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(Citation)
Journal of Contemporary Accounting & Economics,17(3):100281

(Issue Date)
2021-12

(Resource Type)
journal article

(Version)
Accepted Manuscript

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Journal of Contemporary Accounting and Economics, Forthcoming

First version: October 2020
This version: August 2021

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Macroeconomic uncertainty and management forecast accuracy

Abstract

This study examines the effect of macroeconomic uncertainty on the accuracy of management earnings forecasts. Focusing on Japanese management earnings forecasts, which are effectively mandated, I find that during periods of high macroeconomic uncertainty, firms tend to report accurate earnings forecasts. I also find that macroeconomic uncertainty lessens optimistic but not pessimistic errors. These findings are consistent with the scenario that managers try to avoid missing their forecasts or revising their forecasts downward because investors place greater weight on bad news when macroeconomic uncertainty is high. Consistent with this scenario, additional analyses reveal that firms experience a larger decrease in stock prices when they miss their forecasts or revise their forecasts downward under high macroeconomic uncertainty. Moreover, these findings are robust after controlling for the effect of earnings management. These results suggest that the usefulness of management forecasts does not decrease even when macroeconomic uncertainty is high.

Keywords: macroeconomic uncertainty, volatility index, management earnings forecast, Japan

JEL Classification: M41

1. Introduction

In recent years, we have faced greater uncertainty due to macroeconomic events such as financial crises, earthquakes, and the spread of COVID-19.[2] Thus, it has become increasingly important to know how managers behave under high macroeconomic uncertainty. The literature focuses on the effect of uncertainty on investors' reactions to earnings announcements (Epstein and Schneider, 2008; Bird and Yeung, 2012; Williams, 2015; Shin, 2019). However, few studies have investigated the consequences of uncertainty on managers' behavior. Thus, extending these studies, I examine the relationship between macroeconomic uncertainty and management forecast accuracy.

Kim et al. (2016) are the first to investigate the relationship between macroeconomic uncertainty and the accuracy of management earnings forecasts. They predict that managers report inaccurate earnings forecasts during periods of high macroeconomic uncertainty. This is because uncertainty lowers the quality of the information that managers use for forecasting earnings, which makes it more difficult to issue accurate forecasts. However, Kim et al. (2016) find that managers issue more accurate forecasts during periods of high macroeconomic uncertainty. They interpret that this result is derived from self-selection bias because a significant decrease in the issuance and frequency occurs when macroeconomic uncertainty is high. That is, under high macroeconomic uncertainty,

[2] I define uncertainty as "Knightian uncertainty" (Knight, 1921). Although such "uncertainty" is similar to "risk," studies theoretically distinguish between them (Knight, 1921; Ellsberg, 1961; Epstein and Schneider, 2008; Williams, 2015). Under risk, future outcomes are unknown but the probability distribution of those outcomes is known. On the contrary, under uncertainty, the probability distribution of outcomes is also unknown (Knight, 1921; Ellsberg, 1961). Some studies use the word "ambiguity." I use the words "ambiguity" and "uncertainty" interchangeably.

management earnings forecasts become more accurate because only managers who have superior forecasting abilities issue forecasts.

Based on Kim et al. (2016), I first examine whether managers facing high macroeconomic uncertainty issue more accurate forecasts even when self-selection bias is less serious. To this end, I focus on Japanese listed firms. In Japan, most listed firms issue management earnings forecasts in their earnings announcements under strong encouragement from the Tokyo Stock Exchange (Ota, 2006; Kato et al., 2009; Kitagawa and Okuda, 2016; Muramiya and Takada, 2017; Nagata and Nguyen, 2017; Iwasaki et al., 2020; Ishida et al., 2021; Kitagawa and Shuto, 2021).[3] Therefore, using Japanese data mitigates self-selection bias.

In addition to mitigating the self-selection issue, focusing on Japanese firms has several advantages. First, the management earnings forecasts in Japan are issued in earnings announcements. That is, they are bundled forecasts, as discussed in Rogers and Van Buskirk (2013). Therefore, management forecast accuracy is less biased by the timing of issue (e.g., Nagata and Nguyen, 2017).[4] Second, Japanese firms issue point-estimated forecasts (Kato et al., 2009; Iwasaki et al., 2020; Kitagawa and Shuto, 2021).[5] This feature can mitigate the

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[3] The literature also indicates that most Japanese firms issue management earnings forecasts because the litigation risks are lower than those in other countries such as the US and United Kingdom (West, 2001; Ginsburg and Hoetker, 2006).

[4] Rogers and Van Buskirk (2013) indicate that forecast bundling causes the research design issue because it induces the measurement error in forecast news. However, I do not consider the problem because this study focuses on the *forecast accuracy* rather than *forecast news*. Rogers and Van Buskirk (2013, p. 44) indicate that forecast bundling does not cause measurement problems in "forecast bias" (relative to realized earnings) or "forecast precision."

[5] US firms commonly issue range-estimated forecasts (Ciconte et al., 2014; Tang et al., 2015). In Japan, the Tokyo Stock Exchange requires that firms issue range-estimated forecasts when point-estimated forecasts can mislead investors. However, only dividend per share forecasts are sometimes reported by a range estimate (Gotoh, 1997; Ota, 2010).

measurement error problem in calculating management forecast accuracy.[6] Thus, the unique setting in the Japanese management forecasts contributes to refine some research design issues.

The second concern of this study is to provide another scenario that explains why managers issue accurate forecasts when macroeconomic uncertainty is high. One possible scenario is provided by studies that examine the effect of macroeconomic uncertainty on the market reaction to earnings announcements. These studies find that during periods of high macroeconomic uncertainty, investors and analysts recognize bad news as more reliable and react more to bad news than good news (Epstein and Schneider, 2008; Bird and Yeung, 2012; Williams, 2015; Shin, 2019). Furthermore, studies argue that managers disclose information in considering the market response (Verrecchia, 1990). If they miss their forecasts or revise their forecasts downward under high macroeconomic uncertainty, they experience a larger decrease in stock prices. Thus, I predict that during periods of high macroeconomic uncertainty, managers have more incentive to avoid missing their forecasts, resulting in more accurate forecasts. If this is the case, macroeconomic uncertainty should be related to optimistic errors rather than pessimistic errors. Thus, I investigate the relationship between macroeconomic uncertainty and management forecast accuracy by dividing the optimistic sample (i.e., sample for which actual earnings are below the initial earnings forecasts) and pessimistic sample (i.e., sample for which actual earnings exceed the initial earnings

[6] US studies often use the midpoint to measure managers' earnings expectations when managers issue range-estimated forecasts (Baginski et al., 1993). However, Ciconte et al. (2014) provide evidence that managers like to place greater weight on the upper bound of forecast ranges. This means that using the midpoint of range forecasts can induce measurement errors into management forecast accuracy.

forecasts).

The sample consists of 53,681 firm-year observations from 2003 to 2019. I use the absolute value of management forecast errors (i.e., actual earnings minus the initial earnings forecasts) and revisions (i.e., the latest earnings forecasts minus the initial earnings forecasts) to measure management forecast accuracy. As a proxy for macroeconomic uncertainty, I use the Nikkei Stock Average Volatility Index (hereafter "Nikkei Volatility Index") calculated by Nikkei Inc., which corresponds to the Volatility Index calculated by the Chicago Board Options Exchange in the United States. Subsequently, I investigate the relationship between macroeconomic uncertainty and management forecast accuracy. The main findings are that during periods of high macroeconomic uncertainty, managers are likely to issue accurate management forecasts. This suggests that the relationship between macroeconomic uncertainty and forecast accuracy provided by Kim et al. (2016) is observed even when self-selection bias is less serious. Moreover, I find that in the optimistic sample, high macroeconomic uncertainty are related to accurate forecasts. By contrast, in the pessimistic sample, I find no relation between uncertainty and forecast accuracy. This is consistent with the scenario that during periods of high uncertainty, managers issue more accurate forecasts so as not to miss or revise downward their forecasts.

I conduct four additional analyses. First, I investigate the effect of macroeconomic uncertainty on the relationship between management forecast accuracy and stock returns. The result indicates that firms issuing optimistic forecasts under high macroeconomic uncertainty experience larger negative returns, which is consistent with the scenario in the main hypothesis. Second, I investigate the effect of earnings management on the relationship between macroeconomic uncertainty and the management forecast accuracy. The results show that macroeconomic uncertainty is related to the forecast accuracy (especially optimistic errors) after controlling for the effects of earnings management. Third, I focus on the period of the 2011 Great East Japan Earthquake and financial crisis when there is an exogenous shock to the economy leading to an unexpected change in macroeconomic uncertainty. The results reveal that the accuracy of management earnings forecasts significantly increases (especially optimistic forecast errors significantly decrease) in this period. Finally, I conduct a robustness check using alternative proxies for management forecast accuracy. Specifically, I re-examine the main hypotheses using sales forecasts, operating income forecasts, and ordinary income forecasts (i.e., income before extraordinary items, special items, and taxes) instead of net income forecasts. The results demonstrate that the main findings are robust to these management forecast items.

