Management Forecasts, Idiosyncratic Risk, and Information Environment

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Management Forecasts, Idiosyncratic Risk, and Information Environment

Abstract

Studies have identified an increase in the level of average stock return volatility. In this paper, we use the management forecast error as a proxy for disclosure quality to investigate the relationship between management forecast errors and idiosyncratic risk, as management forecasts are important information source on the Japanese stock market. 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 even more positively related to the idiosyncratic risks in relatively bad information environments.

Keywords: Management forecasts, idiosyncratic risk, information environment, quality of disclosure, Japanese stock market

JEL: M41, G12, G14

1. Introduction

Studies (e. g., Campbell et al. 2001; Morch et al. 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 management forecast error 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 the highest correlation with and incremental explanatory power for stock prices, indicating that management forecasts represent an important information source for Japanese stock markets.

This study contributes to the literature in several 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 disclosed information, the lower a firm's idiosyncratic risk. For Japan, Okuda and Kitagawa (2011) find that the higher a firm's quality of earnings, the lower its idiosyncratic risk. Contrariwise, Hutton et al. (2009) argue that opacity is associated with lower idiosyncratic risk.

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. Muramiya (2005) has found that firms with lower

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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.

management earnings forecast accuracy have a higher cost of capital than firms with higher management earnings forecast accuracy, while in our paper, we examine the impact on idiosyncratic risk. Though Aman (2011) indicates that management forecast creditability, is negatively associated with idiosyncratic risk, it defined management forecast creditability as the difference between forecast and actual value. Contrary to this, we define management forecasts error based on the absolute value of the difference between forecast and actual value.

Second, we examine the relationship between management forecasts and idiosyncratic risks after controlling for the determinants ,of management forecasts. Studies (e. g., Gotoh 1997; Ota 2006; Kato et al. 2009; Iwasaki et al. 2012) have found that managers' initial earnings forecasts for a fiscal year are systematically upward biased, and they have analyzed the determinants of that management forecast bias. Asano (2007) finds that firms manage their forecasts as well as their earnings. In order to control the determinants of management forecasts, we regress management forecasts and regard the absolute value of residuals as management forecast error. We show that our measures have more explanatory power than plain management forecasts error.

Third, we examine how the effects of management forecast errors differ according to 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 the ratio of individual ownership as a proxy 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. After controlling for the determinants of management forecasts, we also find that management forecasts error has more explanatory power concerning idiosyncratic risk, suggesting that markets take the determinants of management forecasts into consideration when evaluating firm risks.

We furthermore show that management forecast errors are highly positively related to idiosyncratic risks for smaller firms and firms with higher levels of individual ownership, suggesting that management forecast error is more highly positively related to idiosyncratic risks in relatively bad information environments.

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. Botosan (1997) finds that the association between cost of equity capital and disclosure levels is less significant for firms that attract a greater number of analysts, while 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.

The first measure this study uses as a proxy for the information environment is firm size. Studies such as Atiase (1985) and Freeman (1987) have used firm size this way and have shown that the relationship between management forecast accuracy and stock returns is weak in large firms. Studies have also shown that a better connection with information intermediaries such as analysts and institutional investors reduces the information asymmetry between a firm and external parties because it makes information more easily available. As firm size has been positively related to analysts' following (e.g., Collins et al. 1987), the information asymmetry between a large firm and its investors is expected to be low. We thus measure firm size as the natural log of the market value of its equity.

The second measure we use as a proxy for the information environment is the firm's proportion of individual ownership. Some prior studies indicate that individual investors are less sophisticated and have more information disadvantages than institutional investors.[2] For example, Bartov et al. (2000) find that under some specifications, institutional shareholdings are negatively correlated with post-earnings-announcement drift (PEAD). In addition, Bhattacharya (2001) finds that the volume of small trades is correlated with eamings surprises which suggests that investors who make small trades, i.e. individual investors, may cause PEAD. Battalio and Mendenhall (2005) find that large trades respond more strongly to surprises relative to analyst forecasts, whereas small trades respond more strongly to surprises relative to a seasonal random walk model. Lin et al. (2007) and Chiang et al. (2010) provide evidences consist with these interpretations in IPO setting. Their results imply that institutional investors are better informed about IPO value. Therefore,

[2] However, the mixed evidences are also provided. For example, Hirshleifer et al. (2008) do not find evidence that PEAD is caused by individual investors trading.

firms with a large percentage of individual owners will suffer a relatively high information asymmetry in relation to external parties, making public information such as management forecasts more important. We thus use the individual ownership percentage as a proxy for the information environment and propose the following hypotheses:

Hypothesis II: Management forecast errors are more positively correlated with idiosyncratic return volatility when firms face a worse information environment.

Hypothesis IIa: Management forecast errors are more positively correlated with idiosyncratic return volatility when firms are relatively small.

Hypothesis IIb: Management forecast errors are more positively correlated with idiosyncratic return volatility when the individual ownership ratio is large.

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 literatures (Foerster et al. 2010) use 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 equation (1) below:

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

where

$RET_{i,\,m}$ = daily stock return for firm *i* in month *m*

R_f = risk-free rate[3]

$(R_M - R_f)$ = the value-weight excess market returns[4]

SMB = the size factor spread portfolio

HML = the book-to-price ratio factor spread portfolio

We estimate equation (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 Residual management forecast error

As 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 a sum 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 of sales for year t minus actual sales for year t divided by total assets for year t-1, and divided by each error's

[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 that of Aman (2011) for some points. First, Aman (2011) uses a return generation model in which daily return for each firm is explained by daily market portfolio (the rate of change in the TOPIX) and the industry average return. On the other hand, we use three-factor model in Fama and French (1993). Second, Aman (2011) calculates the idiosyncratic risk as one minus R-square in the return generation model and is log-transformed. By contrast, we calculate idiosyncratic risk as the standard deviation of the residual in three-factor model.

standard deviation in order to match the units.[6]

However, management forecasts are biased; several studies have identified the determinants of management forecast error (Rogers and Stocken 2005; Kato et al. 2009; Iwasaki et al. 2012). 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 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 the relationship between them and idiosyncratic risk. We calculate the residual value by estimating equation (2) below and using it as a proxy for unsystematic management forecast errors (hereafter referred to as "residual management forecast errors").

$$\begin{aligned} MFE_{i,t} = \gamma_0 + \gamma_1 MFE_{i,t-1} + \gamma_2 RMSE_{i,t} + \gamma_3 SIZE_{i,t} + \gamma_4 CINC_{i,t} + \gamma_5 CRATIO_{i,t} \\ + \gamma_6 LEV_{i,t} + \gamma_7 LOSS_{i,t} + \gamma_8 GROWTH_{i,t} + \gamma_9 DIV_{i,t} + \varepsilon \end{aligned} \quad (2)$$

where

MFE_t = management forecast error for sum of the sales, ordinary income, and net

[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.

income (= *MFE_SLS*+*MFE_OI*+*MFE_N*I).

