-factor model in Fama and French (1993) for fiscal year *t*.

In independent variables, the test variable is the absolute value of management forecast error (*AMFE*), as described in Section 3.2. If Hypothesis I is supported, the coefficient of *AMFE* will be positive. As mentioned above, we also test the relationship between idiosyncratic volatility and three specific management forecast errors as well as the total management forecast error (*AMFE*) to check the robustness of our results. Specifically, we examine the relationship between idiosyncratic volatility and the absolute value of management forecast error for (1) sales (*AMFE_SLS*), (2) ordinary income (*AMFE_OI*), and (3) net income (*AMFE_NI*).[8] We also predict that the coefficients of *AMFE_SLS*, *AMFE_OI*, and *AMFE_NI* will be significantly positive.

We control for several variables affecting return volatility in the cross-section. Firm size (*SIZE*) is expected to negatively relate to idiosyncratic volatility because small firms experience higher return volatility (e.g., Pastor & Veronesi, 2003; Rajgopal & Venkatachalam, 2011). We define *SIZE* as the natural log of total assets. We control for firm profitability, which is posited to relate negatively to return volatility (e.g., Wei & Zhang, 2006). Thus, we use net income divided by total assets (*ROA*) and the loss

[7] We did not include operating income forecasts in our analysis owing to data availability constraints. In 2007, the Tokyo Stock Exchange (TSE) introduced the requirement that listed firms had to provide operating income forecasts in view of their growing importance for investors. Therefore, no pre-2007 data were available.

[8] As mentioned, we do not examine the relationship between idiosyncratic return volatility and the absolute value of the residual management forecast error for operating income because of data availability constraints.

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dummy (*LOSS*) as control variables. In addition, as high-growth firms experience higher stock return volatility (e.g., Cao, Simin, & Zhao, 2006; Malkiel & Xu, 2003; Rajgopal & Venkatachalam, 2011), we use the rate of sales changes as a proxy for firm growth. Because distressed firms experience greater stock return volatility (e.g., Campbell et al., 2001; Rajgopal & Venkatachalam, 2011), we include the variables controlling financial distress, defined as financial leverage (*LEV*) and measured by total liabilities divided by total assets.

In addition, the literature indicates that ownership structure influences idiosyncratic volatility. For example, Brockman and Yan (2009) show that blockholders increase idiosyncratic volatility because of their informational advantage. Sias (1996) and Malkiel and Xu (2003) report that institutional ownership has a positive impact on future volatility.[9] Ferreira and Matos (2008) show that high foreign institutional ownership is associated with high firm-level idiosyncratic variance because foreign investors prefer to invest in high-risk firms.

To control for the effect of ownership structure, this study includes the following three independent variables: institutional ownership (*INST*), cross-shareholdings (*CROSS*), and foreign ownership (*FOREIGN*). Because Japanese firms are interrelated through equity ownership cross-holdings and generally rely on large commercial banks, such as a main bank (Douthett & Jung, 2001; Shuto & Kitagawa, 2011), *INST* and *CROSS* are the important ownership variables in Japan.

In addition, it is possible that management forecast accuracy and idiosyncratic risk are affected by the same underlying factor, e.g., the fundamental volatility of a firm's operational performance, financial reporting, or earnings quality. Therefore, I included three earnings quality measures (accruals quality, income smoothness, and earnings predictability) and the cash flow volatility measure into the independent variables. Accruals quality (*AQ*) is defined according to Dechow and Dichev's (2002) study. Income smoothness (*SMOOTH*) is the ratio of a firm's standard deviation of net income (scaled by total assets) to the standard deviation of cash flows from operations (scaled by total assets). Earnings predictability (*PREDICT*) is the square root of the error variance from a firm's autoregressive order one (AR1) model of annual earnings. Cash flow volatility measure (*CFOVOL*) is defined as the standard deviation of cash flows from operations (scaled by total assets).

At last, we include year dummies (*Year Dummy*) and industry dummies (*Industry Dummy*) to control year and industry effects. The Appendix A provides detailed definitions of the variables in Model (2).

3.4. The effect of the information environment on the relationship between residual management forecast errors and idiosyncratic risk

To test Hypothesis IIa on the effect of firm size on the relationship between management forecast accuracy and idiosyncratic risk, we estimate Eq. (3) below:

$$\begin{aligned} RMSE_{i,t} = &\ \gamma_0 + \gamma_1 AMFE_{i,t-1} + \gamma_2 AMFE \times SIZEq1_{i,t-1} + \gamma_3 AMFE \times SIZEq4_{i,t-1} \\ &+ \gamma_4 SIZEq1_{i,t-1} + \gamma_5 SIZEq4_{i,t-1} + \gamma_6 ROA_{i,t-1} + \gamma_7 GROWTH_{i,t-1} + \gamma_8 LOSS_{i,t-1} \\ &+ \gamma_9 LEV_{i,t-1} + \gamma_{10} INST_{i,t-1} + \gamma_{11} CROSS_{i,t-1} + \gamma_{12} FOREIGN_{i,t-1} \\ &+ \gamma_{13} AQ_{i,t-1} + \gamma_{14} SMOOTH_{i,t-1} + \gamma_{15} PREDICT_{i,t-1} + \gamma_{16} CFOVOL_{i,t-1} \\ &+ Year\ \ Dummy + Industry\ \ Dummy + \varepsilon \end{aligned} \tag{3}$$

where *SIZEq*1 is an indicator variable set to one if the level of total assets is in the first quartile, where that quartile contains the firms with the lowest total assets in each year, and zero otherwise. *SIZEq*4 is an indicator variable set to one if the level of total assets is in the fourth quartile, where that quartile contains the firms with the highest total assets in each year, and zero otherwise. Other variables are defined earlier.

To test Hypothesis IIa, we include the interaction term between *AMFE* and the dummy variables based on the quartile of total assets in Eq. (3). The first (fourth) quartile of firm size, *SIZEq*1 (*SIZEq*4), indicates the poor (good) information environment. We expect the coefficient of $AMFE \times SIZEq4$ to be negative (and the coefficient of $AMFE \times SIZEq1$ to be positive), consistent with Hypothesis IIa.

We estimate Eq. (4) to examine Hypothesis IIb on the effect of analyst coverage on the relationship between residual management forecast errors and idiosyncratic risk.

$$\begin{aligned} RMSE_{i,t} = &\ \gamma_0 + \gamma_1 AMFE_{i,t-1} + \gamma_2 AMFE \times COV_{i,t-1} + \gamma_3 COV_{i,t-1} + \gamma_4 SIZE_{i,t-1} + \gamma_5 ROA_{i,t-1} \\ &+ \gamma_6 GROWTH_{i,t-1} + \gamma_7 LOSS_{i,t-1} + \gamma_8 LEV_{i,t-1} + \gamma_9 INST_{i,t-1} + \gamma_{10} CROSS_{i,t-1} \\ &+ \gamma_{11} FOREIGN_{i,t-1} + \gamma_{12} AQ_{i,t-1} + \gamma_{13} SMOOTH_{i,t-1} + \gamma_{14} PREDICT_{i,t-1} + \gamma_{15} CFOVOL_{i,t-1} \\ &+ Year\ \ Dummy + Industry\ \ Dummy + \varepsilon \end{aligned} \tag{4}$$

To test Hypothesis IIb, we include the interaction term between *AMFE* and the dummy variables based on the analyst coverage (*COV*) in Eq. (4). *COV* is an indicator variable set to one if one or more analysts actively track and publish opinions on a company and its stock, and zero otherwise. If *COV* is equal to one, it indicates a good information environment. We expect the coefficient of $AMFE \times COV$ to be negative, consistent with Hypothesis IIb.

[9] On the other hand, Brandt, Brav, Graham, and Kumar (2009) dispute the findings of Malkiel and Xu (2003) and report a negative relationship between institutional ownership and idiosyncratic volatility among low-priced stocks.

Table 2
Sample selection criteria.

The listed firms (other than banks, securities firms, insurance firms) from 2000 to 2008	24,566
Less: The firms' fiscal year does not end in March	(7,584)
Less: Other financial institutions (Nikkei industry code #52)	(441)
Less: Firms that changed their fiscal year end	(1,029)
Less: Missing data for calculation of idiosyncratic risk	(7,384)
Less: Missing data for calculation of management forecast error	(116)
Less: Missing other data except earnings quality and cash flow volatility data	(1,702)
Final sample	6,310

Table 2 provides details on the sample selection criteria. We obtained the data relating to the consolidated financial statements from the *Nikkei Financial Data* CD-ROM and DVD editions available from Nikkei Media Marketing. We obtained the stock price data from the *Nikkei Portfolio Master* of Nikkei Media Marketing. The data regarding the institutional factors in cross-shareholdings and stable shareholdings were collected from the NLI Research Institute's *Data Package of Cross-Shareholding and Stable Shareholding.*

Table 3
Descriptive statistics.