This study makes several contributions to the literature. First, it extends Kim et al. (2016) by focusing on Japanese management forecasts. As previously discussed, adopting these forecasts mitigates the self-selection, timing, and measurement error issues in forecast accuracy measure. Therefore, focusing on Japanese management forecasts can refine the research design. In addition to the institutional feature of management forecast reporting, studying the Japanese market is important because it has experienced events that greatly increase macroeconomic uncertainty such as the 2011 Great East Japan Earthquake and financial crisis. Therefore, focusing on the Japanese setting is beneficial to test the relationship between macroeconomic uncertainty and management forecast accuracy.

Second, this study extends Kim et al. (2016) by providing a scenario explaining why managers issue more accurate forecasts during periods of high macroeconomic uncertainty. I find that macroeconomic uncertainty is related to optimistic errors rather than pessimistic errors. This is consistent with the scenario that during high macroeconomic uncertainty, managers have stronger incentives to avoid revising their forecasts downward or missing their forecasts because investors place greater weight on bad news rather than good news, resulting in more accurate forecasts.

In addition to these academic contributions, this study makes a practical contribution. It is a major concern to know whether management earnings forecasts convey future information even when macroeconomic uncertainty is high. Intuitively, the usefulness of management forecasts decreases during periods of high macroeconomic uncertainty because uncertainty makes it difficult to predict future performance (Kim et al., 2016). However, this study provides evidence that the accuracy of management earnings forecasts does not decrease under high macroeconomic uncertainty; therefore, management forecasts are useful even when the macroeconomy is uncertain.

The remainder of this paper proceeds as follows. In Section 2, I review the extant literature and develop the main hypotheses. Section 3 outlines the research design. Section 4 describes the sample selection process and presents the descriptive statistics. Section 5 reports the main results and Section 6 provides the results of the additional analyses. Section 7 summarizes the main findings of this study and concludes.

2. Literature review and hypothesis development

2.1. Macroeconomic uncertainty and the market response to earnings announcements

A growing body of prior studies investigates the consequences of macroeconomic uncertainty. In particular, most studies focus on the effect of macroeconomic uncertainty on the market response to earnings announcements (Epstein and Schneider, 2008; Bird and Yeung, 2012; Williams, 2015; Shin, 2019).[7] Based on neuroeconomics research, these studies argue that when uncertainty is high, investors act cautiously and adopt a conservative or pessimistic approach by adopting the worst-case scenario (Epstein and Schneider, 2008; Bird and Yeung, 2012; Williams, 2015).

Consistent with this theory, Epstein and Schneider (2008) provide analytical evidence that when uncertain information has arrived, investors respond to bad news more than good news.[8] Williams (2015) empirically finds that investors place greater weight on bad earnings news than good earnings news when macroeconomic uncertainty increases. Using Australian data, Bird and Yeung (2012) find that investors react to bad (good) earnings news but largely ignore good (bad) earnings news when macroeconomic uncertainty is high (low). Shin (2019) focuses on the market reaction around the earnings benchmark under uncertainty. She shows that the market reacts to small negative earnings surprises more than small positive earnings surprises when macroeconomic uncertainty increases, while it symmetrically reacts to small positive and small negative earnings surprises when macroeconomic uncertainty decreases. However, there are few studies that investigate the

[7] Some studies focus on the other aspects of the consequences of macroeconomic uncertainty on investors. For example, Bonsall et al. (2020) present evidence that macroeconomic uncertainty increases investor demand for financial information, leading to greater media coverage of earnings announcements.
[8] If an uncertain signal conveys good (bad) news, the worst-case scenario is that the signal is unreliable (very reliable). Therefore, this asymmetric reaction is consistent with the scenario that during periods of high uncertainty investors choose the worst-case scenario (Epstein and Schneider, 2008).

effect of macroeconomic uncertainty on the accuracy of management earnings forecasts.

2.2. Hypothesis development

The main concern of this study is how macroeconomic uncertainty affects the accuracy of management earnings forecasts. Compared with studies examining the effect of uncertainty on investors' behavior, few studies have investigated the effect of uncertainty on managers' behavior.[9] However, macroeconomic uncertainty is expected to be an important determinant of management forecast accuracy because the prior literature documents that management earnings forecasts incorporate macroeconomic information (Anilowski et al., 2007; Bonsall et al., 2013). Kim et al. (2016) find that macroeconomic uncertainty has a significant impact on the issuance and characteristics of management forecasts. Specifically, they reveal that during periods of high macroeconomic uncertainty, managers tend to issue fewer but shorter-horizon forecasts. They interpret that macroeconomic uncertainty reduces the quality of information that managers use to forecast earnings in the next period, which makes managers withdraw forecasts and shift to shorter forecast horizons.

Kim et al. (2016) also investigate the effect of macroeconomic uncertainty on the accuracy of management earnings forecasts. If macroeconomic uncertainty diminishes the quality of the earnings-related information that managers use to forecast earnings, uncertainty lowers the accuracy of management forecasts.[10] However, in contrast to their prediction,

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[9] Some recent studies investigate this issue (Hsieh et al., 2019; Chen et al., 2019). For example, Hsieh et al. (2019) find that firms facing macroeconomic uncertainty report more conservatively, while Chen et al. (2019) show that audit fees fall when macroeconomic uncertainty is high.

[10] Consistent with this prediction, Hope and Kang (2005) find that the accuracy of analysts' forecast decreases when macroeconomic uncertainty (proxied by inflation and foreign exchange volatility) is high.

Kim et al. (2016) find that managers tend to issue more accurate forecasts when macroeconomic uncertainty is high. They interpret that this result may be driven by self-selection bias. That is, when macroeconomic uncertainty is high, managers who have superior forecasting abilities issue forecasts, whereas managers who have inferior forecasting abilities do not. Thus, management forecast accuracy increases under high macroeconomic uncertainty.

I first re-examine the effect of macroeconomic uncertainty on management forecast accuracy using Japanese data. As stated above, the Japanese setting mitigates self-selection bias because most listed firms in Japan issue management forecasts in accordance with the recommendations of the Tokyo Stock Exchange. Some studies and business press indicate that most firms continue to issue forecasts under higher macroeconomic uncertainty.[11] For example, Asano (2018) finds that 98.7% of listed firms in Japan issued forecasts even when they experienced the Great East Japan Earthquake in 2011. Thus, I examine whether macroeconomic uncertainty increases the accuracy of management forecasts even when self-selection bias is less serious. The first hypothesis is as follows:

Hypothesis 1: The accuracy of management earnings forecasts increases when macroeconomic uncertainty is high.

If Hypothesis 1 is supported, the next concern is why managers issue more accurate forecasts

[11] However, Kim and Fujitani (2020) document that more than half of the Japanese firms postponed issuing earnings forecasts in 2020 due to the spread of COVID-19. Therefore, I exclude 2020 from my sample period.

when macroeconomic uncertainty is high. One possible scenario is provided by studies that examine the effect of uncertainty on the market response to earnings announcements. As mentioned in Section 2.1, investors recognize bad news as more reliable than good news and place greater weight on bad news under high macroeconomic uncertainty (Epstein and Schneider, 2008; Bird and Yeung, 2012; Williams, 2015; Shin, 2019). This implies that during periods of high macroeconomic uncertainty, managers experience large negative market responses if they revise their forecasts downward or miss their forecasts. In line with this argument, Agapova and Madura (2016) find that the market reaction to negative earnings guidance is more pronounced under conditions of greater market uncertainty. Similarly, Loh and Stulz (2018) reveal that investors' information demand dramatically increases during high uncertainty and that investors react more to analysts' stock recommendations and forecast revisions. Therefore, given that managers are strongly encouraged to issue management forecasts in Japan, they have stronger incentives to not revise their forecasts downward or miss their forecasts. As a result, management forecast accuracy increases under high macroeconomic uncertainty.