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 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 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 a 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 a 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 a firm increases its management dividend forecasts over the current dividends and zero otherwise.

We include the independent variables mainly on the basis of Ota (2006, 2011), which 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}), since studies have shown evidence of the persistence of management forecast error (e.g., Ota, 2006, 2011; Gong et al., 2009).

High-risk firms tend to have difficulty forecasting future earnings, and managers find it particularly difficult to forecast loss earnings. Therefore, we expect simultaneous idiosyncratic risk (*RMSE*) to be positively related to management forecast error.

Several studies have found that forecast behavior is associated with firm size (e.g., Baginski and Hassell, 1997; Bamber and Cheon, 1998; Choi and 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 takes "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; Rogers and Stocken, 2005; Ota, 2006). Thus, we include 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 and Sloan, 2002) and are therefore more likely to engage in earnings guidance to meet their expectations at the earnings announcement date (e.g., Matsumoto, 2002; Choi and Ziebart, 2004; Richardson et al., 2004; Ota, 2006). We expect *GROWTH* to be negatively related to *MFE*.

Ota (2006), finding that firms whose management dividend forecasts increase over current dividends have a negative management forecast error, 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.

We estimate equation (1) with a fixed effect model. The sample for this regression model consists of 8,527 firm-year observations covering 2000 to 2008.[7] Each variable is winsorized at 1 and 99 percentiles by year. We then calculate the residual from equation (1).

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[7] We describe the sample selection criteria in more detail in Table 1.

The absolute value of the residual corresponds to the unsystematic portion of management forecast error (*ARMFE*). We use the absolute value because both highly optimistic and pessimistic management forecasts can be interpreted as firm-specific risks for investors. 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*).[8]

Table 4 shows the estimation of the residual management forecast error performed by fixed-effect regression model (2). Most parameter estimates for the variables are statistically significant and have the expected sign. The only exceptions are the firm size (*SIZE*) and capital increase (*CI*) variables. In addition, the R square for the estimation regressions range from 0.123 to 0.203, suggesting that the models have a reasonable explanatory power.

(Insert Table 4 about here)

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 equation (3) as follows:

[8] We did not include operating income forecasts in our analysis due to data availability constraints. In 2007, the Tokyo Stock Exchange (TSE) began to require listed firms to provide operating income forecasts because of their growing importance for investors. Therefore, no pre-2007 data were available.

$$
\begin{aligned}
RMSE_{i,t} &= \gamma_0 + \gamma_1 ARMFE_{i,t-1} + \gamma_4 SIZE_{i,t-1} + \gamma_6 ROA_{i,t-1} + \gamma_7 GROWTH_{i,t-1} + \gamma_8 LOSS_{i,t-1} \\
&+ \gamma_9 LEV_{i,t-1} + \gamma_{10} INST_{i,t-1} + \gamma_{11} CROSS_{i,t-1} + \gamma_{12} FOREIGN_{i,t-1} + \varepsilon
\end{aligned} \tag{3}
$$

where

$RMSE_t$ = idiosyncratic return volatility based on the three-factor model in Fama and French (1993) for fiscal year *t*.

$ARMFE_{t-1}$ = absolute value of the residual management forecast error for sum of sales, ordinary income, and net income for year *t*-1.

$ARMFE\_SLS_{t-1}$ = absolute value of the residual management forecast error for sales for year *t*-1.

$ARMFE\_OI_{t-1}$ = absolute value of the residual management forecast error for ordinary income for year *t*-1.

$ARMFE\_NI_{t-1}$ = absolute value of the residual management forecast error for net income for year *t*-1.

$SIZE_{t-1}$ = natural log of total assets at the end of fiscal 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.

The test variable is the measure of the residual management forecast error (*ARMFE*), as described in section 3.2. If hypothesis Ⅰ is supported, the coefficient of *ARMFE* will be positive. To check the robustness of our result, we test the relationship between idiosyncratic volatility and three specific management forecast errors as well as the total management forecast error (*ARMFE*). Specifically, we examine the relationship between idiosyncratic volatility and the absolute value of the residual management forecast error for (1) sales (*ARMFE_SLS*), (2) ordinary income (*ARMFE_OI*), and (3) net income (*ARMFE_NI*).[9] We also predict that the coefficients of *ARMFE_SLS*, *ARMFE_OI*, and *ARMFE_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 since small firms experience higher return volatility (e.g., Pastor and Veronesi, 2003; Rajgopal and Venkatachalam, 2011). We define *SIZE* as the natural log of total assets. We control for firm profitability, posited to relate negatively to return volatility (e.g., Wei and Zhang, 2006). Thus, we use net income divided by total assets (*ROA*) and the loss dummy (*LOSS*) as control variables. In addition, as high-growth firms experience higher stock return volatility (e.g., Malkiel and Xu, 2003; Cao et al., 2006; Rajgopal and Venkatachalam, 2011), we use the rate of sales changes as a proxy for firm growth. As distressed firms experience greater

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[9] 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.

stock return volatility (e.g., Campbell et al., 2001; Rajgopal and 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.[10] 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.

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

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

To test hypotheses 2a and 2b on the effect of information asymmetry on the

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

relationship between residual management forecast errors and idiosyncratic risk, we estimate equations (4) and (5) below:

$$
\begin{aligned}
RMSE_{i,t} &= \gamma_0 + \gamma_1 ARMFE_{i,t-1} + \gamma_2 ARMFE \times SIZEq1_{i,t-1} + \gamma_3 ARMFE \times SIZEq4_{i,t-1} \\
&+ \gamma_4 SIZEq1_{i,t-1} + \gamma_5 SIZEq4_{i,t-1} + \gamma_6 ROA_{i,t-1} + \gamma_7 GROWTH_{i,t-1} + \gamma_8 LOSS_{i,t-1} \\
&+ \gamma_9 LEV_{i,t-1} + \gamma_{10} INST_{i,t-1} + \gamma_{11} CROSS_{i,t-1} + \gamma_{12} FOREIGN_{i,t-1} + \varepsilon
\end{aligned} \quad (4)
$$

where

$SIZEq1$ = indicator variable set to "one" if the level of total assets is in the 1st quartile, where that quartile contains the firms with the lowest total assets in each year, and "zero" otherwise.