	Mean	Median	Max	Min	SD	Skewness	Kurtosis	N
RMSE	2.030	1.888	4.481	0.782	0.791	1.075	4.555	6,310
AMFE	0.538	0.190	5.128	0.003	0.940	3.306	15.400	6,310
AMFE_SLS	0.399	0.141	3.473	0.002	0.704	3.346	15.575	6,310
AMFE_OI	0.364	0.119	3.509	0.001	0.656	3.329	15.256	6,310
AMFE_NI	0.226	0.061	2.648	0.001	0.461	4.059	22.949	6,310
SIZE	11.870	11.656	14.701	9.631	1.234	0.487	2.718	6,310
ROA	0.016	0.017	0.105	-0.118	0.039	-2.009	16.408	6,310
GROWTH	0.035	0.026	0.440	-0.266	0.127	2.134	21.509	6,310
LOSS	0.179	0.000	1.000	0.000	0.383	1.675	3.807	6,310
LEV	0.571	0.582	0.954	0.127	0.204	-0.206	2.302	6,310
INST	0.330	0.326	0.593	0.074	0.127	0.063	2.264	6,310
CROSS	0.236	0.191	0.673	0.027	0.161	0.925	3.112	6,310
FOREIGN	0.102	0.072	0.395	0.004	0.098	1.192	3.825	6,310
AQ	0.020	0.014	0.096	0.000	0.020	2.205	9.877	6,310
SMOOTH	0.403	0.312	1.575	0.049	0.315	1.783	6.903	6,310
PREDICT	0.270	0.147	1.028	0.004	0.254	1.237	3.953	6,310
CFOVOL	0.041	0.034	0.145	0.007	0.028	2.096	9.723	6,310

Table 3 presents the descriptive statistics for the variables used in this study. The definitions of each variable are as follows. *RMSE* = idiosyncratic return volatility based on the three-factor model in Fama and French (1993) for fiscal year t. *AMFE* = absolute value of the management forecast errors for year $t - 1$. Management forecast errors are defined as Comp1 from principal component analysis of three variables regarding management forecast errors. *AMFE_SLS* = absolute value of management forecast error for sales for year $t - 1$. *AMFE_OI* = absolute value of management forecast error for ordinary income for year $t - 1$. *AMFE_NI* = absolute value of management forecast error for net income for year $t - 1$. *SIZE* = natural log of total assets at the end of fiscal year $t - 1$. *ROA* = return on assets for fiscal year $t - 1$. *GROWTH* = sales growth for fiscal year $t - 1$. *LOSS* = indicator variable with a value of one if the firm reports a net loss and zero otherwise. *LEV* = total liabilities divided by total assets. *INST* = the percentage of institutional ownership at the end of fiscal year $t - 1$. *CROSS* = the percentage of cross-shareholdings at the end of fiscal year $t - 1$. *FOREIGN* = the percentage of foreign ownership at the end of fiscal year $t - 1$. *AQ* = accruals quality for year $t - 1$ defined by Dechow and Dichev (2002). *SMOOTH* = income smoothness for year $t - 1$, which is the ratio of firm's standard deviation of net income (scaled by total assets) to the standard deviation of cash flows from operation (scaled by total assets). *PREDICT* = earnings predictability for year $t - 1$, which is the square root of the error variance from firm's AR1 model of annual earnings. *CFOVOL* = the standard deviation of cash flows from operation for year $t - 1$ (scaled by total assets). All sequential variables are winsorized at the 1st and 99th percentiles by year.

4. Sample and descriptive statistics

4.1. Sample selection

The sample is selected based on the following criteria:

(1) The firms are listed on Japanese stock exchanges from 2000 to 2008.[10]
(2) The firms' fiscal year ends in March.
(3) The firms are not banks, securities firms, insurance firms, or other financial institutions.[11]
(4) Management forecasts, financial statements, stock prices, and other data (such as ownership structure) necessary for estimating our models are available.

We obtain our data on the consolidated financial statements from the *Nikkei Financial Data* CD-ROM and DVD editions available from Nikkei Media Marketing. We obtain our stock price data from the *Portfolio Master* of Financial Data Solutions. Data on

[10] Our sample period starts at 2000 because we use consolidated financial statements (Japanese accounting standards for consolidation accounting introduced from 2000). Also, our sample period ends at 2008 due to the data availability of analyst forecasts.
[11] The industries of the sample firms are identified using the Nikkei medium industry classification code (*Nikkei gyousyu chu-bunrui*).

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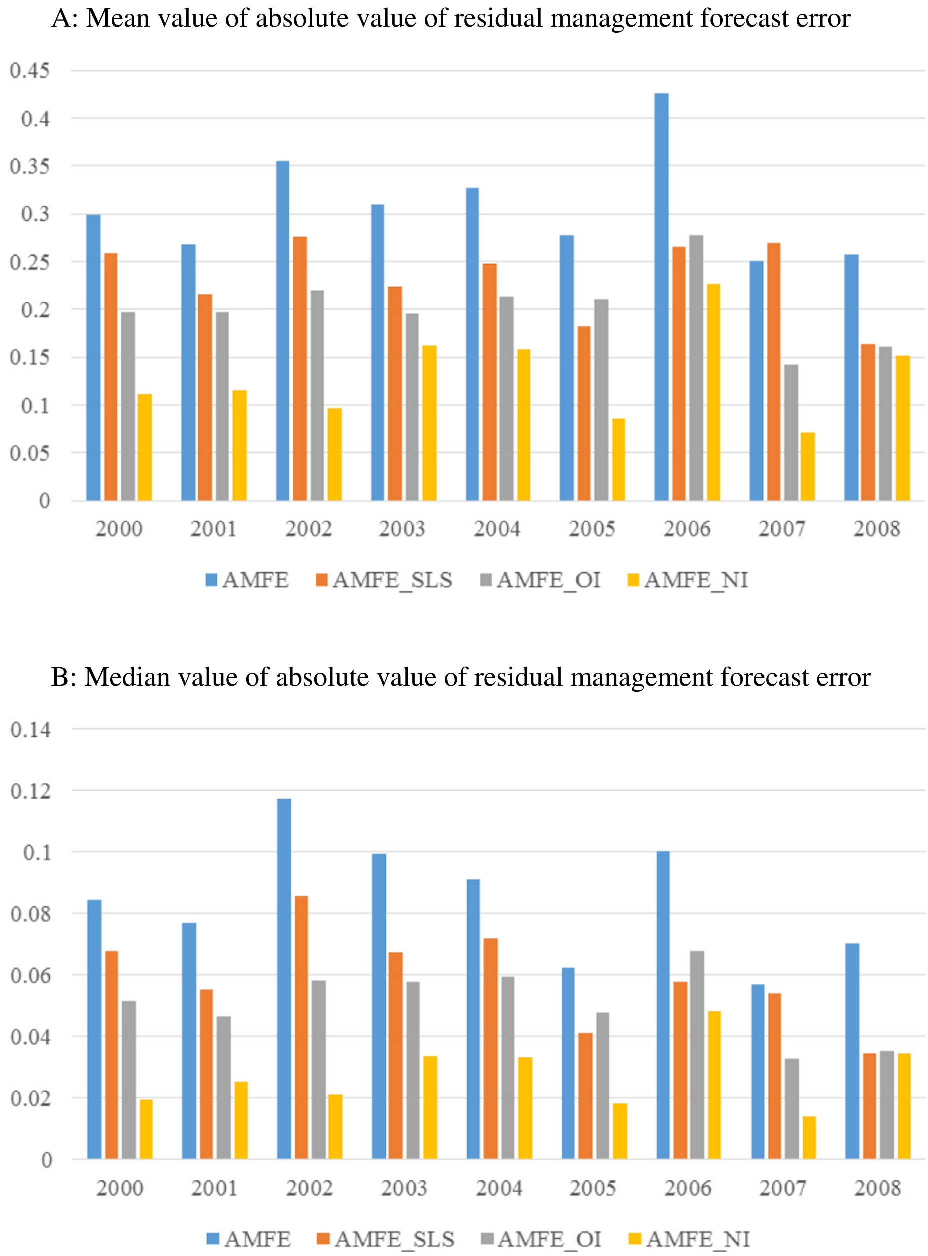

Fig. 1. Management forecast error by year Panel A: Mean value of absolute value of residual management forecast error Panel B: Median value of absolute value of residual management forecast error Fig. 1 shows mean and median absolute value of residual management forecast error by year. The definitions of each variable are as follows. *ARMFE* = absolute value of residual management forecast error for sum of the sales, ordinary income, and net income. *ARMFE_SLS* = absolute value of residual management forecast error for sales. *ARMFE_OI* = absolute value of residual management forecast error for ordinary income. *ARMFE_NI* = absolute value of residual management forecast error for net income. Each variable is winsorized at the 1st and 99th percentiles by year.

the institutional factors in cross-shareholdings and stable shareholdings are collected from the NLI Research Institute's *Data Package of Cross-Shareholding and Stable Shareholding*. Details on the sample selection criteria are provided in Table 2. The final sample comprises 6,310 firm-year observations.