It is possible that the incentive structure for managers in Japan could be different from that for US managers because there is a greater role for banks compared with equity investors in Japanese capital markets (e.g., Hoshi et al., 1990, 1991; Aoki et al., 1994). However, studies indicate that the role of banks in Japan has been decreasing after the 1990s (e.g., Arikawa and Miyajima, 2002; Hoshi et al., 2018). At the same time, studies also reveal that the proportion of equity finance in Japan has been increasing (e.g., Suzuki, 2018). According to a survey by the Bank of Japan, in the 1980s, bank borrowing was the most common source of funding. By contrast, after the 2000s (which corresponds to my sample period), the proportion of equity financing exceeded that of borrowing financing.[12] Therefore, Japanese as well as US managers are strongly motivated by the equity market. In fact, based on a questionnaire created with reference to Graham et al. (2005), Suda and Hanaeda (2008) indicate that Japanese managers recognize the management earnings forecasts as the most important earnings benchmark and try to meet them considering the response of capital markets (including stock price reaction).[13] Thus, I predict that the above scenario will be applicable to the Japanese setting.

If the above scenario is validated, macroeconomic uncertainty will be related to optimistic forecast errors (i.e., inaccuracy that occurs when firms miss their earnings forecasts) rather than pessimistic forecast errors (i.e., inaccuracy that occurs when firms beat their earnings forecasts). This is because optimistic errors reflect the extent of managers missing their forecasts, while pessimistic errors reflect the extent of managers beating their forecasts.[14] Thus, I develop the second hypothesis as follows:

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[12] The details of funding in 1980 is 1) bank borrowing (42.2%), 2) trade credit (24.3%), and 3) equity (23.1%). By contrast, in 2015, it is 1) equity (51.1%), and 2) bank borrowing (23.5%). These imply that the importance of the stock market in Japan has recently become closer to that of the US.

[13] Suda and Hanaeda (2008) indicate that 97.09% of respondents agree or strongly agree that management forecasts are the most important earnings benchmark. The authors also reveal that, 1) 95.30%, 2) 87.54%, and 3) 87.87% of respondents agree or strongly agree that meeting earnings benchmarks helps them 1) build credibility with the capital market, 2) convey their future growth prospects to investors, and 3) maintain or increase their stock prices, respectively.

[14] Another possible scenario is that managers attempt to mitigate the effect of macroeconomic uncertainty on investors' information asymmetry by issuing high quality information. Consistent with this scenario, Verrecchia (1990) and Nagar et al. (2019) reveal that uncertainty makes managers increase voluntary disclosures. If this is the case, macroeconomic uncertainty is related to both optimistic and pessimistic forecast bias.

Hypothesis 2: The optimistic errors rather than the pessimistic errors of management earnings forecasts are reduced when macroeconomic uncertainty is high.

3. Research design

3.1. Proxy for management forecast accuracy

As a proxy for management forecast accuracy, I use two variables. The first variable is the absolute value of management forecast errors (*abs (ERRORS)*). Management forecast errors are defined as the initial earnings forecasts for the next period minus net income in the next period (Ota, 2011; Muramiya and Takada, 2017; Iwasaki et al. 2020). The second variable is the absolute value of management forecast revisions (*abs (REVISIONS)*). Management forecast revisions are defined as the initial earnings forecasts for the next period minus the latest earnings forecasts for the next period (Iwasaki et al., 2020). In Japan, the Securities Listing Regulations (Rule 411-2) requires listed firms to update management forecasts if there are material revisions in management estimates.[15] Because the Act requires forecast revisions, managers who report largely inaccurate initial forecasts must subsequently revise them so that the latest forecasts are close to the realized earnings. Therefore, the management forecast revisions in Japan can be used as the proxy for the accuracy of initial management forecasts. Both management forecast errors and forecast revisions are deflated by total assets at the beginning of the fiscal year. Figure 1 summarizes the timetable of the forecast variables. If managers issue inaccurate (accurate) forecasts, these variables are positive (zero).

[15] The material revisions in management estimates are defined as the change in sales estimates of 10% or more and/or the change in earnings estimates of 30% or more (Securities Listing Regulations, Rule 405 (1), and (3), and Enforcement Rules for Securities Listing Regulations, Rule 407).

3.2. Proxy for macroeconomic uncertainty

As a proxy for macroeconomic uncertainty, I use the Nikkei Volatility Index (*VIX*) calculated by Nikkei Inc. This measure corresponds to the Volatility Index calculated by the Chicago Board Options Exchange in the United States.[16] Studies argue that the Volatility Index captures investors' expectation of future volatility (Williams, 2015; Kim et al., 2016; Chen et al., 2019; Bonsall et al., 2020). Thus, unlike other proxies for macroeconomic uncertainty such as market return volatility and GDP volatility, the Nikkei Volatility Index is a forward-looking indicator. Because I focus on the uncertainty inherent in forecasting earnings in the future period, using the Nikkei Volatility Index as a proxy for macroeconomic uncertainty is appropriate.

Figure 2 shows the time series of the Nikkei Volatility Index for 2002–2019. This shows that the value jumped in October 2008 and March 2011. These increases reflect the financial crisis and Great East Japan Earthquake, implying that the Nikkei Volatility Index reasonably captures macroeconomic uncertainty. I measure *VIX* as the average value of the Nikkei Volatility Index over the 20 operating days ending the fiscal year.[17,18]

3.3. Regression models

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[16] Many U.S. studies use the Volatility Index as a proxy for macroeconomic uncertainty (Acharya et al., 2013; Bonsall et al., 2013; Williams, 2015; Drake et al., 2016; Kim et al., 2016; Menkveld et al., 2017; Chen et al., 2019; Bochkay and Joos, 2020; Bonsall et al., 2020).

[17] *VIX* is deflated by 100 to adjust the magnitude of the coefficient in the regression models.

[18] As a robustness check, I re-examine the main analysis using *VIX* defined as the average value over three months. I find that the main conclusion does not change.

To test Hypotheses 1 and 2, I develop model 1:

$$ACCURACY_t = \beta_0+\beta_1 VIX_{t-1}+\beta_2 ACCURACY_{t-1}+\beta_3 ABRETVOL_{t-1}+\beta_4 EARNVOL_{t-1}$$
$$+\beta_5 INDRETVOL_{t-1}+\beta_6 POSUE_{t-1}+\beta_7 LOSS_{t-1}+\beta_8 SIZE_{t-1}$$
$$+\beta_9 BTM_{t-1}+ \beta_{10} LEV_{t-1}+\beta_{11} MOMENT_{t-1}+\beta_{12} SEGMENT_{t-1}$$
$$+\beta_{13} INSTOWN_{t-1}+\beta_{14} FOREOWN_{t-1}+\beta_{15} FIRMOWN_{t-1}$$
$$+Year\ Dummies\ +Industry\ Dummies\ +\varepsilon \qquad (1)$$

where the dependent variables (*ACCURACY*) are the two measures for management forecast accuracy discussed in Section 3.1 (*abs (ERRORS)* and *abs (REVISIONS)*). For the independent variables, I focus on the Nikkei Volatility Index (*VIX*) discussed in Section 3.2. I first regress model 1 in the full sample. If Hypothesis 1 is supported, the coefficient of *VIX* will be significantly negative. Subsequently, I regress model 1 using two subsamples: an optimistic sample (i.e., sample in which net income in year *t* minus net income forecasts for year *t* is negative) and a pessimistic sample (i.e., sample in which net income in year *t* minus net income forecasts for year *t* is positive). If Hypothesis 2 is supported, the coefficient of *VIX* in the optimistic sample is more negative than that in the pessimistic sample.

Following prior studies (Ota, 2006; Kim et al., 2016), the model includes several control variables. First, I include lagged management forecast accuracy ($ACCURACY_{t-1}$, that is $abs\ (ERRORS)_{t-1}$ and $abs\ (REVISIONS)_{t-1}$) because there is serial correlation in management earnings forecast errors (Gong et al., 2011). Second, I include market-adjusted return volatility (*ABRETVOL*),[19] earnings volatility (*EARNVOL*),[20] and industry return volatility (*INDRETVOL*)[21] to control for firm-specific and industry-wide uncertainty. Third, the positive earnings change dummy (*POSUE*) and loss dummy (*LOSS*) are included to control for a firm's profitability. Fourth, I add firm size (*SIZE*), the book-to-market ratio (*BTM*), financial leverage (*LEV*), and the momentum effect (*MOMENT*) to control for the firm's risks (Fama and French, 1993; Jegadeesh and Tisman, 1993; Chan et al., 1996). Fifth, I control for business diversification measured by the number of business segments (*SEGMENT*).[22] Finally, to control for the ownership structure, stock ownership by financial institutions (*INSTOWN*), foreign investors (*FOREOWN*), and other firms (*FIRMOWN*) is included. Table 1 defines the variables. The expected signs of the coefficients of $ACCURACY_{t\text{-}1}$, *ABRETVOL*, *EARNVOL*, *INDRETVOL*, *LOSS*, *BTM*, *LEV*, *MOMENT*, *SEGMENT*, *FOREOWN*, and *FIRMOWN* are positive, while those of *POSUE*, *SIZE*, and *INSTOWN* are negative.