$SIZEq4$ = indicator variable set to "one" if the level of total assets is in the 4th quartile, where that quartile contains the firms with the highest total assets in each year, and "zero" otherwise.

$$
\begin{aligned}
RMSE_{i,t} &= \gamma_0 + \gamma_1 ARMFE_{i,t-1} + \gamma_2 ARMFE \times INDq1_{i,t-1} + \gamma_3 ARMFE \times INDq4_{i,t-1} \\
&+ \gamma_4 INDq1_{i,t-1} + \gamma_5 INDq4_{i,t-1} + \gamma_6 SIZE_{i,t-1} + \gamma_7 ROA_{i,t-1} + \gamma_8 GROWTH_{i,t-1} \\
&+ \gamma_9 LOSS_{i,t-1} + \gamma_{10} LEV_{i,t-1} + \gamma_{11} INST_{i,t-1} + \gamma_{12} CROSS_{i,t-1} + \gamma_{13} FOREIGN_{i,t-1} + \varepsilon
\end{aligned} \quad (5)
$$

where

$INDq1$ = indicator variable set to "one" if the percentage of individual ownership is in the 1st quartile, where that quartile contains the firms with the lowest individual ownership in each year, and "zero" otherwise.

$INDq4$ = indicator variable set to "one" if the percentage of individual ownership is in the 4th quartile, where that quartile contains the firms with the highest individual ownership in each year, and "zero" otherwise.

To test hypothesis Ⅱa, we include the interaction term between *ARMFE* and the dummy variables based on the quartile of total assets in equation (4). The 1st (4th) quartile of firm size, *SIZEq*1 (*SIZEq*4), indicates the poor (good) information environment. We expect the coefficient of *ARMFE*×*SIZEq*1 to be positive and the coefficient of *ARMFE*×*SIZEq*4 to be negative, consistent with hypothesis Ⅱa.

To test hypothesis Ⅱb, we include the interaction term between *ARMFE* and the dummy variables based on the quartile of percentage of individual ownership (*INDq*1 and *INDq*4) in equation (5). The 1st (4th) quartile of individual ownership, *INDq*1 (*INDq*4), indicates the good (poor) information environment. We expect the coefficient of *ARMFE*×*INDq*1 to be negative and the coefficient of *ARMFE*×*INDq*4 to be positive, consistent with hypothesis Ⅱb.

4. Sample and descriptive statistics

4.1 Sample selection

The sample is selected on the basis of the following criteria:

(1) The firms are listed on Japanese stock exchanges from 2000 to 2008.

(2) The firms' fiscal year ends in March.

(3) The firms are not banks, securities firms, insurance firms, or other financial institutions.[11]

[11] The industries of the sample firms were identified using the Nikkei medium industry classification code (*Nikkei gyousyu chu-bunrui*).

(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 obtained our stock price data from the *Portfolio Master* of Financial Data Solutions. Data on 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*. Details on the sample selection criteria are provided in Table 1. The final sample comprises 7,450 firm-year observations.

(Insert Table 1 about here)

4.2 Descriptive statistics

Table 2 presents the descriptive statistics for the variables used in this study. In order to mitigate the effect of outliers, each sequential variable is winsorized at 1 and 99 percentiles by year. The mean values of the residual management forecast error and the residual forecast error for sales, ordinary income, and net income are 0.673, 0.291, 0.285, and 0.198, respectively. The mean value of idiosyncratic risk is 2.073, similar to that of prior studies.

(Insert Table 2 about here)

Figure 1 shows the mean and median absolute values of the residual management forecast error (*ARMFE*) by year. Although *ARMFE* decreases slightly, from 0.6 to 0.5, overall *ARMFE* levels do not differ dramatically across the years. The mean values of *ARMFE_SLS*, *ARMFE_OI*, and *ARMFE_NI* also remain stable over the years.

(Insert Figure 1 about here)

Table 3 presents a correlation matrix for the variables used in the main analysis, with Pearson (Spearman) correlations below (above) the diagonal. *ARMFE*, *ARMFE_SLS*, *ARMFE_OI*, and *ARMFE_NI* correlate positively with each other. For the Spearman rank correlation, *ARMFE* 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]

(Insert Table 3 about here)

5. Main results

5.1 The results of testing hypothesis Ⅰ

[12] In our regression analysis, we calculate the 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.

Table 5 describes the result of the univariate analysis. Panel A (panel B) of Table 5 shows the mean (median) values of idiosyncratic risk across the absolute values of the residual management forecast error (*ARMFE*, *ARMFE_SLS*, *ARMFE_OI*, and *ARMFE_NI*) quartile portfolios. Despite the lack of clear monotonic trends, firms with higher forecast errors tend to be at high idiosyncratic risk, consistent with our prediction. The results of the t-test (the Wilcoxon signed rank test) show that the difference between the 1^{st} and 4^{th} quartiles is statistically significant. Although the difference is not significant when sorted according to the forecast error for ordinary income (*ARMFE_OI*), the difference between the 1^{st} and 3^{rd} quartiles is significant at the 1% level.

(Insert Table 5 about here)

Table 6 shows the results of the multivariate regressions of model (3). To clarify the importance of estimating the residual management forecast errors (*ARMFE*), we first investigate the relationship between the absolute value of total management forecast error (*AMFE*) and idiosyncratic risk, as reported in panel A. To mitigate cross-sectional and time-series dependence, we cluster the standard errors by firm and fiscal year (Petersen 2009). Although the coefficients of *AMFE*, *AMFE_SLS*, and *AMFE_OI* are significantly positive, as expected, the significance levels are quite low, and the coefficient of *AMFE_NI* is not significant. Therefore, while total management forecast errors increase idiosyncratic risk, the results of our analysis are not robust.

We next investigate the relationship between the absolute value of the residual management forecast error (*ARMFE*) and idiosyncratic risk, our main interest. The results are reported in Table 6, panel B. Panel B shows that *ARMFE* is significantly positive at below 0.01 levels, as expected. We also find that the coefficients of the components of *ARMFE*—*ARMFE_SLS*, *ARMFE_OI*, and *ARMFE_NI*—are significantly positive at below 0.01 levels. These results indicate that less accurate management forecasts increase idiosyncratic return volatility, supporting hypothesis Ⅰ. When set beside the results of panel A, these results show that unsystematic forecast errors are more strongly correlated with subsequent idiosyncratic risk than are total forecast errors, consistent with some prior studies, such as Ota (2011).

Both panel A and B shows that almost all control variables have their expected signs and are statistically significant at conventional levels, except for *ROA*, *GROWTH*, and *INST*. Cross-shareholdings, a distinctive ownership structure in Japan, have a positive effect on idiosyncratic risk.