4.2. Descriptive statistics

Table 3 presents the descriptive statistics for the variables used in this study. In order to mitigate the effects of outliers, each sequential variable is winsorized at the 1st and 99th percentiles by year. The mean (median) values of the absolute value of

Table 4
Correlation matrix.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
(1) *RMSE* $_{t}$		**0.03**	0.01	**0.02**	0.00	**-0.14**	**-0.30**	**-0.19**	**0.32**	**0.24**	**-0.06**	**0.10**	**-0.17**	**0.18**	**0.07**	**-0.06**	**0.15**
(2) *AMFE* $_{t-1}$	**0.03**		**0.77**	**0.79**	**0.75**	**0.61**	**-0.09**	**-0.05**	**0.20**	**0.17**	**0.24**	**-0.20**	**0.32**	**0.08**	**0.11**	0.02	0.00
(3) *AMFE_SLS* $_{t-1}$	**0.06**	**0.79**		**0.59**	**0.53**	**0.64**	**-0.04**	**0.03**	**0.05**	**0.23**	**0.22**	**-0.16**	**0.30**	**0.03**	**0.04**	0.02	**-0.04**
(4) *AMFE_OI* $_{t-1}$	**0.06**	**0.87**	**0.60**		**0.70**	**0.62**	0.01	**0.03**	**0.09**	**0.09**	**0.27**	**-0.22**	**0.38**	**0.05**	**0.15**	0.02	-0.02
(5) *AMFE_NI* $_{t-1}$	0.01	**0.78**	**0.50**	**0.69**		**0.54**	**-0.14**	**-0.03**	**0.34**	**0.15**	**0.23**	**-0.22**	**0.30**	**0.09**	**0.14**	-0.01	0.02
(6) *SIZE* $_{t-1}$	**-0.18**	**0.58**	**0.56**	**0.57**	**0.48**		0.00	**0.05**	**-0.06**	**0.24**	**0.42**	**-0.26**	**0.48**	**-0.07**	**-0.07**	**0.03**	**-0.18**
(7) *ROA* $_{t-1}$	**-0.28**	**-0.08**	-0.01	0.01	**-0.19**	0.01		**0.43**	**-0.66**	**-0.47**	-0.01	**-0.07**	**0.43**	**-0.03**	**0.12**	**0.27**	**0.03**
(8) *GROWTH* $_{t-1}$	**-0.13**	**0.02**	**0.09**	0.03	-0.01	0.02	**0.32**		**-0.28**	**-0.16**	-0.01	**-0.03**	**0.27**	**0.03**	**0.09**	**0.14**	0.00
(9) *LOSS* $_{t-1}$	**0.35**	**0.13**	**0.03**	**0.06**	**0.26**	**-0.05**	**-0.65**	**-0.22**		**0.24**	**-0.04**	**0.03**	**-0.24**	**0.17**	**0.06**	**-0.13**	**0.06**
(10) *LEV* $_{t-1}$	**0.25**	**0.15**	**0.18**	**0.08**	**0.16**	**0.26**	**-0.40**	**-0.11**	**0.25**		**0.06**	**0.04**	**-0.32**	**-0.03**	**-0.06**	**-0.16**	**-0.06**
(11) *INST* $_{t-1}$	**-0.09**	**0.17**	**0.14**	**0.20**	**0.13**	**0.42**	0.01	**-0.07**	**-0.04**	**0.07**		**-0.56**	**0.24**	**-0.10**	-0.02	**-0.04**	**-0.17**
(12) *CROSS* $_{t-1}$	**0.08**	**-0.12**	**-0.08**	**-0.16**	**-0.13**	**-0.19**	**-0.03**	0.00	0.01	**0.06**	**-0.54**		**-0.38**	0.02	**-0.07**	0.00	**0.04**
(13) *FOREIGN* $_{t-1}$	**-0.15**	**0.31**	**0.27**	**0.34**	**0.24**	**0.42**	**0.33**	**0.18**	**-0.19**	**-0.29**	**0.18**	**-0.34**		0.01	**0.10**	**0.21**	**-0.03**
(14) *AQ* $_{t-1}$	**0.21**	**0.06**	**0.02**	**0.05**	**0.09**	**-0.11**	**-0.12**	**0.07**	**0.21**	**-0.03**	**-0.15**	**0.03**	**0.03**		**0.03**	0.00	**0.24**
(15) *SMOOTH* $_{t-1}$	**0.07**	**0.08**	**0.03**	**0.11**	**0.08**	**-0.08**	**0.06**	**0.08**	**0.05**	**-0.06**	**-0.03**	**-0.05**	**0.10**	**0.07**		**0.05**	**-0.36**
(16) *PREDICT* $_{t-1}$	**-0.07**	**0.06**	**0.07**	**0.06**	0.02	**0.05**	**0.23**	**0.13**	**-0.12**	**-0.16**	**-0.02**	-0.01	**0.23**	0.01	**0.06**		**-0.07**
(17) *CFOVOL* $_{t-1}$	**0.14**	-0.01	**-0.02**	**-0.02**	0.01	**-0.18**	0.01	**0.10**	**0.04**	**-0.08**	**-0.20**	**0.03**	0.01	**0.32**	**-0.25**	**-0.08**	

Table 4 presents the correlation matrix for the variables used in the main analysis, with Pearson (Spearman) correlations below (above) the diagonal. The definitions of each variable are as follows. *RMSE* = idiosyncratic return volatility based on the three-factor model in Fama and French (1993) for fiscal year *t*. *AMFE* = absolute value of the management forecast errors for year $t-1$. Management forecast errors are defined as Comp1 from principal component analysis of three variables regarding management forecast errors. *AMFE_SLS* = absolute value of management forecast error for sales for year $t-1$. *AMFE_OI* = absolute value of management forecast error for ordinary income for year $t-1$. *AMFE_NI* = absolute value of management forecast error for net income for year $t-1$. *SIZE* = natural log of total assets at the end of fiscal year $t-1$. *ROA* = return on assets for fiscal year $t-1$. *GROWTH* = sales growth for fiscal year $t-1$. *LOSS* = indicator variable with a value of one if the firm reports a net loss and zero otherwise. *LEV* = total liabilities divided by total assets. *INST* = the percentage of institutional ownership at the end of fiscal year $t-1$. *CROSS* = the percentage of cross-shareholdings at the end of fiscal year $t-1$. *FOREIGN* = the percentage of foreign ownership at the end of fiscal year $t-1$. *AQ* = accruals quality for year $t-1$ defined by Dechow and Dichev (2002). *SMOOTH* = income smoothness for year $t-1$, which is the ratio of firm's standard deviation of net income (scaled by total assets) to the standard deviation of cash flows from operation (scaled by total assets). *PREDICT* = earnings predictability for year $t-1$, which is the square root of the error variance from firm's AR1 model of annual earnings. *CFOVOL* = the standard deviation of cash flows from operation for year $t-1$ (scaled by total assets). All sequential variables are winsorized at the 1st and 99th percentiles by year. Bold indicates statistically significant at less than 0.1 level of significance using a two-tailed t-test.

management forecast error and the forecast error for sales, ordinary income, and net income are 0.510, 0.376, 0.346, and 0.214 (0.181, 0.133, 0.113, and 0,057), respectively. The mean (median) value of idiosyncratic risk is 2.085 (1.940), which is similar to that of prior studies.

Fig. 1 shows the mean and median absolute values of the management forecast error (*AMFE*) by year. Although *AMFE* is relatively high in 2006 (the mean value is 0.426, and median value is 0.100), the overall *AMFE* levels do not differ dramatically across years. The mean values of *AMFE_SLS*, *AMFE_OI*, and *AMFE_NI* indicate similar tendencies with *AMFE*.