4. Sample and descriptive statistics

[19] I define market-adjusted returns as stock returns minus value-weighted market returns. The value-weighted market return is calculated based on the market value of the equity of all listed firms except institutional firms, preferred securities, Japanese real estate investment trusts (J-REITs), and special investment corporations. The market values of equity are calculated based on the stock price at the end of the previous month.

[20] As a robustness check, I use the volatility of industry-adjusted earnings. However, the main conclusions do not change.

[21] The industry classification is defined using the two-digit Nikkei Middle Industry Classification Code (*Nikkei gyousyu chu-bunrui*).

[22] Accounting Standards Board of Japan Statement No. 17 "Accounting Standard for Segment Information Disclosures" was established in 2011. Considering this effect, if firms disclose the number of business segments after 2011 but not those before 2010, I replace the missing values with the number in 2011. Even if I drop the missing values or *SEGMENT* from the regression model, the main conclusions do not change.

Table 2 summarizes the sample selection criteria. My initial sample consists of 74,462 firm-year observations covering 2003 to 2019.[23] This sample comprises Japanese listed firms and excludes financial institutions such as banks, securities companies, insurance companies, and credit and leasing firms. A total of 786 firm-year observations are deleted from the initial sample accounting periods that changed after the initial sample was formed. I also delete 7,626 firm-year observations, as the variables using financial statement data (*POSUE*, *LOSS*, *EARNVOL*, and *LEV*) are missing. Furthermore, I delete 10,393 firm-year observations, as the variables calculated using the segment, market, and ownership data (*SEGMENT*, *ABRETVOL*, *INDRETVOL*, *SIZE*, *BTM*, *MOMENT*, *INSTOWN*, *FOREOWN*, and *FIRMOWN*) are missing. Finally, I delate 1,976 firm-year observations for which the proxies for management forecast accuracy (*abs (ERRORS)* and *abs (REVISIONS)*) cannot be calculated. I obtain data on the financial statements, management earnings forecasts, business segment, and ownership from the NEEDS-Financial QUEST database of Nikkei Inc.[24] and stock price data from the NPM database of Financial Data Solutions, Inc. I obtain the Nikkei Volatility Index from Investing.com. The final sample consists of 53,681 firm-year observations.

Table 3 presents the sample observations of management earnings forecasts and the time lag (i.e., days between fiscal year end and announcement dates of management earnings forecasts) by year. I find that in final sample, around 96% of Japanese firms issue management forecasts. Thus, focusing on the Japanese setting mitigates self-selection bias,

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[23] My sample period starts in 2003 because the NEEDS-Financial QUEST database includes data on the latest earnings and dividend forecasts from 2003.

[24] If the firm does not report consolidated financial statements, I use parent-only financial statement data.

as discussed by previous studies (Ota, 2006; Kato et al., 2009; Kitagawa and Okuda, 2016; Muramiya and Takada, 2017; Nagata and Nguyen, 2017; Iwasaki et al., 2020; Kitagawa and Shuto, 2021). I also find that along with actual earnings they issue management forecasts in 44 days after the fiscal year ends. More importantly, the percentage and timing of firms issuing management forecasts is stable by year. This implies that Japanese firms do not stop or postpone issuing earnings forecasts even when they experience events that greatly increase macroeconomic uncertainty such as financial crisis and the Great East Japan Earthquake. Thus, the interpretation that only managers with superior forecasting abilities issue management forecasts in high macroeconomic uncertainty (Kim et al., 2016) does not seem to be applied to the Japanese data.

Table 4 shows the descriptive statistics.[25] The mean (median) values of *abs (ERRORS)* and *abs (REVISIONS)* are 0.023 (0.009) and 0.020 (0.007), respectively, which are similar to those of prior studies (Kitagawa and Okuda, 2016). The mean (median) value of the Nikkei Volatility Index is 24.4 (23.3), which is greater than that of prior studies in the United States. For example, Kim et al. (2016) document that the mean (median) value of *VIX* is 20.32 (21.46). One reason for this discrepancy is that my sample period includes uncertain events such as financial crisis and the Great East Japan Earthquake.[26] The summary statistics of the other variables are similar to those in prior studies.[27]

[25] To mitigate the effect of outliers, all the variables except the indicator variables (*LOSS* and *POSUE*) are winsorized at the 1st and 99th percentiles by year. Because the fiscal year end is in March, *VIX* is not winsorized. Even if I winsorize *VIX* at the 1st and 99th percentiles, the main conclusion does not change.
[26] Even if I exclude the years of the global financial crisis and Great East Japan Earthquake (i.e., 2009 and 2011) from the sample, my conclusion does not change.
[27] I also compute the variance inflation factor (VIF) among these variables to check for multicollinearity and find that the mean VIF values are all below 5. As the standard VIF value for multicollinearity detection is 10, I conclude that there is no multicollinearity in the regression models.

5. Empirical results

5.1. Univariate analysis

Table 5 presents the results of the univariate analysis. Sample firms are divided into five quantile groups based on the Nikkei Volatility Index (*VIX*) and the tables shows the mean and median values of the accuracy of management forecasts (*abs (ERRORS)* and *abs (REVISIONS)*).[28] Panel A shows the results of the full sample. Although it is not monotonic, the mean and median values of *abs (ERRORS)* and *abs (REVISIONS)* tend to be smaller, as *VIX* increases from groups 1 (lowest) to 5 (highest). In addition, the difference in the mean and median values of *abs (ERRORS)* and *abs (REVISIONS)* of group 1 are significantly different than those of group 5. This implies that managers issue more accurate forecasts when macroeconomic uncertainty is high, consistent with Hypothesis 1.

Furthermore, Panel B shows the results of the optimistic sample. The results in Panel B show a similar tendency to those in Panel A. That is, the mean and median values of *abs (ERRORS)* and *abs (REVISIONS)* tend to be smaller as *VIX* increases from groups 1 (lowest) to 5 (highest). This means that optimistic bias decreases under high macroeconomic uncertainty. By contrast, Panel C, which summarizes the results of the pessimistic sample, reveals that the mean and median values of *abs (ERRORS)* and *abs (REVISIONS)* tend to be larger, as *VIX* increases from groups 1 (lowest) to 5 (highest). That is, pessimistic bias increases when macroeconomic uncertainty is high. In summary, the results in Panels B and

[28] Because the value of *VIX* is different by year-month (not firm-year), the observations of each quintile group differ.

C indicate that macroeconomic uncertainty is negatively related to the accuracy of management forecasts only when the forecast is optimistic, consistent with Hypothesis 2.

5.2. Multivariate analysis

Table 6 presents the regression multivariate results of the model in the full sample. Following Kim et al. (2016), I use standard errors clustered at the firm level, as proposed by Rogers (1993) and Petersen (2009). The table shows that the coefficient of *VIX* is negative and significant at the 1% level in all cases. These results mean that macroeconomic uncertainty reduces the magnitudes of forecast errors and forecast revisions. This is consistent with Hypothesis 1 that during periods of high macroeconomic uncertainty, managers issue more accurate forecasts. This is also consistent with the results of Kim et al. (2016), which means that the results do not seem to be derived from self-selection bias.

As for the control variables, the coefficients of $ACCURACY_{t\text{-}1}$ are significantly positive, suggesting that managers who reported accurate forecasts in the previous year also report accurate forecasts in the current year. Furthermore, the coefficients of *ABRETVOL* and *EARNVOL* are significantly positive, suggesting that managers report inaccurate forecasts when firm-specific volatility is greater. The coefficient of *LOSS* is positive, suggesting that firms with worse profitability tend to report optimistic forecasts.[29] The coefficient of *SEGMENT* is positive, suggesting that firms with more complex structures find it difficult to forecast earnings. Finally, the coefficient of *INSTOWN* is negative and that of *FOREOWN* is

[29] The coefficient of *POSUE* is positive, which is inconsistent with *LOSS*. However, Pearson's correlation coefficients show that *POSUE* is negatively related to *abs (ERRORS)* and *abs (REVISIONS)* (-0.086 and -0.093, respectively).

positive. These results are consistent with the scenario that stock ownership by financial institution disciplines firms' behavior, whereas stock ownership by foreign investors strengthens capital market pressure. These results are consistent with those of previous studies.