(Insert Table 6 about here)

5.2 The results of testing hypothesis Ⅱ

Table 7 presents the results of the estimation of equation (4) during the test of hypothesis Ⅱa. Panel A of Table 7 shows the effect of firm size on the relationship between the absolute value of management forecast error and idiosyncratic risk. The coefficient of *AMFE*×*SIZEq4* is significantly negative at a 10% level, as expected, suggesting that, for firms with a good information environment, management forecast accuracy is relatively unimportant to evaluations of firm-specific risk. The coefficient of *AMFE_OI×SIZEq4* is also significantly negative at a 5% level. However, the coefficients of *AMFE_NI×SIZEq4* are not significant. The coefficients of interaction term regarding *SIZEq1* are also not significant, contrary to our prediction. Therefore, the evidence on the effect of firm size on the relationship between the absolute value of management forecast error and idiosyncratic risk is less robust.

Next, we observe the effect of firm size on the relationship between the absolute value of residual management forecast error and idiosyncratic risk in panel B of Table 7. The coefficient of *ARMFE×SIZEq1* is significantly positive at a 1% level, consistent with our prediction. The coefficients of *ARMFE_SLS×SIZEq1*, *ARMFE_OI×SIZEq1*, and *ARMFE_SLS×SIZEq1* are also significantly positive at a 1% level. In addition, the coefficients of *ARMFE×SIZEq4*, *ARMFE_SLS×SIZEq4*, *ARMFE_OI×SIZEq4*, and *ARMFE_SLS×SIZEq4* are significantly negative at a 1% level, as expected. These results imply that small (large) firms show a high (low) correlation between idiosyncratic risk and the absolute value of residual management forecasts.

(Insert Table 7 about here)

Table 8 reports the results of the estimation of equation (5) during the test of hypothesis Ⅱb. Panel A of Table 8 shows the effect of individual ownership on the relationship between the absolute value of management forecast error and idiosyncratic risk. Although the coefficients of *AMFE×INDq4* and *AMFE_SLS×INDq4* are significantly positive, as expected, the other interaction terms are not significant. Therefore, the evidence concerning the effect of individual ownership on the relationship between the absolute value of management forecast error and idiosyncratic risk is not very robust.

On the other hand, panel B of Table 8 displays the effect of individual investor ownership on the relationship between the absolute value of residual management forecast error and idiosyncratic risk. The coefficients of *ARMFE×INDq4*, *ARMFE_SLS×INDq4*, *ARMFE_OI×INDq4*, and *ARMFE_NI×INDq4* are all significantly positive, suggesting that firms with a significant individual ownership show a high correlation between idiosyncratic risk and the absolute value of residual management forecast errors.

(Insert Table 8 about here)

Thus, our results support hypotheses 2a and 2b: in firms with a poor (good) information environment, management accuracy is more (less) important to the evaluation of firms' specific risk, and the residual portion of management forecast errors has a stronger impact on idiosyncratic risk, consistent with the results in section 5.1.

6. Conclusion

This paper has considered management forecast error as a proxy for disclosure quality and has investigated the relationship between management forecast error 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 more positively related with idiosyncratic risks in smaller firms and firms with a higher level of individual ownership, indicating that management forecast error is more positively related with idiosyncratic risks in relatively poor information environments.

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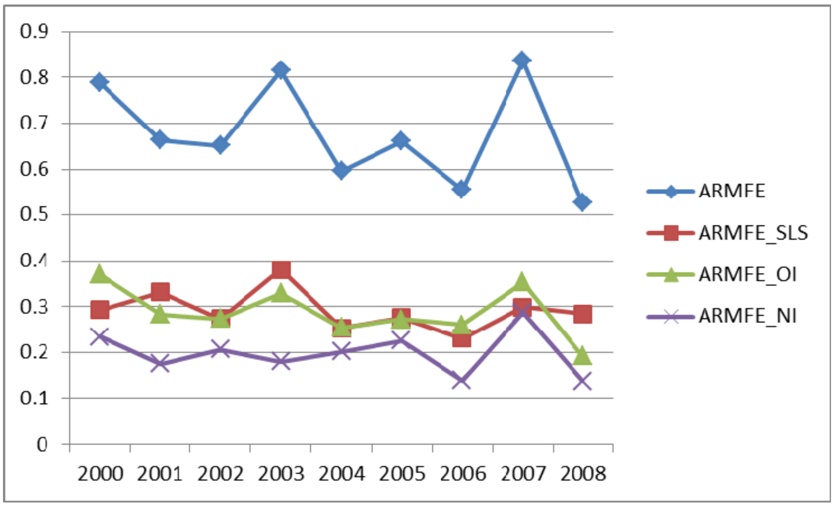
Figure 1
Residual management forecast error by year

Panel A: mean value of absolute value of residual management forecast error



Panel B: median value absolute value of residual management forecast error

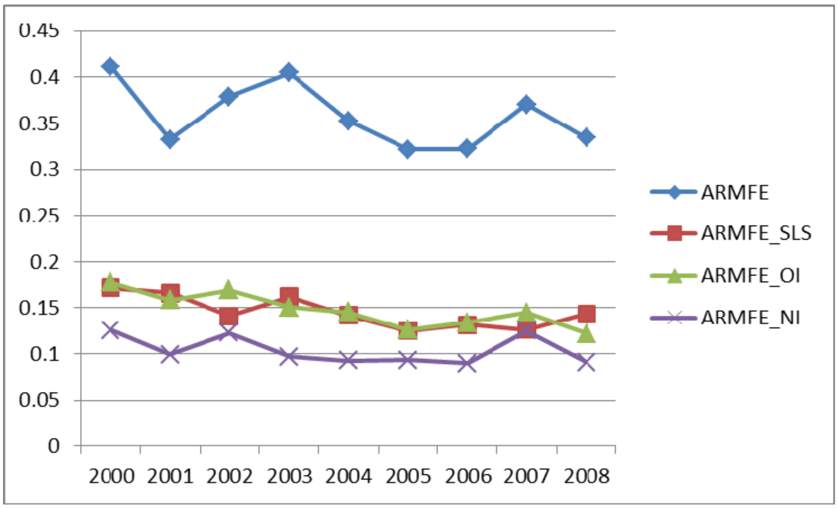


Figure 1 shows mean and median absolute value of residual management forecast error by year. The definitions of each variable are as follows. *ARMFE* = absolute value of residual management forecast error for sum of the sales, ordinary income, and net income. *ARMFE_SLS* = absolute value of residual 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 1 and 99 percentiles by year.