Table 4 presents a correlation matrix for the variables used in the main analysis, with Pearson (Spearman) correlations below (above) the diagonal. *AMFE*, *AMFE_SLS*, *AMFE_OI*, and *AMFE_NI* correlate positively with each other. For the Spearman rank correlation, *AMFE* has a positive correlation with *RMSE*, as expected. We need not consider the multicollinearity problem in our model because no extremely high correlation among independent variables is observed.[12]

5. Main results

5.1. The results of testing Hypothesis I

Table 5 shows the results of the multivariate regressions of Model (2). The table shows that the coefficient of *AMFE*, which is our primary concern, is significantly positive, as expected. We also find that the coefficients of the components of *AMFE, AMFE_SLS*, and *AMFE_NI* are significantly positive. These results indicate that less accurate management forecasts increase idiosyncratic return volatility, supporting Hypothesis I.

The table also shows that almost all control variables have their expected signs and are statistically significant at conventional levels, except for *ROA*, *GROWTH*, *INST*, and *CROSS*. Institutional ownership, a distinctive ownership structure in Japan, has a negative effect on idiosyncratic risk. In addition, the coefficient of foreign ownership becomes significantly positive. The coefficients of *AQ, SMOOTH*, and *CFOVOL* are significantly positive at less than 0.01 levels, and that of *PREDICT* is significant at 0.1 level, suggesting that lower earnings quality and volatile operating performance are also correlated with higher idiosyncratic risk. These are consistent with the results of prior studies showing that better earnings quality reduces firm risk (Okuda & Kitagawa, 2011; Rajgopal & Venkatachalam, 2011).

[12] In our regression analysis, we calculate the variance inflation factor (VIF) to verify whether a multicollinearity problem, signified by a high correlation among some of the independent variables, exists. We find that the VIF values are all less than 3. Considering that the standard VIF value for multicollinearity detection is 10, we may conclude that there is no multicollinearity problem in our models.

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Table 5
Management forecast accuracy and idiosyncratic risk.

		$RMSE_t$		$RMSE_t$		$RMSE_t$		$RMSE_t$	
	Expected sign	Coef. (t-value)	Coef. (t-value)	Coef. (t-value)	Coef. (t-value)	Coef. (t-value)	Coef. (t-value)	Coef. (t-value)	Coef. (t-value)
Constant	?	4.29***	3.67***	4.10***	3.48***	4.30***	3.70***	4.23**	3.64***
		(13.10)	(11.21)	(12.05)	(10.14)	(12.73)	(10.78)	(13.20)	(11.35)
$AMFE_{t-1}$	+	0.05***	0.03**						
		(3.77)	(2.52)						
$AMFE\_SLS_{t-1}$	+			0.01*	0.01*				
				(1.68)	(1.66)				
$AMFE\_OI_{t-1}$	+					0.08***	0.05***		
						(4.11)	(2.79)		
$AMFE\_NI_{t-1}$	+							0.09***	0.05**
								(3.79)	(2.30)
$SIZE_{t-1}$	−	-0.22***	-0.18***	-0.20***	-0.17***	-0.22***	-0.18***	-0.22***	-0.18***
		(-11.38)	(-9.85)	(-9.54)	(-8.10)	(-11.38)	(-9.78)	(-12.25)	(-10.74)
ROA_{t-1}	−	0.12	-0.09	0.07	-0.12	0.01	-0.15	0.20	-0.04
		(0.20)	(-0.21)	(0.13)	(-0.28)	(0.02)	(-0.34)	(0.34)	(-0.10)
$GROWTH_{t-1}$	−	-0.23	-0.31*	-0.22	-0.30	-0.22	-0.30*	-0.23	-0.30
		(-1.24)	(-1.68)	(-1.17)	(-1.59)	(-1.19)	(-1.66)	(-1.19)	(-1.62)
$LOSS_{t-1}$	+	0.29***	0.26***	0.31***	0.26***	0.29***	0.25***	0.28***	0.25***
		(7.16)	(6.36)	(7.88)	(6.70)	(7.37)	(6.55)	(6.51)	(6.00)
LEV_{t-1}	+	1.31***	1.28***	1.30***	1.28***	1.31***	1.29***	1.31***	1.29***
		(8.97)	(8.61)	(9.02)	(8.66)	(9.07)	(8.69)	(9.04)	(8.69)
$INST_{t-1}$	+	-0.37*	-0.25	-0.40**	-0.27	-0.37*	-0.25	-0.37*	-0.26
		(-1.84)	(-1.20)	(-2.03)	(-1.34)	(-1.84)	(-1.19)	(-1.84)	(-1.22)
$CROSS_{t-1}$	+	0.04	0.10	0.03	0.09	0.05	0.10	0.04	0.10
		(0.29)	(0.70)	(0.20)	(0.65)	(0.33)	(0.72)	(0.32)	(0.72)
$FOREIGN_{t-1}$	+	1.64***	1.31***	1.67***	1.31***	1.62***	1.30***	1.64***	1.32***
		(8.64)	(6.87)	(8.93)	(7.03)	(8.52)	(6.74)	(8.69)	(7.06)
AQ_{t-1}	+		1.54***		1.60***		1.52***		1.09***
			(2.69)		(2.83)		(2.65)		(2.70)
$SMOOTH_{t-1}$	+		0.29***		0.30***		0.28***		0.29***
			(6.08)		(6.14)		(5.89)		(6.24)
$PREDICT_{t-1}$	+		0.10*		0.10*		0.10*		0.10*
			(1.66)		(1.76)		(1.69)		(1.73)
$CFOVOL_{t-1}$	+		2.97***		3.07***		2.95***		3.02***
			(5.39)		(5.44)		(5.38)		(5.57)
Year Dummy		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Dummy		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2		0.500	0.507	0.499	0.506	0.501	0.507	0.500	0.506
Obs.		6,310	6,310	6,310	6,310	6,310	6,310	6,310	6,310

Table 5 shows the results of the multivariate regressions of model (2). *RMSE* = idiosyncratic return volatility based on the three-factor model in Fama and French (1993) for fiscal year *t*. *AMFE* = absolute value of the management forecast errors for year $t-1$. Management forecast errors are defined as Comp1 from principal component analysis of three variables regarding management forecast errors. *AMFE_SLS* = absolute value of management forecast error for sales for year $t-1$. *AMFE_OI* = absolute value of management forecast error for ordinary income for year $t-1$. *AMFE_NI* = absolute value of management forecast error for net income for year $t-1$. *SIZE* = natural log of total assets at the end of fiscal year $t-1$. *ROA* = return on assets for fiscal year $t-1$. *GROWTH* = sales growth for fiscal year $t-1$. *LOSS* = indicator variable with a value of one if the firm reports a net loss and zero otherwise. *LEV* = total liabilities divided by total assets. *INST* = the percentage of institutional ownership at the end of fiscal year $t-1$. *CROSS* = the percentage of cross-shareholdings at the end of fiscal year $t-1$. *FOREIGN* = the percentage of foreign ownership at the end of fiscal year $t-1$. *AQ* = accruals quality for year $t-1$ defined by Dechow and Dichev (2002). *SMOOTH* = income smoothness for year $t-1$, which is the ratio of firm's standard deviation of net income (scaled by total assets) to the standard deviation of cash flows from operation (scaled by total assets). *PREDICT* = earnings predictability for year $t-1$, which is the square root of the error variance from firm's AR1 model of annual earnings. *CFOVOL* = the standard deviation of cash flows from operation for year $t-1$ (scaled by total assets). All sequential variables are winsorized at the 1st and 99th percentiles by year. In the panel, *t*-values are corrected for heteroskedasticity as well as for cross-sectional and time-series correlation using a two-way cluster at the firm and year levels, as proposed by Petersen (2009); ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.1 levels, respectively, using a two-tailed *t*-test.

5.2. The results of testing Hypothesis II

Table 6 presents the results of the estimation of Eq. (3) found during the test of Hypothesis IIa. The results of regression analysis excluding earnings quality and cash flow volatility variables show that the coefficient on *AMFE* is positively significant, consistent with the result in Section 5.1. In addition, the coefficient on the interaction, *AMFE* × *SIZEq4*, which is our main concern, is significantly negative at less than 0.01 levels. These results imply that the accuracy of larger firms' management forecasts has a less significant impact on idiosyncratic risk, which is consistent with Hypothesis IIa. However, when we include earnings quality and cash flow volatility variables into the regression model, the coefficient of *AMFE* becomes insignificant while that of *AMFE* × *SIZEq4* is still negative and significant. This means that earnings quality and fundamental volatility affect the results of testing Hypothesis IIa.

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Table 6
The effect of firm size on the relationship between management forecast accuracy and idiosyncratic risk.