Table 7 presents the regression results for the optimistic and pessimistic samples. Panel A reveals that the coefficient of *VIX* is significantly negative in the optimistic sample, suggesting that macroeconomic uncertainty reduces optimistic errors (i.e., the extent to which actual earnings fall below management forecasts). By contrast, Panel B reveals that the coefficient of *VIX* is insignificant in the pessimistic sample, suggesting that macroeconomic uncertainty is not related to pessimistic errors (i.e., the extent to which actual earnings exceed management forecasts). These results mean that macroeconomic uncertainty reduces the magnitudes of optimistic forecast errors and downward forecast revisions, but does not affect the magnitude of pessimistic forecast errors and upward forecast revisions, consistent with Hypothesis 2. This supports the scenario that during periods of high macroeconomic uncertainty, managers try not to issue optimistic forecasts because investors react more to bad news than good news in times of high uncertainty.

6. Additional analyses

6.1. Macroeconomic uncertainty and market evaluation of management forecast accuracy

I investigate the effect of macroeconomic uncertainty on the relationship between management forecast accuracy and stock returns. My hypothesis assumes that investors react more to bad news under high macroeconomic uncertainty based on prior studies (Epstein and

Schneider, 2008; Bird and Yeung, 2012; Williams, 2015; Shin, 2019). However, I do not directly investigate whether firms issuing optimistic forecasts experience larger negative returns when macroeconomic uncertainty is high. Therefore, I regress model 2, which is similar to that of Williams (2015), to examine whether the assumption in the main analysis is valid:

$$BHAR_t = \beta_0 + \beta_1 OPTIMISTIC_t + \beta_2 VIXD_{t-1} + \beta_3 OPTIMISTIC_t * VIXD_{t-1}$$
$$+Control\ Variables + Year\ Dummies + Industry\ Dummies + \varepsilon \qquad (2)$$

where the dependent variables are market-adjusted buy-and-hold abnormal returns over the 12 months ending the fiscal end of year *t*.[30] Market-adjusted abnormal returns are defined as a firm's returns minus value-weighted market returns.[31]

For the independent variables, $OPTIMISTIC_t$ is an indicator variable set to one if management forecasts in year *t* are optimistic and zero otherwise. Optimism is measured by management forecast errors (i.e., the initial earnings forecasts for year *t* minus net income in year *t*, labeled *OPTIMERR*) and management forecast revisions (the initial earnings forecasts for year *t* minus the latest earnings forecasts for year *t*, labeled *OPTIMREV*). $VIXD_{t-1}$ is an indicator variable set to one if VIX_{t-1} is above the median and zero otherwise. VIX_{t-1} is calculated as the average value of the daily Nikkei Volatility Index over the one month before the management forecast announcement date, as defined earlier. I focus on the interaction

[30] All delisted firms are included to avoid survivorship bias. If a firm is delisted during the holding period, I assume the delisting return is zero. I confirm that the result is not changed if I do not consider the delisting.
[31] For the definition of the value-weighted market return, see the definition of *ABRETVOL*.

terms of *OPTIMISTIC* and *VIXD*. If firms issuing optimistic forecasts experience larger negative returns under high macroeconomic uncertainty, the coefficient of *OPTIMISTIC*VIXD* will be significantly negative. In addition to these variables, I control for known risks: market-adjusted return volatility (*ABRETVOL*), earnings volatility (*EARNVOL*), industry return volatility (*INDRETVOL*), size (*SIZE*), the book-to-market ratio (*BTM*), and the momentum effect (*MOMENT*). All the control variables are defined in model 1.

Table 8 shows the regression results of model 2. The coefficients of *OPTIMERR* and *OPTIMREV* are significantly negative, suggesting that firms issuing optimistic forecasts experience negative returns. More importantly, the coefficients of *OPTIMERR*VIXD* and *OPTIMREV*VIXD* are significantly negative. These results suggest that firms issuing optimistic forecasts under high macroeconomic uncertainty experience larger negative returns. This is also consistent with the finding in the literature that investors place greater weight on bad news when macroeconomic uncertainty is high (Epstein and Schneider, 2008; Bird and Yeung, 2012; Williams, 2015; Shin, 2019). As for the control variables, the coefficient of *SIZE* is significantly negative and that of *BTM* is significantly positive, which are consistent with the predictions.[32] In summary, I conclude that the main scenario that during periods of high macroeconomic uncertainty managers issue accurate forecasts to avoid larger negative returns is validated.

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[32] The coefficient of *MOMENT* is significantly negative, which is inconsistent with the prediction. One possible explanation is that this variable could reflect reversal effects (Jegadeesh, 1990) since the measures for the reversal effect are omitted from model 2 because of the high correlations.

6.2. Controlling for the effect of earnings management

In terms of the accuracy of management forecasts, managers have two dials to turn: earnings forecasts and the reported earnings. A management forecast can be accurate ex post because managers were able to predict the earnings accurately, or because they made sure the reported earnings were close to what they had previously forecast. Thus, I conduct additional analyses that include discretionary accruals in year *t* ($DACC_t$) in the independent variables of model (1). Discretionary accruals are estimated using the model in Kothari et al. (2005).[33] I estimate the coefficients of the model by industry (not by year-industry) because macroeconomic uncertainty may affect all firms in the same year.[34] The final sample is reduced from 53,681 to 52,806.

The results are summarized in Table 9. Panel A is the result of the full sample. The panel shows that the coefficient of *VIX* remains significantly negative after controlling for *DACC*, which is consistent with the result of Table 6. This result implies that managers who face higher macroeconomic uncertainty are likely to issue more accurate initial forecasts. The coefficient of *DACC* is significantly negative, which suggests that managers also engage in earnings management to make realized earnings closer to their forecasts. Panel B (C) reports the result of the optimistic (pessimistic) sample. The panels reveal that the coefficient of *VIX* in the optimistic sample remains significantly negative and that in the pessimistic sample is insignificant. The results suggest that the main results in Table 7 are maintained

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[33] As a robustness check, I also adopt the models from Dechow et al. (1995), Kasznik (1999), and Allen et al. (2013), and confirm that the conclusion does not change.

[34] The industries are identified by the two-digit Nikkei Middle Industry Classification Code (*Nikkei gyousyu chu-bunrui*).

after controlling for the effect of earnings management. Interestingly, in panel B, the coefficient of *DACC* is significantly negative, suggesting that managers engage in upward earnings management in year *t* to try to avoid missing their forecasts. Panel C also shows that the coefficient of *DACC* is significantly negative, suggesting that some firms beat their forecasts by conducting upward earnings management. These results are consistent with the previous literature (e.g., Kasznik, 1999).

In summary, I find that managers are likely to engage in earnings management to lessen the management forecast errors. However, after controlling for the effect of earnings management, the negative relationship between macroeconomic uncertainty and management forecast accuracy is observed (especially in the optimistic sample). This implies that managers who face higher macroeconomic uncertainty are likely to issue more accurate (especially less optimistic) forecasts.

6.3. The exogenous shock to the economy and the change in management forecast accuracy

This study mainly investigates statistical associations. Thus, to strengthen identification, this section focuses on a specific setting when there is an exogenous shock to the economy leading to an unexpected change in macroeconomic uncertainty. Specifically, I focus on the periods of financial crisis and the Great East Japan Earthquake, and investigate whether the accuracy of management forecasts increases during these periods. I develop the following model (3).

$$\Delta ACCURACY_t = \beta_0 + \beta_1 Uncertainty\ Shock_{t\text{-}1} + Control\ Variables$$

$$+\textit{Industry Dummies} + \varepsilon \quad (3)$$

The dependent variables (*ΔACCURACY*) are the change in the two measures for management forecast accuracy defined in section 3.1 (*Δabs (ERRORS), Δabs (REVISIONS)*). For the independent variables, I focus on *Uncertainty Shock*$_{t\text{-}1}$, which is an indicator variable set to one if the year *t*-1 is 2009 or 2011. Because these years are affected by financial crisis or the Great East Japan Earthquake, this measure is expected to capture the exogenous shock to the economy leading to an unexpected change in macroeconomic uncertainty. If the increase in such uncertainty makes management forecasts more accurate, the coefficient of *Uncertainty Shock*$_{t\text{-}1}$ will be significantly negative. All the control variables are the same as those in model (1).

The results are summarized in Table 10. Panel A is the result of the full sample. The panel shows that the coefficient of *Uncertainty Shock* is significantly negative, suggesting that the large increase in macroeconomic uncertainty is likely to make management forecasts more accurate. The result of the optimistic sample in Panel B also shows that the coefficient of *Uncertainty Shock* is significantly negative. However, by contrast, the result of the pessimistic sample in Panel C reveals that the coefficient of *Uncertainty Shock* is rather positive. These results suggest that the large increase in macroeconomic uncertainty is likely to lessen the optimistic forecast errors, but not pessimistic forecast errors, consistent with Hypothesis 2.