Table 1
Sample selection criteria

The listed firms from 2000 to 2008.	24566
Less: The firms' fiscal year does not end in March	(7584)
Less: Banks, securities firms, insurance firms, and other financial institutions.	(441)
Less: Firms that changed their fiscal year end.	(1029)
Less: Missing data for calculation of idiosyncratic risk.	(7384)
Less: Missing data for calculation of management forecast error.	(116)
Less: Missing other data for estimation of model (2).	(515)
	8527
Less: Missing other data for estimation of models (3), (4), and (5).	(1077)
Final sample	7450

Table 1 provides detail 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 2
Descriptive statistics

	Mean	Median	Max	Min	SD	Skewness	Kurtosis	N
RMSE	2.073	1.925	4.605	0.782	0.817	1.047	4.398	7450
ARMFE	0.673	0.356	4.875	0.008	0.953	3.182	15.376	7450
ARMFE_SLS	0.291	0.143	2.231	0.004	0.432	3.294	15.979	7450
ARMFE_OI	0.285	0.143	2.141	0.004	0.425	3.375	16.936	7450
ARMFE_NI	0.198	0.101	1.661	0.002	0.296	3.703	20.393	7450
SIZE	11.804	11.620	14.701	9.527	1.236	0.455	2.840	7450
ROA	0.017	0.017	0.111	-0.135	0.041	-1.863	14.974	7450
GROWTH	0.035	0.025	0.469	-0.269	0.133	2.249	20.668	7450
LOSS	0.178	0.000	1.000	0.000	0.382	1.686	3.843	7450
LEV	0.566	0.574	0.956	0.127	0.204	-0.166	2.284	7450
INST	0.325	0.320	0.593	0.066	0.129	0.088	2.249	7450
CROSS	0.235	0.193	0.673	0.022	0.162	0.904	3.087	7450
FOREIGN	0.101	0.070	0.395	0.004	0.098	1.217	3.906	7450
IND	0.317	0.302	0.731	0.064	0.151	0.561	2.999	7450

Table 2 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. *ARMFE* = absolute value of residual management forecast error for sum of the sales, ordinary income, and net income for year t-1. *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. *IND* = the percentage of individual ownership at the end of fiscal year t-1. All sequential variables are winsorized at 1 and 99 percentiles by year.

Table 3
Correlation matrix

	RMSE	*ARMFE*	*ARMFE_SLS*	*ARMFE_OI*	*ARMFE_NI*	*SIZE*	*ROA*	*GROWTH*	*LOSS*	*LEV*	*INST*	*CROSS*	*FOREIGN*	*INDIVIDUAL*
RMSE		0.07***	0.06***	0.04***	0.10***	-0.17***	-0.25***	-0.16***	0.27***	0.19***	0.06***	0.13***	0.01	0.07***
ARMFE	0.00		0.65***	0.75***	0.64***	0.33***	-0.13***	0.02	0.21***	0.18***	0.12***	-0.12***	0.18***	-0.17***
ARMFE_SLS	0.01	0.75***		0.47***	0.37***	0.34***	-0.08***	0.03***	0.10***	0.19***	0.10***	-0.10***	0.17***	-0.16***
ARMFE_OI	0.03	0.85***	0.55***		0.57***	0.39***	-0.10***	0.01	0.17***	0.13***	0.15***	-0.15***	0.23***	-0.21***
ARMFE_NI	0.01	0.72***	0.42***	0.64***		0.30***	-0.22***	-0.05***	0.34***	0.21***	0.10***	-0.13***	0.12***	-0.10***
SIZE	-0.21***	0.51***	0.49***	0.52***	0.46***		-0.04***	0.01***	-0.08***	0.17***	0.34***	0.04***	0.32***	-0.50***
ROA	-0.26***	-0.05***	-0.04**	-0.01	-0.15***	0.09***		0.39***	-0.72***	-0.38***	0.00	-0.04***	0.11***	-0.08***
GROWTH	-0.11***	0.08***	0.12***	0.06***	0.01	-0.02***	0.24***		-0.29***	-0.04***	0.03***	0.00	0.09***	-0.06***
LOSS	0.30***	0.11***	0.05***	0.08***	0.23***	-0.08***	-0.61***	-0.21***		0.19***	-0.03***	0.01**	-0.06***	0.10***
LEV	0.22***	0.16***	0.19***	0.10***	0.18***	0.20***	-0.22***	-0.02***	0.19***		-0.01	0.01***	-0.14***	-0.02***
INST	0.02	0.17***	0.12***	0.20***	0.12***	0.42***	0.06***	-0.02**	-0.05***	0.01		0.66***	0.83***	-0.24***
CROSS	0.13***	-0.13***	-0.09***	-0.15***	-0.14***	-0.02***	-0.02**	-0.02***	0.02	0.04***	0.25***		0.63***	-0.27***
FOREIGN	-0.09***	0.26***	0.20***	0.29***	0.22***	0.36***	0.11***	0.07***	-0.10***	-0.17***	0.49***	0.08***		-0.21***
INDIVIDUAL	0.11***	-0.19***	-0.17***	-0.22***	-0.13***	-0.49***	-0.11***	0.00	0.10***	-0.04***	-0.34***	-0.38***	-0.31***	

Table 3 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. *ARMFE* = absolute value of residual management forecast error for sum of the sales, ordinary income, and net income for year t-1. *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. *INDIVIDUAL* = the percentage of individual ownership at the end of fiscal year t-1. All sequential variables are winsorized at 1 and 99 percentiles by year, and ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.1 levels using a two-tailed *t*-test.

Table 4
Regression for the residual forecast error

	Expected sign	*MFE* t		*MFE_SLS* t		*MFE_OI* t		*MFE_NI* t	
		Coef.	t-value	Coef.	t-value	Coef.	t-value	Coef.	t-value
Constant		-1.489	-1.26	0.620	1.11	-1.261***	-2.76	-0.491	-1.33
MFE t-1	+	0.130***	5.31						
*MFE_SLS*t-1	+			0.151***	5.51				
MFE_OI t-1	+					0.090***	3.51		
MFE_NI t-1	+							0.057**	2.55
RMSE t	+	0.141***	6.07	0.086***	8.14	0.038***	3.90	0.027***	3.87
SIZE t	−	0.049	0.49	-0.089*	-1.87	0.091**	2.35	0.006	0.19
CI t	−	-0.051	-0.75	-0.019	-0.61	-0.021	-0.73	-0.001	-0.02
CRATIO t	+	0.088**	2.00	0.024	1.37	0.040**	2.11	0.043***	3.42
LEV t	+	1.028***	3.26	0.449***	3.16	0.125	0.94	0.584***	5.98
LOSS t	+	0.822***	16.08	0.098***	4.20	0.269***	12.51	0.414***	23.86
GROWTH t	−	-2.916***	-14.46	-1.676***	-15.75	-0.950***	-12.53	-0.274***	-5.68
DIV t	−	-0.300***	-8.91	-0.068***	-4.67	-0.141***	-9.73	-0.084***	-8.19
R^2 *(within)*		0.203		0.197		0.123		0.180	
Obs.		8527		8527		8527		8527	

Table 4 reports the results of fixed-effect regression model (2) in estimating the residual management forecast error. The definitions of each variable are as follows. *MFE* t = management forecast error for the sum of sales, ordinary income, and net income (= *MFE_SLS*+*MFE_OI*+*MFE_N*I). *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 1 and 99 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 using a two-tailed *t*-test.