		RMSE t		*RMSE* t		*RMSE* t		*RMSE* t	
	Expected sign	Coef. (t-value)	Coef. (t-value)	Coef. (t-value)	Coef. (t-value)	Coef. (t-value)	Coef. (t-value)	Coef. (t-value)	Coef. (t-value)
Constant	?	1.84*** (6.29)	1.53*** (5.30)	1.86*** (6.38)	1.53*** (5.38)	1.84*** (6.30)	1.54*** (5.31)	1.86*** (6.39)	1.55*** (5.38)
AMFE $_{t-1}$	+	0.13*** (3.21)	0.04 (1.11)						
AMFE_SLS $_{t-1}$	+			0.00 (0.05)	0.03 (0.87)				
AMFE_OI $_{t-1}$	+					0.20*** (3.54)	0.08 (1.28)		
AMFE_NI $_{t-1}$	+							0.18* (1.90)	0.03 (0.31)
AMFE × *SIZEq1* $_{t-1}$	+	0.23 (1.12)	0.02 (0.13)						
AMFE_SLS × *SIZEq1* $_{t-1}$	+			0.04 (0.23)	0.08 (0.64)				
AMFE_OI × *SIZEq1* $_{t-1}$	+					0.42 (1.61)	0.09 (0.30)		
AMFE_NI × *SIZEq1* $_{t-1}$	+							0.73*** (2.80)	0.29 (1.00)
AMFE × *SIZEq4* $_{t-1}$	−	-0.16*** (-4.12)	-0.09** (-2.44)						
AMFE_SLS × *SIZEq4* $_{t-1}$	−			-0.08* (-1.80)	-0.06 (-1.40)				
AMFE_OI × *SIZEq4* $_{t-1}$	−					-0.23*** (-4.29)	-0.12** (-2.19)		
AMFE_NI × *SIZEq4* $_{t-1}$	−							-0.21*** (-2.58)	-0.08 (-1.09)
SIZE1 $_{t-1}$	+	0.24*** (3.56)	0.23*** (3.76)	0.25*** (4.02)	0.23*** (4.06)	0.24*** (3.71)	0.23*** (3.65)	0.22*** (4.01)	0.21*** (4.11)
SIZE4 $_{t-1}$	−	-0.14*** (-3.19)	-0.13*** (-3.06)	-0.15*** (-3.48)	-0.13*** (-3.12)	-0.16*** (-3.55)	-0.15*** (-3.52)	-0.18*** (-3.93)	-0.17*** (-3.71)
ROA $_{t-1}$	−	0.31 (0.49)	-0.13 (-0.25)	0.11 (0.17)	-0.19 (-0.41)	0.14 (0.25)	-0.15 (-0.33)	0.63 (0.87)	-0.03 (-0.05)

GROWTH $_{t-1}$	−	-0.21	-0.33*	-0.19	-0.31	-0.22	-0.34*	-0.23	-0.34*
		(-1.07)	(-1.79)	(-0.94)	(-1.62)	(-1.15)	(-1.88)	(-1.19)	(-1.88)
LOSS $_{t-1}$	+	0.31***	0.26***	0.32***	0.26***	0.30***	0.25***	0.30***	0.26***
		(7.34)	(6.43)	(8.10)	(6.90)	(6.98)	(6.20)	(6.28)	(5.73)
LEV $_{t-1}$	+	1.17***	1.16***	1.18***	1.18***	1.17***	1.15***	1.17***	1.15***
		(8.45)	(8.29)	(8.68)	(8.49)	(8.43)	(8.32)	(8.56)	(8.30)
INST $_{t-1}$	+	-0.61***	-0.43**	-0.60***	-0.43**	-0.60***	-0.43**	-0.60***	-0.43**
		(-3.00)	(-2.19)	(-2.96)	(-2.15)	(-2.99)	(-2.20)	(-2.94)	(-2.18)
CROSS $_{t-1}$	+	-0.03	0.02	-0.02	0.02	-0.03	0.02	-0.03	0.02
		(-0.23)	(0.12)	(-0.15)	(0.18)	(-0.19)	(0.13)	(-0.21)	(0.13)
FOREIGN $_{t-1}$	+	1.06***	0.94***	1.15***	0.97***	1.05***	0.92***	1.03***	0.91***
		(6.11)	(5.33)	(6.29)	(5.22)	(6.03)	(5.17)	(5.69)	(5.12)
AQ $_{t-1}$	+		1.72***		1.83***		1.68***		1.68***
			(2.89)		(3.22)		(2.67)		(2.58)
SMOOTH $_{t-1}$	+		0.29***		0.30***		0.29***		0.29***
			(5.96)		(5.89)		(6.05)		(6.01)
PREDICT $_{t-1}$	+		0.12*		0.12*		0.11*		0.11*
			(1.81)		(1.91)		(1.77)		(1.72)
CFOVOL $_{t-1}$	+		3.46***		3.50***		3.42***		3.45***
			(6.52)		(6.49)		(6.61)		(6.55)
Year Dummy		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Dummy		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2		0.484	0.558	0.484	0.506	0.484	0.505	0.484	0.505
Obs.		6,310	6,310	6,310	6,310	6,310	6,310	6,310	6,310

Table 6 presents the results of the estimation of Eq. (3) in testing Hypotheses IIa. The table presents the effect of firm size on the relationship between the absolute value of residual management forecast error and idiosyncratic risk. The definitions of each variable are as follows. *RMSE* = idiosyncratic return volatility based on the three-factor model in Fama and French (1993) for fiscal year *t*. *AMFE* = absolute value of the management forecast errors for year $t-1$. Management forecast errors are defined as Comp1 from principal component analysis of three variables regarding management forecast errors. *AMFE_SLS* = absolute value of management forecast error for sales for year $t-1$. *AMFE_OI* = absolute value of management forecast error for ordinary income for year $t-1$. *AMFE_NI* = absolute value of management forecast error for net income for year $t-1$. *SIZEq*1 = indicator variable set to one if the level of total assets is in the first quartile, where that quartile contains the firms with the lowest total assets in each year, and zero otherwise. *SIZEq*4 = indicator variable set to one if the level of total assets is in the fourth quartile, where that quartile contains the firms with the highest total assets in each year, and zero otherwise. *ROA* = return on assets for fiscal year $t-1$. *GROWTH* = sales growth for fiscal year $t-1$. *LOSS* = indicator variable with a value of one if the firm reports a net loss and zero otherwise. *LEV* = total liabilities divided by total assets. *INST* = the percentage of institutional ownership at the end of fiscal year $t-1$. *CROSS* = the percentage of cross-shareholdings at the end of fiscal year $t-1$. *FOREIGN* = the percentage of foreign ownership at the end of fiscal year $t-1$. *AQ* = accruals quality for year $t_{-}1$ defined by Dechow and Dichev (2002). *SMOOTH* = income smoothness for year $t_{-}1$, which is the ratio of firm's standard deviation of net income (scaled by total assets) to the standard deviation of cash flows from operation (scaled by total assets). *PREDICT* = earnings predictability for year $t_{-}1$, which is the square root of the error variance from firm's AR1 model of annual earnings. *CFOVOL* = the standard deviation of cash flows from operation for year $t_{-}1$ (scaled by total assets). All sequential variables are winsorized at the 1st and 99th percentiles by year. In the panel, *t*-values are corrected for heteroskedasticity as well as for cross-sectional and time-series correlation using a two-way cluster at the firm and year levels, as proposed by Petersen (2009); ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.1 levels, respectively, using a two-tailed *t*-test.

Table 7
The effect of analyst coverage on the relationship between management forecast accuracy and idiosyncratic risk.