6.4. Alternative measures of management forecast accuracy

The Tokyo Stock Exchange encourages Japanese listed firms to issue management forecasts of their main items, including sales, operating income, ordinary income (i.e., income before extraordinary items, special items, and taxes), net income, earnings per share, and dividend per share. Thus, most firms include these items in the documents released at their earnings announcements (known as *Kessan Tanshin*). The main analysis focuses only on the accuracy of net income forecasts, but I also use other management forecasts as a robustness check. Specifically, I calculate the accuracy of 1) sales forecasts, 2) operating income forecasts, and 3) ordinary income forecasts and test Hypotheses 1 and 2 using these variables instead of the accuracy of net income forecasts.[35]

The untabulated results reveal a similar tendency to the main result. Specifically, when I regress model 1 in the full sample, the coefficient of *VIX* is significantly negative in all cases, consistent with Hypothesis 1. The coefficients of *VIX* are also significantly negative in all cases when I regress model 1 in the optimistic sample. By contrast, the coefficient is insignificant in all cases when I regress model 1 in the pessimistic sample. These results mean that macroeconomic uncertainty is only related to optimistic errors, consistent with Hypothesis 2. In summary, the results of the main analysis are robust even when I measure forecast accuracy using sales forecasts, operating income forecasts, and ordinary income forecasts. These results again suggest that the results of the main analysis are not derived from the forecasts of specific earnings components such as special items and non-operating items.

[35] The sample period of operating income forecasts is 2007 to 2019. This is because the Tokyo Stock Exchange has required listed firms to provide operating income forecasts since 2007.

7. Conclusion

This study examines the effect of macroeconomic uncertainty on management earnings accuracy. Focusing on Japanese management earnings forecasts, I find that during periods of high macroeconomic uncertainty, firms tend to report accurate earnings forecasts. As most Japanese firms issue management forecasts, the result suggests that the relationship between macroeconomic uncertainty and the accuracy of management forecasts does not simply reflect self-selection bias. Furthermore, I also find that macroeconomic uncertainty is related to optimistic errors but not pessimistic errors. These findings are consistent with the scenario that managers try to avoid missing their forecasts or revising their forecasts downward because investors place greater weight on bad news when macroeconomic uncertainty is higher.

Consistent with this scenario, additional analyses reveal that firms that miss their earnings forecasts experience larger decreases in stock prices when macroeconomic uncertainty is high. Moreover, the result that macroeconomic uncertainty increases the accuracy of earnings forecasts (lessens optimistic errors) is robust after controlling for the effect of earnings management and using alternative proxies for forecast accuracy (i.e., measures calculated by sales forecasts, operating income forecasts, and ordinary income forecasts). I also find that the accuracy of management earnings forecasts significantly increase (optimistic errors significantly decrease) in the period of the 2011 Great East Japan Earthquake and financial crisis.

It is important to know the accuracy of management forecasts because management forecasts are relevant information sources to investors and analysts (see the survey of Hirst et al., 2008). Kim et al. (2016) examine the relationship between macroeconomic uncertainty and management forecast accuracy. Extending their study, I provide evidence that during periods of high macroeconomic uncertainty, managers seem to issue accurate forecasts because they consider the market response. This evidence also has the practical implication that management earnings are useful for information users such as investors even when macroeconomic uncertainty is high.

However, it should be noted that the results do not provide direct evidence regarding the US market as investigated by Kim et al. (2016). As stated above, management forecasts in Japan are effectively mandated while those in the US and other countries are voluntary. Although mandatory disclosure mitigates selection issues, voluntary disclosure choices reveal managers' incentives and constraints in ways that are not always observable in the former. Thus, it is hard to draw a direct comparison between the results (i.e., Japanese setting) and those of Kim et al. (2016) (i.e., US setting).

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Table 1 Variable definitions

Variable	Definition
abs (ERRORS) $_t$	The absolute value of management forecast errors in year *t*. Management forecast errors in year *t* are calculated as (the initial earnings forecasts for year *t* − net income in year *t*) / total assets at the end of year *t*-1.
abs (REVISIONS) $_t$	The absolute value of management forecast revisions in year *t*. Management forecast revisions in year *t* are calculated as (the initial earnings forecasts for year *t* − the latest earnings forecasts for year *t*) / total assets at the end of year *t*-1.
VIX_{t-1}	The average value of the daily Nikkei Stock Average Volatility Index over the 20 operating days before the earnings announcement date of year *t*-1 (the date that the management forecast for year *t* is announced). The value is deflated by 100.
$ABRETVOL_{t-1}$	The standard deviation of monthly market-adjusted abnormal returns over fiscal year *t*-1. Market-adjusted abnormal returns are defined as a firm's returns minus value-weighted market returns.
$EARNVOL_{t-1}$	The standard deviation of ROA in year *t*-1 (= net income in year *t*-1 / total assets at the end of year *t*-2) over the period *t*-5 to *t*-1.
$INDRETVOL_{t-1}$	The standard deviation of monthly industry returns over fiscal year *t*-1. The industry is identified by the two-digit Nikkei industry code.
$POSUE_{t-1}$	An indicator variable set to one if the change in ROA in year *t*-1 (= net income in year *t*-1 / total assets at the end of year *t*-2) is positive and zero otherwise.
$LOSS_{t-1}$	An indicator variable set to one if net income in year *t*-1 is negative and zero otherwise.
$SIZE_{t-1}$	Natural logarithm of the market value of equity at the end of year *t*-1.
BTM_{t-1}	Net assets divided by the market value of equity at the end of year *t*-1.
LEV_{t-1}	Total liabilities divided by total assets at the end of year *t*-1.
$MOMENT_{t-1}$	Monthly buy-and-hold stock return over fiscal year *t*-1.
$SEGMENT_{t-1}$	The firm's number of business segments in year *t*-1.
$INSTOWN_{t-1}$	The proportion of total shares owned by financial institutions at the end of year *t*-1.
$FOREOWN_{t-1}$	The proportion of total shares owned by foreign investors at the end of year *t*-1.
$FIRMOWN_{t-1}$	The proportion of total shares owned by other firms at the end of year *t*-1.

Table 2 Sample selection criteria

Criterion	*N*
Japanese listed firms from January 2003 to December 2019 excluding financial institutions.	74,462
Less: Firms that changed their fiscal year end during the calculation of the variables	-786
Less: The variables using financial statement data (*POSUE*, *LOSS*, *EARNVOL*, and *LEV*) are missing.	-7,626
Less: The variables using segment, market, or ownership data (*SEGMENT*, *ABRETVOL*, *SIZE*, *BTM*, *STDINDRET*, *MOMENT*, *INSTOWN*, *FOREOWN*, and *FIRMOWN*) are missing.	-10,393
Less: The variables using management earnings forecast data (*abs (ERRORS)* and *abs (REVISIONS)*) are missing.	-1,976
Final sample	53,681

Table 3 Sample observations and time lag of management forecasts by year

	Percentage of firms issuing management forecasts			Time lag between fiscal year end and announcement date of management forecasts	
Year	Issuing	Not issuing	Percentages	Mean	Median
2003	3,076	98	96.91%	50.989	53.000
2004	3,107	116	96.40%	49.747	51.000
2005	3,169	63	98.05%	48.219	50.000
2006	3,204	86	97.39%	47.287	49.000
2007	3,267	68	97.96%	46.207	47.000
2008	3,328	113	96.72%	45.338	46.000
2009	3,333	138	96.02%	43.650	45.000
2010	3,299	130	96.21%	42.417	44.000
2011	3,204	123	96.30%	41.690	43.000
2012	3,133	130	96.02%	41.077	43.000
2013	3,081	112	96.49%	47.919	43.000
2014	3,066	117	96.32%	40.693	41.000
2015	3,095	110	96.57%	40.272	40.000
2016	3,094	145	95.52%	40.215	42.000
2017	3,066	135	95.78%	40.417	42.000
2018	3,074	125	96.09%	40.833	42.000
2019	3,085	167	94.86%	40.541	42.000
Total	53,681	1,976	96.45%	43.981	44.000