Table 5
Idiosyncratic risk at the end of year *t* across four quartiles

Mean value of idiosyncratic risk at the end of year *t* across four quartiles sorted by

	ARMFE $_{t-1}$	*ARMFE_SLS* $_{t-1}$	*ARMFE_OI* $_{t-1}$	*ARMFE_NI* $_{t-1}$
Q1 (Lowest)	1.988	2.016	2.020	1.941
Q2	2.046	2.063	2.093	2.015
Q3	2.157	2.132	2.134	2.180
Q4 (Highest)	2.101	2.081	2.046	2.156
Q4 – Q1	0.113***	0.066**	0.026	0.215***
t-stat.	4.304	2.517	1.024	8.127

Median value of idiosyncratic risk at the end of year *t* across four quartiles sorted by

	ARMFE $_{t-1}$	*ARMFE_SLS* $_{t-1}$	*ARMFE_OI* $_{t-1}$	*ARMFE_NI* $_{t-1}$
Q1 (Lowest)	1.870	1.889	1.881	1.838
Q2	1.900	1.898	1.922	1.871
Q3	1.992	1.991	1.997	1.996
Q4 (Highest)	1.960	1.928	1.914	2.009
Q4 – Q1	0.089***	0.039*	0.032	0.171***
z-stat.	3.599	1.775	0.947	6.590

Table 5 describes the result of the univariate analysis. panel A (panel B) of Table 5 shows the mean (median) values of idiosyncratic risk across the absolute values of the residual management forecast errors. The definitions of each variable are as follows. *ARMFE* $_{t-1}$ = absolute value of residual management forecast error for the sum of sales, ordinary income, and net income for year t-1. *ARMFE_SLS* $_{t-1}$ = absolute value of residual management forecast error for sales for year t-1. *ARMFE_OI* $_{t-1}$ = absolute value of residual management forecast error for ordinary income foryear t-1. *ARMFE_NI* $_{t-1}$ = absolute value of residual management forecast error for net income for year t-1. All sequential variables are winsorized at the 1 and 99 percentiles by year. In the panels, "t-stat." means "t-test statistics," and "z-stat." means "Wilcoxon rank-sum statistics;" ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.1 levels using a two-tailed *t*-test.

Table 6
Management forecast accuracy and idiosyncratic risk

Panel A: absolute value of management forecast error

	Expected	$RMSE_t$		$RMSE_t$		$RMSE_t$		$RMSE_t$	
	sign	Coef.	t-value	Coef.	t-value	Coef.	t-value	Coef.	t-value
Constant	+/−	3.506***	8.63	3.486***	8.75	3.539***	8.86	3.294***	8.80
$AMFE_{t-1}$	+	0.014*	1.65						
$AMFE\_SLS_{t-1}$	+			0.028*	1.83				
$AMFE\_OI_{t-1}$	+					0.045*	1.79		
$AMFE\_NI_{t-1}$	+							-0.042	-1.28
$SIZE_{t-1}$	−	-0.209***	-6.44	-0.207***	-6.49	-0.213***	-6.69	-0.188***	-6.48
ROA_{t-1}	−	-0.687	-0.92	-0.704	-0.92	-0.745	-0.97	-0.769	-0.97
$GROWTH_{t-1}$	−	-0.454	-1.02	-0.460	-1.05	-0.447	-1.01	-0.437	-0.98
$LOSS_{t-1}$	+	0.539***	6.45	0.545***	6.56	0.536***	6.43	0.563***	6.49
LEV_{t-1}	+	1.126***	6.85	1.120***	6.88	1.134***	6.95	1.124***	6.89
$INST_{t-1}$	+	0.303	0.69	0.299	0.70	0.305	0.69	0.255	0.58
$CROSS_{t-1}$	+	0.404*	1.93	0.400*	1.92	0.412*	1.95	0.387*	1.84
$FOREIGN_{t-1}$	+	1.224***	2.80	1.238***	2.83	1.226***	2.76	1.272***	2.92
Adj. R^2		0.219		0.218		0.219		0.218	
Obs.		7450		7450		7450		7450	

Panel B: absolute value of residual management forecast error

	Expected	$RMSE_t$		$RMSE_t$		$RMSE_t$		$RMSE_t$	
	sign	Coef.	t-value	Coef.	t-value	Coef.	t-value	Coef.	t-value
Constant	+/−	3.617***	9.17	3.619***	9.93	3.600***	9.27	3.410***	9.31
$ARMFE_{t-1}$	+	0.060***	2.79						
$ARMFE\_SLS_{t-1}$	+			0.133***	4.08				
$ARMFE\_OI_{t-1}$	+					0.124**	2.37		
$ARMFE\_NI_{t-1}$	+							0.018**	2.18
$SIZE_{t-1}$	−	-0.220***	-7.07	-0.221***	-7.67	-0.218***	-7.13	-0.200***	-6.95
ROA_{t-1}	−	-0.723	-0.98	-0.681	-0.91	-0.738	-0.97	-0.678	-0.89
$GROWTH_{t-1}$	−	-0.477	-1.08	-0.498	-1.15	-0.464	-1.05	-0.397	-1.02
$LOSS_{t-1}$	+	0.524***	6.18	0.537***	6.53	0.528***	6.33	0.543***	6.60
LEV_{t-1}	+	1.118***	6.74	1.109***	6.66	1.132***	6.90	1.120***	6.82
$INST_{t-1}$	+	0.309	0.71	0.330	0.75	0.291	0.66	0.307	0.70
$CROSS_{t-1}$	+	0.412**	1.99	0.416**	2.01	0.408**	1.96	0.410**	1.97
$FOREIGN_{t-1}$	+	1.211***	2.71	1.245***	2.84	1.205***	2.66	1.224***	2.78
Adj. R^2		0.221		0.221		0.221		0.218	
Obs.		7450		7450		7450		7450	

Table 6 shows the results of the multivariate regressions of model (3). Panel A shows the relationship between the absolute value of the total management forecast error and idiosyncratic risk, and Panel B 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. *AMFE* = absolute value of management forecast error for the sum of sales, ordinary income, and net income (*MFE*) for year t-1. *AMFE_SLS* = absolute value of management forecast error for sales (*MFE_SLS*) foryear t-1. *AMFE_OI* = absolute value of management forecast error for ordinary income (*MFE_OI*) for year t-1. *AMFE_NI* = absolute value of management forecast error for net income (*MFE_SI*) for year t-1. *ARMFE* = absolute value of residual management forecast error for the sum of sales, ordinary income, and net income for year t-1. *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. All sequential variables are winsorized at the 1 and 99 percentiles by year. In the panel, *t*-values are corrected for heteroskedasticity a swell as for ross-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 using a two-tailed *t*-test.