	Expected sign	$RMSE_t$		$RMSE_t$		$RMSE_t$		$RMSE_t$	
		Coef. (t-value)	Coef. (t-value)	Coef. (t-value)	Coef. (t-value)	Coef. (t-value)	Coef. (t-value)	Coef. (t-value)	Coef. (t-value)
Constant	?	4.43*** (16.11)	3.80*** (13.47)	4.23*** (14.96)	3.61*** (12.41)	4.44*** (15.46)	3.82*** (12.82)	4.34*** (15.70)	3.75*** (13.28)
$AMFE_{t-1}$	+	0.22*** (2.61)	0.13* (1.72)						
$AMFE\_SLS_{t-1}$	+			0.09 (1.20)	0.03 (0.42)				
$AMFE\_OI_{t-1}$	+					0.36** (2.54)	0.17 (1.34)		
$AMFE\_NI_{t-1}$	+							0.36** (2.34)	0.26* (1.83)
$AMFE \times COV_{t-1}$	+	-0.18** (-2.09)	-0.11* (-1.65)						
$AMFE\_SLS \times COV_{t-1}$	+			-0.09 (-1.04)	-0.04 (-0.55)				
$AMFE\_OI \times COV_{t-1}$	+					-0.29** (-1.99)	-0.13 (-0.99)		
$AMFE\_NI \times COV_{t-1}$	+							-0.29** (-1.99)	-0.23* (-1.68)
COV_{t-1}	+	0.14** (2.07)	0.11 (1.64)	0.12* (1.78)	0.09 (1.39)	0.14** (1.98)	0.10 (1.47)	0.13* (1.77)	0.11 (1.46)
$SIZE_{t-1}$	−	-0.24*** (-16.09)	-0.21*** (-13.84)	-0.22*** (-14.40)	-0.19*** (-12.57)	-0.25*** (-15.98)	-0.21*** (-13.31)	-0.23*** (-16.29)	-0.20*** (-14.25)
ROA_{t-1}	−	0.18 (0.39)	-0.10 (-0.29)	-0.03 (-0.06)	-0.24 (-0.61)	-0.04 (-0.09)	-0.25 (-0.64)	0.37 (0.73)	0.04 (0.10)
$GROWTH_{t-1}$	−	-0.25 (-1.41)	-0.35* (-1.94)	-0.24 (-1.31)	-0.33* (-1.84)	-0.24 (-1.33)	-0.34* (-1.91)	-0.25 (-1.37)	-0.35* (-1.93)
$LOSS_{t-1}$	+	0.28*** (6.75)	0.24*** (5.86)	0.30*** (7.57)	0.25*** (6.33)	0.28*** (7.03)	0.24*** (6.09)	0.27*** (5.94)	0.23*** (5.21)
LEV_{t-1}	+	1.35*** (10.32)	1.31*** (10.07)	1.34*** (10.34)	1.31*** (10.12)	1.35*** (10.43)	1.31*** (10.20)	1.35*** (10.37)	1.31*** (10.14)
$INST_{t-1}$	+	-0.41** (-2.29)	-0.32* (-1.79)	-0.44** (-2.49)	-0.34* (-1.93)	-0.41** (-2.28)	-0.32* (-1.77)	-0.42** (-2.32)	-0.32* (-1.81)
$CROSS_{t-1}$	+	0.01 (0.08)	0.04 (0.29)	0.01 (0.05)	0.04 (0.28)	0.02 (0.19)	0.05 (0.36)	0.02 (0.12)	0.04 (0.29)
$FOREIGN_{t-1}$	+	1.55*** (8.09)	1.34*** (7.06)	1.59*** (8.27)	1.34*** (7.09)	1.53*** (7.98)	1.32*** (6.90)	1.54*** (7.99)	1.32*** (7.02)
AQ_{t-1}	+		1.61*** (3.10)		1.69*** (3.29)		1.57*** (2.93)		1.59*** (3.06)
$SMOOTH_{t-1}$	+		0.24*** (5.38)		0.26*** (5.36)		0.24*** (5.23)		0.25*** (5.36)
$PREDICT_{t-1}$	+		0.09 (1.53)		0.10* (1.70)		0.10 (1.63)		0.10 (1.58)
$CFOVOL_{t-1}$	+		2.76*** (5.30)		2.92*** (5.31)		2.79*** (5.33)		2.77*** (5.44)
Year Dummy		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Dummy		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2		0.501	0.519	0.501	0.518	0.504	0.519	0.505	0.520
Obs.		6,310	6,310	6,310	6,310	6,310	6,310	6,310	6,310

Table 7 presents the results of the estimation of Eq. (4) in testing Hypothesis IIb. The table presents the effect of analyst following on the relationship between the absolute value of residual management forecast error and idiosyncratic risk. The definitions of each variable are as follows. *RMSE* = idiosyncratic return volatility based on the three-factor model in Fama and French (1993) for fiscal year *t*. *AMFE* = absolute value of the management forecast errors for year $t-1$. Management forecast errors are defined as Comp1 from principal component analysis of three variables regarding management forecast errors. *AMFE_SLS* = absolute value of management forecast error for sales for year $t-1$. *AMFE_OI* = absolute value of management forecast error for ordinary income for year $t-1$. *AMFE_NI* = absolute value of management forecast error for net income for year $t-1$. *COV* = indicator variable set to one if one or more analysts actively track and publish opinions on a company and its stock, and zero otherwise. SIZE = natural log of total assets at the end of fiscal year $t-1$. *ROA* = return on assets for fiscal year $t-1$. *GROWTH* = sales growth for fiscal year $t-1$. *LOSS* = indicator variable with a value of one if the firm reports a net loss and zero otherwise. *LEV* = total liabilities divided by total assets. *INST* = the percentage of institutional ownership at the end of fiscal year $t-1$. *CROSS* = the percentage of cross-shareholdings at the end of fiscal year $t-1$. *FOREIGN* = the percentage of foreign ownership at the end of fiscal year $t-1$. *AQ* = accruals quality for year t_1 defined by Dechow and Dichev (2002). *SMOOTH* = income smoothness for year t_1, which is the ratio of firm's standard deviation of net income (scaled by total assets) to the standard deviation of cash flows from operation (scaled by total assets). *PREDICT* = earnings predictability for year t_1, which is the square root of the error variance from firm's AR1 model of annual earnings. *CFOVOL* = the standard deviation of cash flows from operation for year t_1 (scaled by total assets). All sequential variables are winsorized at the 1st and 99th percentiles by year. In the panel, *t*-values are corrected for heteroskedasticity as well as for cross-sectional and time-series correlation using a two-way cluster at the firm and year levels, as proposed by Petersen (2009); ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.1 levels, respectively, using a two-tailed *t*-test.

Table 8
Regression for the residual forecast error.

	Expected	MFE_t		MFE_SLS_t		MFE_OI_t		MFE_NI_t	
	sign	Coef.	z-value	Coef.	z-value	Coef.	z-value	Coef.	z-value
Constant	?	-3.678***	-3.152	-1.637*	-1.930	-4.772***	-5.373	-0.721	-1.149
MFE_{t-1}	+	0.205***	15.215						
MFE_SLS_{t-1}	+			0.147***	10.094				
MFE_OI_{t-1}	+					0.169***	12.771		
MFE_NI_{t-1}	+							0.152***	12.362
$RMSE_t$	+	-0.011	-0.439	-0.006	-0.327	-0.021	-1.171	0.006	0.498
$SIZE_t$	–	-0.308***	-3.074	-0.172**	-2.366	-0.438***	-5.747	-0.003	-0.063
CI_t	–	-0.038	-0.995	-0.032	-1.134	-0.033	-1.159	-0.002	-0.090
$CRATIO_t$	+	0.047	1.404	-0.010	-0.412	0.053**	2.172	0.048***	2.722
LEV_t	+	0.725**	2.299	-0.145	-0.625	-0.139	-0.602	1.265***	7.578
$LOSS_t$	+	0.489***	15.071	0.081***	3.370	0.223***	9.353	0.422***	24.783
$GROWTH_t$	–	-1.430***	-15.364	-1.499***	-21.811	-0.750***	-10.927	-0.222***	-4.508
DIV_t	–	-0.170***	-6.599	-0.069***	-3.631	-0.136***	-7.217	-0.082***	-6.041
Year Dummies		Yes		Yes		Yes		Yes	
Obs.		8,527		8,527		8,527		8,527	

Table 8 reports the estimation results of the residual management forecast error found using the dynamic panel data model. The definitions of each variable are as follows. MFE_t = management forecast error, which is defined as Comp1 from principal component analysis of three variables regarding management forecast errors. MFE_SLS_t = management forecast error of sales (= [initial management forecasts of sales for year *t* minus actual sales for year *t*] / total assets for year $t-1$). The management forecast error for sales for year *t* is divided by the standard deviation of the error for year *t*. MFE_OI_t = management forecast error of ordinary income (= [initial management forecasts of ordinary income for year *t* minus the actual ordinary income for year *t*] / total assets for year $t-1$). The management forecast error of ordinary income for year *t* is divided by the standard deviation of the error for year *t*. MFE_NI_t = management forecast error of net income (= [initial management forecasts of net income for year t minus the actual net income for year *t*] / total assets for year $t-1$). The management forecast error of net income for year *t* is divided by the standard deviation of the error for year *t*. $RMSE_t$ = idiosyncratic return volatility based on the three-factor model in Fama and French (1993) for fiscal year *t*. $SIZE_t$ = natural log of total assets at the end of year *t*. $CINC_t$ = indicator variable with a value of one if the firm increases its contributed capital and zero otherwise. $CRATIO_t$ = current assets divided by current liabilities at the end of year *t*. LEV_t = total liabilities divided by total assets at the end of year *t*. $LOSS_t$ = indicator variable with a value of one if the firm reports a net loss and zero otherwise. $GROWTH_t$ = sales growth at the end of year *t*. DIV_t = indicator variable with a value of one if the firm increases its management dividend forecasts over the current dividends and zero otherwise. All sequential variables are winsorized at the 1st and 99th percentiles by year. The *t*-values are calculated by the robust estimation of the fixed-effects panel data models, and ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.1 levels, respectively, using a two-tailed *t*-test.