Table 4 Descriptive statistics

	Mean	Median	Std. Dev.	Skewness	Kurtosis	*N*
$abs\ (ERRORS)_t$	0.023	0.009	0.042	4.274	26.044	53,681
$abs\ (REVISIONS)_t$	0.020	0.007	0.039	4.262	26.287	53,681
VIX_{t-1}	0.244	0.233	0.067	2.225	13.668	53,681
$ABRETVOL_{t-1}$	0.096	0.078	0.064	2.535	11.942	53,681
$EARNVOL_{t-1}$	0.035	0.019	0.048	3.740	20.356	53,681
$INDRETVOL_{t-1}$	0.051	0.048	0.019	0.834	4.135	53,681
$POSUE_{t-1}$	0.580	1.000	0.494	-0.324	1.105	53,681
$LOSS_{t-1}$	0.169	0.000	0.374	1.771	4.135	53,681
$SIZE_{t-1}$	9.628	9.395	1.737	0.595	3.006	53,681
BTM_{t-1}	1.259	1.070	0.873	1.553	6.678	53,681
LEV_{t-1}	0.503	0.507	0.209	-0.005	2.149	53,681
$MOMENT_{t-1}$	0.133	0.050	0.510	2.748	19.941	53,681
$SEGMENT_{t-1}$	4.731	5.000	2.491	-0.400	2.078	53,681
$INSTOWN_{t-1}$	0.173	0.149	0.129	0.734	2.831	53,681
$FOREOWN_{t-1}$	0.084	0.036	0.109	1.708	5.585	53,681
$FIRMOWN_{t-1}$	0.279	0.246	0.192	0.655	2.618	53,681

Note:

$abs\ (ERRORS)_t$ = the absolute value of management forecast errors in year *t*. $abs\ (REVISIONS)_t$ = the absolute value of management forecast revisions in year *t*. VIX_{t-1} = the average value of the daily Nikkei Stock Average Volatility Index over the 20 operating days before the management forecast announcement date (deflated by 100). $ABRETVOL_{t-1}$ = the standard deviation of monthly market-adjusted abnormal returns over fiscal year *t*-1. $EARNVOL_{t-1}$ = the standard deviation of ROA in year *t*-1 over the period *t*-5 to *t*-1. $INDRETVOL_{t-1}$ = the standard deviation of monthly industry returns over fiscal year *t*-1. $POSUE_{t-1}$ = an indicator variable set to one if the change in ROA in year *t*-1 is positive and zero otherwise. $LOSS_{t-1}$ = an indicator variable set to one if net income in year *t*-1 is negative and zero otherwise. $SIZE_{t-1}$ = natural logarithm of the market value of equity at the end of year *t*-1. BTM_{t-1} = net assets divided by the market value of equity at the end of year *t*-1. LEV_{t-1} = total liabilities divided by total assets at the end of year *t*-1. $MOMENT_{t-1}$ = monthly buy-and-hold stock return over fiscal year *t*-1. $SEGMENT_{t-1}$ = the firm's number of business segments in year *t*-1. $INSTOWN_{t-1}$ = the proportion of total shares owned by financial institutions at the end of year *t*-1. $FOREOWN_{t-1}$ = the proportion of total shares owned by foreign investors at the end of year *t*-1. $FIRMOWN_{t-1}$ = the proportion of total shares owned by other firms at the end of year *t*-1. All the variables except *LOSS* and *POSUE* are winsorized at the 1st and 99th percentiles by year.

Table 5 Results of the univariate analysis

Panel A: Full sample					
		abs (ERRORS) $_t$		*abs (REVISIONS)* $_t$	
Sorted by *VIX*	*N*	Mean	Median	Mean	Median
1 (Lowest)	10,738	0.029	0.011	0.025	0.009
2	10,943	0.021	0.009	0.017	0.006
3	10,678	0.021	0.009	0.018	0.006
4	10,714	0.022	0.009	0.019	0.007
5 (Highest)	10,608	0.023	0.010	0.020	0.007
5 (Highest) − 1 (Lowest)		-0.006***	-0.001***	-0.005***	-0.002***
t-stat. / z-stat.		8.510	7.189	8.756	4.650
Panel B: Optimistic sample (Net income in year *t* < Net income forecast for year *t*)					
		abs (ERRORS) $_t$		*abs (REVISIONS)* $_t$	
Sorted by *VIX*	*N*	Mean	Median	Mean	Median
1 (Lowest)	6,599	0.038	0.016	0.034	0.014
2	5,295	0.029	0.011	0.025	0.009
3	5,277	0.028	0.010	0.025	0.009
4	5,290	0.030	0.011	0.026	0.009
5 (Highest)	5,756	0.030	0.012	0.027	0.010
5 (Highest) − 1 (Lowest)		-0.008***	-0.004***	-0.007***	-0.004***
t-stat. / z-stat.		7.965	10.704	8.255	8.766
Panel C: Pessimistic sample (Net income in year *t* > Net income forecast for year *t*)					
		abs (ERRORS) $_t$		*abs (REVISIONS)* $_t$	
Sorted by *VIX*	*N*	Mean	Median	Mean	Median
1 (Lowest)	4,139	0.013	0.006	0.010	0.004
2	5,648	0.014	0.008	0.010	0.004
3	5,401	0.014	0.007	0.011	0.005
4	5,424	0.015	0.008	0.011	0.005
5 (Highest)	4,852	0.015	0.008	0.012	0.006
5 (Highest) − 1 (Lowest)		0.002***	0.001***	0.002***	0.002***
t-stat. / z-stat.		3.281	3.658	5.928	7.870

Note:

abs (ERRORS) $_t$ = the absolute value of management forecast errors in year *t*. *abs (REVISIONS)* $_t$ = the absolute value of management forecast revisions in year *t*. *VIX* $_{t-1}$ = the average value of the daily Nikkei Stock Average Volatility Index over the 20 operating days before the management forecast announcement date (deflated by 100). *** indicates that the value is significantly different than 0 at the 1% level using a two-tailed *t*-test and Wilcoxon rank-sum test.

Table 6 Results of the multivariate analysis: Testing Hypothesis 1

		(1) Dependent variable = *abs (ERRORS)* $_t$		(2) Dependent variable = *abs (REVISIONS)* $_t$	
	Exp. sign	Coef.	(*t*-stat.)	Coef.	(*t*-stat.)
VIX_{t-1}	(−)	-0.010***	(-2.586)	-0.013***	(-3.512)
$abs\ (ERRORS)_{t-1}$	(+)	0.270***	(19.164)		
$abs\ (REVISIONS)_{t-1}$	(+)			0.217***	(17.010)
$ABRETVOL_{t-1}$	(+)	0.057***	(11.455)	0.050***	(10.779)
$EARNVOL_{t-1}$	(+)	0.169***	(16.451)	0.149***	(16.016)
$INDRETVOL_{t-1}$	(+)	-0.012	(-0.755)	-0.003	(-0.218)
$POSUE_{t-1}$	(−)	0.002***	(4.347)	0.001**	(2.284)
$LOSS_{t-1}$	(+)	0.007***	(8.647)	0.007***	(9.055)
$SIZE_{t-1}$	(−)	-0.002***	(-7.835)	-0.001***	(-6.026)
BTM_{t-1}	(+)	-0.002***	(-6.721)	-0.001***	(-3.908)
LEV_{t-1}	(+)	-0.007***	(-5.661)	-0.005***	(-4.780)
$MOMENT_{t-1}$	(+)	-0.005***	(-8.402)	-0.005***	(-8.562)
$SEGMENT_{t-1}$	(+)	0.000***	(4.417)	0.000***	(3.501)
$INSTOWN_{t-1}$	(−)	-0.018***	(-9.767)	-0.015***	(-8.864)
$FOREOWN_{t-1}$	(+)	0.007**	(2.535)	0.003	(1.344)
$FIRMOWN_{t-1}$	(+)	-0.008***	(-6.476)	-0.007***	(-6.369)
Constant	(+/−)	0.029***	(10.600)	0.024***	(9.403)
Year Dummies		Included		Included	
Industry Dummies		Included		Included	
Adj. R^2		0.296		0.264	
N		53,681		53,681	

Note:

abs (ERRORS) $_t$ = the absolute value of management forecast errors in year *t*. *abs (REVISIONS)* $_t$ = the absolute value of management forecast revisions in year *t*. VIX_{t-1} = the average value of the daily Nikkei Stock Average Volatility Index over the 20 operating days before the management forecast announcement date (deflated by 100). $ABRETVOL_{t-1}$ = the standard deviation of monthly market-adjusted abnormal returns over fiscal year *t*-1. $EARNVOL_{t-1}$ = the standard deviation of ROA in year *t*-1 over the period *t*-5 to *t*-1. $INDRETVOL_{t-1}$ = the standard deviation of monthly industry returns over fiscal year *t*-1. $POSUE_{t-1}$ = an indicator variable set to one if the change in ROA in year *t*-1 is positive and zero otherwise. $LOSS_{t-1}$ = an indicator variable set to one if net income in year *t*-1 is negative and zero otherwise. $SIZE_{t-1}$ = natural logarithm of the market value of equity at the end of year *t*-1. BTM_{t-1} = net assets divided by the market value of equity at the end of year *t*-1. LEV_{t-1} = total liabilities divided by total assets at the end of year *t*-1. $MOMENT_{t-1}$ = monthly buy-and-hold stock return over fiscal year *t*-1. $SEGMENT_{t-1}$ = the firm's number of business segments in year *t*-1. $INSTOWN_{t-1}$ = the proportion of total shares owned by financial institutions at the end of year *t*-1. $FOREOWN_{t-1}$ = the proportion of total shares owned by foreign investors at the end of year *t*-1. $FIRMOWN_{t-1}$ = the proportion of total shares owned by other firms at the end of year *t*-1. All the variables except *VIX*, *LOSS*, and *POSUE* are winsorized at the 1st and 99th percentiles by year. The *t*-statistics in parentheses are based on standard errors clustered at the firm level (Rogers, 1993; Petersen, 2009). *** and ** indicate that the value is significantly different than 0 at the 1% and 5% levels, respectively using a two-tailed *t*-test.