Table 7
The effect of firm size on the relationship between management forecast accuracy and idiosyncratic risk

Panel A: absolute value of management forecast error

	Expected	*RMSE* t		*RMSE* t		*RMSE* t		*RMSE* t	
	sign	Coef.	t-value	Coef.	t-value	Coef.	t-value	Coef.	t-value
Constant	+/—	1.416***	9.78	1.429***	9.87	1.414***	9.91	1.453***	9.83
AMFE t-1	+	0.089	1.34						
AMFE_SLS t-1	+			0.076	0.69				
AMFE_OI t-1	+					0.285*	1.80		
AMFE_NI t-1	+							-0.159	-0.74
AMFE×SIZEq1 t-1	+	-0.052	-0.09						
AMFE_SLS×SIZEq1 t-1	+			1.691	0.50				
AMFE_OI×SIZEq1 t-1	+					-0.153	-0.10		
AMFE_NI×SIZEq1 t-1	+							-0.272	-0.26
AMFE×SIZEq4 t-1	—	-0.114*	-1.80						
AMFE_SLS×SIZEq4 t-1	—			-0.134	-1.22				
AMFE_OI×SIZEq4 t-1	—					-0.340**	-2.33		
AMFE_NI×SIZEq4 t-1	—							0.023	0.12
SIZEq1 t-1	+	0.719***	3.41	0.638***	2.58	0.725***	3.45	0.692***	3.79
SIZEq4 t-1	—	-0.212***	-3.49	-0.225***	-3.93	-0.209***	-3.52	-0.235***	-4.51
ROA t-1	—	-0.390	-0.44	-0.446	-0.52	-0.346	-0.41	-0.732	-0.75
GROWTH t-1	—	-0.422	-0.95	-0.405	-0.91	-0.436	-0.99	-0.421	-0.96
LOSS t-1	+	0.575***	6.53	0.574***	6.75	0.572***	6.46	0.609***	6.63
LEV t-1	+	0.908***	6.24	0.911***	6.37	0.904***	6.25	0.909***	6.32
INST t-1	+	0.048	0.10	0.045	0.10	0.053	0.11	0.028	0.06
CROSS t-1	+	0.386*	1.71	0.391*	1.71	0.382*	1.67	0.366	1.61
FOREIGN t-1	+	0.711*	1.89	0.705*	1.89	0.690*	1.82	0.805**	2.21
Adj. R^2		0.199		0.199		0.199		0.203	
Obs.		7450		7450		7450		7450-	

Panel B: absolute value of residual management forecast error

	Expected	*RMSE* t		*RMSE* t		*RMSE* t		*RMSE* t	
	sign	Coef.	t-value	Coef.	t-value	Coef.	t-value	Coef.	t-value
Constant	+/—	1.342***	8.48	1.310***	8.63	1.360***	8.78	1.396***	9.16
ARMFE t-1	+	0.291***	3.95						
ARMFE_SLS t-1	+			0.773***	3.48				
ARMFE_OI t-1	+					0.643***	3.41		
ARMFE_NI t-1	+							0.509***	2.59
ARMFE×SIZEq1 t-1	+	0.644***	5.25						
ARMFE_SLS×SIZEq1 t-1	+			0.782***	2.90				
ARMFE_OI×SIZEq1 t-1	+					2.371***	5.75		
ARMFE_NI×SIZEq1 t-1	+							1.952***	2.57
ARMFE×SIZEq4 t-1	—	-0.328***	-4.16						
ARMFE_SLS×SIZEq4 t-1	—			-0.874***	-3.87				
ARMFE_OI×SIZEq4 t-1	—					-0.713***	-3.67		
ARMFE_NI×SIZEq4 t-1	—							-0.737***	-3.14
SIZEq1 t-1	+	0.269*	1.75	0.402**	2.53	0.224*	1.66	0.397*	1.94
SIZEq4 t-1	—	-0.137**	-2.30	-0.120*	-1.94	-0.158**	-2.51	-0.155***	-3.00
ROA t-1	—	-0.203	-0.23	-0.085	-0.10	-0.112	-0.13	-0.353	-0.37
GROWTH t-1	—	-0.523	-1.25	-0.529	-1.27	-0.531	-1.24	-0.437	-1.01
LOSS t-1	+	0.529***	6.44	0.558***	6.84	0.549***	6.66	0.554***	6.34
LEV t-1	+	0.899***	5.93	0.916***	6.12	0.897***	6.02	0.905***	6.16
INST t-1	+	0.084	0.18	0.097	0.21	0.080	0.18	0.038	0.08
CROSS t-1	+	0.400*	1.81	0.403*	1.84	0.396*	1.79	0.363	1.60
FOREIGN t-1	+	0.659*	1.81	0.657*	1.75	0.636*	1.69	0.712**	2.02
Adj. R^2		0.207		0.212		0.205		0.205	
Obs.		7450		7450		7450		7450	

Table 7 presents the results of the estimation of equation (4) in testing hypothesis Ⅱa. Panel A shows the effect of firm size on the relationship between the absolute value of total management forecast error and idiosyncratic risk, and Panel B presents the effect of firm size on the relationship between th eabsolute 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 management forecast error for the sum of ales, ordinary income, and net income (*MFE*) for year t-1. *AMFE_SLS* = absolute value of management forecast error for sales (*MFE_SLS*) for year t-1. *AMFE_OI* = absolute value of management forecast error for ordinary income (*MFE_OI*) for year t-1. *AMFE_NI* = absolute value of management forecast error for net income (*MFE_SI*) for year t-1. *ARMFE* = absolute value of residual management forecast error for the sum of sales, ordinary income, and net income for year t-1. *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. *SIZEq*1 = indicator variable set to "one" if the level of total assets is in the 1st 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 4th 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. All sequential variables are winsorized at the 1 and 99 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 using a two-tailed *t*-test.