The coefficients of the components of *AMFE* show similar tendencies. The results of regression analysis excluding earnings quality and cash flow volatility variables, the coefficients of *AMFE_OI*, and *AMFE_NI* are significantly positive and those of *AMFE_OI* × *SIZEq4*, and *AMFE_NI* × *SIZEq4* are negative at 0.01 levels. The coefficient of *AMFE_SLS* × *SIZEq4* is significantly negative at 0.1 level.

However, when we consider the effect of earnings quality and cash flow volatility, the coefficients of *AMFE_SLS*, *AMFE_OI*, and *AMFE_NI* are all positive but not significant. Furthermore, the coefficients of *AMFE_SLS* × *SIZEq4* and *AMFE_NI* × *SIZEq4* become insignificant.

Table 7 reports the results of the estimation of Eq. (4) from the test of Hypothesis IIb. The table describes the effect of analyst coverage on the relationship between the absolute value of management forecast error and idiosyncratic risk. The coefficient of *AMFE* is significantly positive and that of *AMFE* × *COV* is significantly negative. These results suggest that firms with one or more analysts actively tracking and publishing opinions on them show a lower correlation between idiosyncratic risk and the absolute value of management forecast errors, which is consistent with Hypothesis IIb. The coefficients of *AMFE* and *AMFE* × *COV* are significant after controlling for earnings quality and fundamental volatility.

The coefficients of *AMFE_OI* and *AMFE_NI* are also significantly positive, and those of *AMFE_OI* × *COV* and *AMFE_NI* × *COV* are significantly negative without controlling for earnings quality and cash flow volatility. However, when we consider the effect of earnings quality and cash flow volatility, the coefficients of *AMFE_OI* and *AMFE_OI* × *COV* become insignificant.

Thus, our results substantially support Hypotheses IIa and IIb: in firms with a good information environment, management forecast accuracy is less important to the evaluation of firms' specific risk. However, we should note that the results of testing Hypotheses IIa and IIb are not robust and affected by earnings quality and fundamental volatility.

6. Additional analyses using residual management forecasts

In this section, we conduct additional analysis regarding management forecast error variables. Specifically, using well-known determinants of management forecast error, we decompose forecast error into two components: systematic and unsystemtic forecast errors. Several studies have identified the determinants of management forecast error (Iwasaki, Kitagawa, & Shuto, 2012; Kato, Skinner, & Kunimura, 2009; Rogers & Stocken, 2005). For example, Ota (2006, 2011) shows that financial distress, firm growth, firm size, and prior forecast errors are associated with bias in Japanese management forecasts. In addition, Ota (2011) suggests that Japanese analysts are at least somewhat aware of the factors related to systematic bias in management earnings forecasts. If investors are aware of these systematic management forecast errors, the idiosyncratic risk for the following year

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Table 9
Residual value of management forecast accuracy and idiosyncratic risk

	Expected sign	$RMSE_t$		$RMSE_t$		$RMSE_t$		$RMSE_t$	
		Coef. (t-value)	Coef. (t-value)	Coef. (t-value)	Coef. (t-value)	Coef. (t-value)	Coef. (t-value)	Coef. (t-value)	Coef. (t-value)
Constant	?	4.63*** (12.36)	3.93*** (10.79)	4.60*** (12.35)	3.91*** (10.74)	4.57*** (12.75)	3.89*** (11.05)	4.66*** (12.99)	4.00*** (11.25)
$ARMFE_{t-1}$	+	0.04* (1.66)	0.02* (1.65)						
$ARMFE\_SLS_{t-1}$	+			0.04 (1.37)	0.01 (0.50)				
$ARMFE\_OI_{t-1}$	+					0.03 (1.25)	0.00 (0.07)		
$ARMFE\_NI_{t-1}$	+							0.17** (2.43)	0.13* (1.80)
$SIZE_{t-1}$	−	-0.25*** (-9.41)	-0.21*** (-8.28)	-0.24*** (-9.56)	-0.21*** (-8.54)	-0.24*** (-10.06)	-0.21*** (-8.92)	-0.25*** (-10.17)	-0.22*** (-8.72)
ROA_{t-1}	−	-0.05 (-0.07)	-0.29 (-0.60)	-0.01 (-0.01)	-0.27 (-0.59)	-0.02 (-0.03)	-0.27 (-0.58)	-0.04 (-0.06)	-0.30 (-0.64)
$GROWTH_{t-1}$	−	-0.18 (-0.79)	-0.30 (-1.41)	-0.18 (-0.79)	-0.30 (-1.39)	-0.16 (-0.72)	-0.29 (-1.39)	-0.14 (-0.63)	-0.28 (-1.36)
$LOSS_{t-1}$	+	0.36*** (8.62)	0.29*** (6.97)	0.36*** (8.31)	0.29*** (6.74)	0.36*** (8.49)	0.29*** (6.83)	0.32*** (8.35)	0.26*** (8.04)
LEV_{t-1}	+	1.27*** (8.95)	1.24*** (8.60)	1.26*** (8.93)	1.24*** (8.63)	1.27*** (8.95)	1.24*** (8.62)	1.27*** (8.85)	1.25*** (8.59)
$INST_{t-1}$	+	-0.31 (-1.60)	-0.16 (-0.87)	-0.33* (-1.67)	-0.17 (-0.90)	-0.32 (-1.63)	-0.18 (-0.92)	-0.28 (-1.50)	-0.13 (-0.73)
$CROSS_{t-1}$	+	0.22* (1.68)	0.26** (1.98)	0.20 (1.55)	0.25* (1.91)	0.21 (1.61)	0.25* (1.87)	0.23* (1.77)	0.27** (2.10)
$FOREIGN_{t-1}$	+	2.10*** (9.40)	1.77*** (8.64)	2.09*** (9.52)	1.77*** (8.74)	2.09*** (9.46)	1.76*** (8.73)	2.06*** (9.76)	1.75*** (8.82)
AQ_{t-1}	+		1.67*** (2.74)		1.67*** (2.73)		1.67*** (2.73)		1.64*** (2.67)
$SMOOTH_{t-1}$	+		0.32*** (6.81)		0.33*** (6.58)		0.33*** (6.64)		0.32*** (6.74)
$PREDICT_{t-1}$	+		0.06 (0.91)		0.06 (0.92)		0.06 (0.93)		0.06 (0.91)
$CFOVOL_{t-1}$	+		3.61*** (6.31)		3.62*** (6.17)		3.64*** (6.17)		3.54*** (6.39)
Year Dummy		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Dummy		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2		0.451	0.476	0.450	0.476	0.450	0.476	0.453	0.478
Obs.		6,310	6,310	6,310	6,310	6,310	6,310	6,310	6,310

Table 9 presents the relationship between the absolute value of residual management forecast error and idiosyncratic risk. The definitions of each variable are as follows. *RMSE* = idiosyncratic return volatility based on the three-factor model in Fama and French (1993) for fiscal year *t*. *ARMFE* = absolute value of the residual management forecast errors for year $t-1$. Management forecast errors are defined as Comp1 from principal component analysis of three variables regarding management forecast errors. *ARMFE_SLS* = absolute value of residual management forecast error for sales for year $t-1$. *ARMFE_OI* = absolute value of residual management forecast error for ordinary income for year $t-1$. *ARMFE_NI* = absolute value of residual management forecast error for net income for year $t-1$. *SIZE* = natural log of total assets at the end of fiscal year $t-1$. *ROA* = return on assets for fiscal year $t-1$. *GROWTH* = sales growth for fiscal year $t-1$. *LOSS* = indicator variable with a value of one if the firm reports a net loss and zero otherwise. *LEV* = total liabilities divided by total assets. *INST* = the percentage of institutional ownership at the end of fiscal year $t-1$. *CROSS* = the percentage of cross-shareholdings at the end of fiscal year $t-1$. *FOREIGN* = the percentage of foreign ownership at the end of fiscal year $t-1$. *AQ* = accruals quality for year $t-1$ defined by Dechow and Dichev (2002). *SMOOTH* = income smoothness for year $t-1$, which is the ratio of firm's standard deviation of net income (scaled by total assets) to the standard deviation of cash flows from operation (scaled by total assets). *PREDICT* = earnings predictability for year $t-1$, which is the square root of the error variance from firm's AR1 model of annual earnings. *CFOVOL* = the standard deviation of cash flows from operation for year $t-1$ (scaled by total assets). All sequential variables are winsorized at the 1st and 99th percentiles by year. In the panel, *t*-values are corrected for heteroskedasticity as well as for cross-sectional and time-series correlation using a two-way cluster at the firm and year levels, as proposed by Petersen (2009); ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.1 levels, respectively, using a two-tailed *t*-test.

should be more strongly correlated with the unsystematic portion of management forecast errors (i.e., those forecast errors not explicable by the factors related to systematic management forecast bias). Therefore, we first determine the unsystematic portion of management forecast errors and then investigate its relationship with idiosyncratic risk. We calculate the residual value by estimating Eq. (5) below and using it as a proxy for unsystematic management forecast errors (hereafter referred to as "residual management forecast errors").

$$MFE_{i,t} = \gamma_0 + \gamma_1 MFE_{i,t-1} + \gamma_2 RMSE_{i,t} + \gamma_3 SIZE_{i,t} + \gamma_4 CINC_{i,t} + \gamma_5 CRATIO_{i,t} + \gamma_6 LEV_{i,t} + \gamma_7 LOSS_{i,t} + \gamma_8 GROWTH_{i,t} + \gamma_9 DIV_{i,t} + Year\ \ Dummy + \varepsilon \quad (5)$$

where the dependent variable is the management forecast error as defined earlier. As independent variables, we include some determinant factors of management forecast error as independent variables. In this regard, we mainly follow Ota (2006, 2011), who investigates the determinants of management forecast bias in Japanese listed firms. First, we include the management forecast error for the previous year (MFE_{t-1}), as studies have shown evidence of the persistence of management forecast error (e.g., Gong, Li, & Wang, 2011; Ota, 2006, 2011).

To address the possible existence of endogeneity, we include simultaneous idiosyncratic risk (*RMSE*). Considering that managers tend to release optimistic forecasts (e.g., Kato et al., 2009), we expect *RMSE* to be positively related to management forecast errors. Several studies have found that forecast behavior is associated with firm size (e.g., Baginski & Hassell, 1997; Bamber & Cheon, 1998; Choi & Ziebart, 2004). After hypothesizing that large firms are likely to issue conservative earnings forecasts because they regard management forecasts as commitments to stakeholders, Ota (2006) finds a negative relationship between firm size and management forecast errors. Following these studies, we include firm size (*SIZE*), calculated as the natural log of the market value at the end of year *t*.

Ota (2006) shows that firms issue prudential forecasts before seeking external financing. Therefore, we include a capital increase dummy (*CI*) that is set to one if firms increase their contributed capital and zero otherwise.

The literature shows that managers of distressed firms are more likely to issue optimistic earnings forecasts than are the managers of other firms (e.g., Frost, 1997; Ota, 2006; Rogers & Stocken, 2005). Thus, we include the current ratio (*CRATIO*) and financial leverage (*LEV*) as independent variables. Because firms suffering losses are likely to disclose optimistic forecasts (e.g., Ota, 2006), we include a loss firm dummy (*LOSS*) as an independent variable.

We also include sales growth (*GROWTH*) as an independent variable. High-growth firms experience a relatively large negative stock price response to negative earnings surprises (e.g., Skinner & Sloan, 2002) and are, therefore, more likely to engage in earnings guidance to meet their expectations at the earnings announcement date (e.g., Choi & Ziebart, 2004; Matsumoto, 2002; Ota, 2006; Richardson, Teoh, & Wysocki, 2004;). We expect *GROWTH* to be negatively related to *MFE*.

Finding that firms whose management dividend forecasts increase over current dividends have a negative management forecast error, Ota (2006) posits that increased dividend forecasts contain information about strong future firm performance beyond that provided by management earnings forecasts. Therefore, we include an increased dividend forecast dummy (*DIV*) with a value of one if a firm increases its management dividend forecasts over current dividends and zero otherwise. Last, we include year dummies (*Year Dummy*) to control year effects.

We estimate Eq. (5) with a dynamic panel data model. Specifically, our estimation method is based on Arellano and Bond (1991), which developed a generalized method of moments (GMM) estimator that treats the model as a system of equations, one for each time period. The sample for this estimation model consists of 8,527 firm-year observations covering 2000 to 2008. Each variable is winsorized at the 1st and 99th percentiles by year. We then calculate the residual from Eq. (5). The absolute value of the residual corresponds to the unsystematic portion of management forecast error (*ARMFE*). To check the robustness of our results, we apply the same procedure to three specific management forecasts (i.e., sales forecasts, ordinary income forecasts, and net income forecasts) and calculate the absolute value of the residual forecast error (*ARMFE_SLS*, *ARMFE_OI*, and *ARMFE_NI*).

Table 8 provides the estimation results of the residual management forecast error determined using the dynamic panel data model. Coefficients on management forecast errors for year $t-1$ (MFE_{t-1}, MFE_SLS_{t-1}, MFE_OI_{t-1}, and MFE_NI_{t-1}) are significantly positive, suggesting that management forecast errors have serial correlations. In addition, coefficients of the loss dummy (*LOSS*) are significantly positive, and coefficients of the firm size (*SIZE*), sales growth (*GROWTH*), and change in dividends dummy (*DIV*) are significantly negative, which is consistent with prior studies.[13]

Table 9 presents the regression results of Model (3) using *ARMFE* (*ARMFE_SLS*, *ARMFE_OI*, *ARMFE_NI*) instead of *AMFE* (*AMFE_SLS*, *AMFE_OI*, *AMFE_NI*). Although the coefficients of *ARMFE* and *ARMFE_NI* are significantly positive, the significance levels are lower than those of *AMFE* and *AMFE_NI*. These results indicate that less accurate management forecasts increase idiosyncratic return volatility. In addition, the coefficients of *ARMFE_OI* and *ARMFE_OI* are insignificant. The overall results provide weak evidence for the management forecasts' accuracy and the idiosyncratic return volatility, suggesting that investors do not necessarily distinguish systematic and unsystematic management forecast error.

7. Conclusion

This paper has considered management forecast error as a proxy for disclosure quality and has investigated the relationship between disclosure quality and idiosyncratic risk. Our analyses show that management forecast error is positively related with idiosyncratic risk, indicating that high-quality public information reduces that risk. Furthermore, our evidence demonstrates that management forecast error is less positively related with idiosyncratic risk in firms with the highest total assets and firms with one or more analysts actively tracking and publishing opinions on them. This indicates that management forecast error is less positively related with idiosyncratic risk in relatively good information environments.

[13] The coefficient of *RMSE* is not significant, which is inconsistent with our prediction. However, we found a positive correlation between *MFE* and *RMSE* when we eliminated year and industry dummies.

Appendix A. Definitions of variables

Variables	Measurement
$RMSE_{t}$	Idiosyncratic return volatility based on the three-factor model in Fama and French (1993) for fiscal year *t*.
$AMFE_{t-1}$	Absolute value of Comp1 from principal component analysis of three variables regarding management forecast errors: (1) management forecast error of sales, (2) management forecast error of ordinary income, and (3) management forecast error of net income.
$AMFE\_SLS_{t-1}$	Absolute value of management forecast error of sales (= [initial management forecasts of sales for year *t* minus actual sales for year t]/total assets for year $t-1$).
$AMFE\_OI_{t-1}$	Absolute value of management forecast error of ordinary income (= [initial management forecasts of ordinary income for year *t* minus actual ordinary income for year *t*] / total assets for year $t-1$).
$AMFE\_NI_{t-1}$	Absolute value of management forecast error of net income (= [initial management forecasts of net income for year *t* minus actual net income for year *t*] / total assets for year $t-1$).
$SIZE_{t-1}$	Natural log of total assets at the end of year $t - 1$.
ROA_{t-1}	Return on assets for fiscal year $t - 1$.
$GROWTH_{t-1}$	Sales growth for fiscal year $t - 1$.
$LOSS_{t-1}$	Indicator variable with a value of one if the firm reports a net loss and zero otherwise.
LEV_{t-1}	Total liabilities divided by total assets at the end of fiscal year $t - 1$.
$INST_{t-1}$	The percentage of institutional ownership at the end of fiscal year $t - 1$.
$CROSS_{t-1}$	The percentage of cross-shareholdings at the end of fiscal year $t - 1$.
$FOREIGN_{t-1}$	The percentage of foreign ownership at the end of fiscal year $t - 1$.
AQ_{t-1}	Accruals quality defined for year $t - 1$ by Dechow and Dichev (2002).
$SMOOTH_{t-1}$	Income smoothness for year $t-1$, which is the ratio of firm's standard deviation of net income scaled by total assets to the standard deviation of cash flows from operation scaled by total assets.
$PREDICT_{t-1}$	Earnings predictability for year $t-1$, which is the square root of the error variance from firm's AR1 model of annual earnings.
$CFOVOL_{t-1}$	Cash flow volatility for year $t-1$, which is defined as the standard deviation of cash flows from operation scaled by total assets.

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