Table 8
The effect of individual investors' ownership on the relationship between management forecast accuracy and idiosyncratic risk

Panel A: absolute value of management forecast error

	Expected sign	$RMSE_t$ Coef.	$RMSE_t$ t-value	$RMSE_t$ Coef.	$RMSE_t$ t-value	$RMSE_t$ Coef.	$RMSE_t$ t-value	$RMSE_t$ Coef.	$RMSE_t$ t-value
Constant	+/—	3.463***	8.88	3.427***	8.21	3.462***	9.40	3.228***	8.57
$AMFE_{t-1}$	+	0.009	0.85						
$AMFE\_SLS_{t-1}$	+			0.021	0.91				
$AMFE\_OI_{t-1}$	+					0.020	0.73		
$AMFE\_NI_{t-1}$	+							-0.062	-1.52
$AMFE \times INDq1_{t-1}$	—	0.005	0.46						
$AMFE\_SLS \times INDq1_{t-1}$	—			0.001	0.03				
$AMFE\_OI \times INDq1_{t-1}$	—					0.041	1.23		
$AMFE\_NI \times INDq1_{t-1}$	—							0.032	0.83
$AMFE \times INDq4_{t-1}$	+	0.114**	2.25						
$AMFE\_SLS \times INDq4_{t-1}$	+			0.149*	1.91				
$AMFE\_OI \times INDq4_{t-1}$	+					0.199	1.53		
$AMFE\_NI \times INDq4_{t-1}$	+							0.102	0.83
$INDq1_{t-1}$	—	0.073	0.87	0.078	0.95	0.056	0.67	0.071	0.87
$INDq4_{t-1}$	+	0.146	1.13	0.167	1.28	0.173	1.43	0.183	1.42
$SIZE_{t-1}$	—	-0.217***	-6.96	-0.213***	-6.86	-0.219***	-7.16	-0.194***	-6.81
ROA_{t-1}	—	-0.563	-0.77	-0.675	-0.89	-0.680	-0.89	-0.699	-0.86
$GROWTH_{t-1}$	—	-0.462	-1.04	-0.462	-1.05	-0.458	-1.03	-0.449	-1.00
$LOSS_{t-1}$	+	0.541***	6.53	0.546***	6.62	0.537***	6.47	0.566***	6.56
LEV_{t-1}	+	1.168***	7.11	1.157***	7.17	1.180***	7.33	1.164***	7.19
$INST_{t-1}$	+	0.447	0.66	0.435	0.66	0.470	0.69	0.390	0.58
$CROSS_{t-1}$	+	0.492	1.01	0.486	1.01	0.525	1.07	0.474	0.98
$FOREIGN_{t-1}$	+	1.262**	2.23	1.279**	2.26	1.274**	2.25	1.297**	2.31
Adj. R^2		0.225		0.224		0.225		0.224	
Obs.		7450		7450		7450		7450	

Panel B: absolute value of residual management forecast error

	Expected sign	$RMSE_t$ Coef.	$RMSE_t$ t-value	$RMSE_t$ Coef.	$RMSE_t$ t-value	$RMSE_t$ Coef.	$RMSE_t$ t-value	$RMSE_t$ Coef.	$RMSE_t$ t-value
Constant	+/—	3.583**	9.02	3.571***	9.08	3.569***	9.42	3.376***	7.89
$ARMFE_{t-1}$	+	0.050**	2.51						
$ARMFE\_SLS_{t-1}$	+			0.131***	3.31				
$ARMFE\_OI_{t-1}$	+					0.083**	2.14		
$ARMFE\_NI_{t-1}$	+							0.004	0.04
$ARMFE \times INDq1_{t-1}$	—	-0.003	-0.13						
$ARMFE\_SLS \times INDq1_{t-1}$	—			-0.046	-0.93				
$ARMFE\_OI \times INDq1_{t-1}$	—					0.045	0.74		
$ARMFE\_NI \times INDq1_{t-1}$	—							-0.044	-0.62
$ARMFE \times INDq4_{t-1}$	+	0.235***	2.99						
$ARMFE\_SLS \times INDq4_{t-1}$	+			0.413*	1.68				
$ARMFE\_OI \times INDq4_{t-1}$	+					0.628***	3.31		
$ARMFE\_NI \times INDq4_{t-1}$	+							0.246*	1.87
$INDq1_{t-1}$	—	0.076	0.87	0.087	1.08	0.059	0.65	0.088	1.05
$INDq4_{t-1}$	+	0.081	0.66	0.114	0.92	0.090	0.73	0.126	0.96
$SIZE_{t-1}$	—	-0.231***	-7.53	-0.231***	-7.92	-0.230***	-7.70	-0.210***	-6.67
ROA_{t-1}	—	-0.453	-0.62	-0.478	-0.62	-0.522	-0.69	-0.455	-0.60
$GROWTH_{t-1}$	—	-0.490	-1.13	-0.505	-1.17	-0.477	-1.09	-0.446	-1.00
$LOSS_{t-1}$	+	0.523***	6.21	0.535***	6.51	0.526***	6.39	0.545***	6.29
LEV_{t-1}	+	1.158***	6.73	1.146***	6.68	1.178***	6.93	1.166***	6.89
$INST_{t-1}$	+	0.487	0.75	0.514	0.79	0.480	0.74	0.443	0.67
$CROSS_{t-1}$	+	0.527	1.13	0.542	1.16	0.535	1.13	0.498	1.04
$FOREIGN_{t-1}$	+	1.323**	2.48	1.364***	2.57	1.321**	2.45	1.343**	2.48
Adj. R^2		0.232		0.232		0.231		0.228	
Obs.		7450		7450		7450		7450	

Table 8 presents the results of the estimation of equation (5) in testing hypothesis Ⅱb. Panel A shows the effect of individual ownership on the relationship between the absolute value of total management forecast error and idiosyncratic risk, and Panel B presents the effect of individual ownership 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. *ARMFE* = absolute value of residual management forecast error for the sum of sales, ordinary income, and net income for year t-1. *ARMFE_SLS* = absolute value of the residual management forecast error for sales for year t-1. *ARMFE_OI* = absolute value of the residual management forecast error for ordinary income for year t-1. *ARMFE_NI* = absolute value of the residual management forecast error for net income for year t-1. *INDq*1 = indicator variable set to "one" if the percentage of individual ownership is in the 1^{st} quartile, where that quartile contains the firms with the lowest individual ownership in each year and "zero" otherwise. *INDq*4 = indicator variable set to "one" if the percentage of individual ownership is in the 4^{th} quartile, where that quartile contains the firms with the highest individual ownership in each year, 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. All sequential variables are winsorized at the 1 and 99 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 using a two-tailed t-test.

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