Table 7 Results of the multivariate analysis: Testing Hypothesis 2

Panel A: Optimistic sample (Net income in year *t* < Net income forecast for year *t*)					
		(1) Dependent variable = *abs (ERRORS)* $_t$		(2) Dependent variable = *abs (REVISIONS)* $_t$	
	Exp. sign	Coef.	(*t*-stat.)	Coef.	(*t*-stat.)
$VIX_{t\text{-}1}$	(−)	-0.018***	(-2.570)	-0.020***	(-3.234)
Constant	(+/−)	0.029***	(6.704)	0.023***	(5.632)
Control Variables		Included		Included	
Year Dummies		Included		Included	
Industry Dummies		Included		Included	
Adj. R^2		0.349		0.312	
N		28,217		28,217	

Panel B: Pessimistic sample (Net income in year *t* > Net income forecast for year *t*)					
		(1) Dependent variable = *abs (ERRORS)* $_t$		(2) Dependent variable = *abs (REVISIONS)* $_t$	
	Exp. sign	Coef.	(*t*-stat.)	Coef.	(*t*-stat.)
$VIX_{t\text{-}1}$	(−)	0.003	(0.880)	0.001	(0.317)
Constant	(+/−)	0.022***	(10.063)	0.017***	(8.501)
Control Variables		Included		Included	
Year Dummies		Included		Included	
Industry Dummies		Included		Included	
Adj. R^2		0.214		0.173	
N		25,464		25,464	

Note:

abs (ERRORS) $_t$ = the absolute value of management forecast errors in year *t*. *abs (REVISIONS)* $_t$ = the absolute value of management forecast revisions in year *t*. $VIX_{t\text{-}1}$ = the average value of the daily Nikkei Stock Average Volatility Index over the 20 operating days before the management forecast announcement date (deflated by 100). All the variables except *VIX*, *LOSS*, and *POSUE* are winsorized at the 1st and 99th percentiles by year. The *t*-statistics in parentheses are based on standard errors clustered at the firm level (Rogers, 1993; Petersen, 2009). *** indicates that the value is significantly different than 0 at the 1% level using a two-tailed *t*-test.

Table 8 Macroeconomic uncertainty and the market response to managerial optimism

		(1) Dependent variable = $BHAR_t$		(2) Dependent variable = $BHAR_t$	
	Exp. sign	Coef.	(*t*-stat.)	Coef.	(*t*-stat.)
$OPTIMERR_t$	(−)	-0.135***	(-13.309)		
$OPTIMREV_t$	(−)			-0.130***	(-13.360)
$VIXD_{t-1}$	(+/−)	0.047***	(6.499)	0.043***	(6.447)
$VIXD_{t-1}$*$OPTIMERR_t$	(−)	-0.065***	(-9.006)		
$VIXD_{t-1}$*$OPTIMREV_t$	(−)			-0.072***	(-10.447)
$ABRETVOL_{t-1}$	(+)	-0.023	(-0.513)	0.020	(0.445)
$INDRETVOL_{t-1}$	(+)	-0.278*	(-1.848)	-0.196	(-1.307)
$SIZE_{t-1}$	(−)	-0.018***	(-13.537)	-0.017***	(-12.810)
BTM_{t-1}	(+)	0.047***	(13.420)	0.051***	(14.394)
$MOMENT_{t-1}$	(+)	-0.047***	(-8.463)	-0.050***	(-9.028)
Constant	(+/−)	0.333***	(14.753)	0.299***	(13.407)
Year Dummies		Included		Included	
Industry Dummies		Included		Included	
Adj. R^2		0.154		0.155	
N		53,681		53,681	

Note:

BHARt = Market-adjusted abnormal returns over the 12 months ending the fiscal end of year *t*. Market-adjusted abnormal returns are defined as a firm's returns minus value-weighted market returns. $OPTIMERR_t$ = an indicator variable set to one if management forecast errors in year *t* are positive and zero otherwise. Management forecast errors in year *t* are calculated as (the initial earnings forecasts for year *t* – net income in year *t*). $OPTIMREV_t$ = an indicator variable set to one if management forecast revisions in year *t* are positive and zero otherwise. Management forecast revisions in year *t* are calculated as (the initial earnings forecasts for year *t* – the latest earnings forecasts for year *t*). $VIXD_{t-1}$ = an indicator variable set to one if VIX_{t-1} is above the median value and zero otherwise. VIX_{t-1} is calculated as the average value of the daily Nikkei Stock Average Volatility Index over the 20 operating days before the management forecast announcement date (deflated by 100). $ABRETVOL_{t-1}$ = the standard deviation of monthly market-adjusted abnormal returns over fiscal year *t*-1. $INDRETVOL_{t-1}$ = the standard deviation of monthly industry returns over fiscal year *t*-1. $SIZE_{t-1}$ = natural logarithm of the market value of equity at the end of year *t*-1. BTM_{t-1} = net assets divided by the market value of equity at the end of year *t*-1. $MOMENT_{t-1}$ = monthly buy-and-hold stock return over fiscal year *t*-1. All the variables except the indicator variables are winsorized at the 1st and 99th percentiles by year. The *t*-statistics in parentheses are based on standard errors clustered at the firm level (Rogers, 1993; Petersen, 2009). *** and * indicate that the value is significantly different than 0 at the 1% and 10% levels, respectively using a two-tailed *t*-test.

Table 9 Results of the multivariate analysis controlling for discretionary accruals

Panel A: Full sample

		(1) Dependent variable = *abs (ERRORS)* $_t$		(2) Dependent variable = *abs (REVISIONS)* $_t$	
	Exp. Sign	Coef.	(*t*-stat.)	Coef.	(*t*-stat.)
VIX_{t-1}	(−)	-0.011***	(-2.774)	-0.013***	(-3.517)
$DACC_t$	(−)	-0.018***	(-3.313)	-0.011**	(-2.195)
Constant	(+/−)	0.028***	(10.230)	0.023***	(8.963)
Control Variables		Included		Included	
Year Dummies		Included		Included	
Industry Dummies		Included		Included	
Adj. R^2		0.286		0.257	
N		52,806		52,806	

Panel B: Optimistic sample (Net income in year *t* < Net income forecast for year *t*)

		(1) Dependent variable = *abs (ERRORS)* $_t$		(2) Dependent variable = *abs (REVISIONS)* $_t$	
	Exp. Sign	Coef.	(*t*-stat.)	Coef.	(*t*-stat.)
VIX_{t-1}	(−)	-0.018***	(-2.678)	-0.020***	(-3.184)
$DACC_t$	(−)	-0.027***	(-3.239)	-0.019***	(-2.446)
Constant	(+/−)	0.027***	(6.315)	0.021***	(5.230)
Control Variables		Included		Included	
Year Dummies		Included		Included	
Industry Dummies		Included		Included	
Adj. R^2		0.339		0.304	
N		27,740		27,740	

Panel C: Pessimistic sample (Net income in year *t* > Net income forecast for year *t*)

		(1) Dependent variable = *abs (ERRORS)* $_t$		(2) Dependent variable = *abs (REVISIONS)* $_t$	
	Exp. Sign	Coef.	(*t*-stat.)	Coef.	(*t*-stat.)
VIX_{t-1}	(−)	0.003	(0.905)	0.001	(0.428)
$DACC_t$	(+)	-0.012**	(-2.490)	-0.007*	(-1.680)
Constant	(+/−)	0.021***	(9.689)	0.016***	(8.106)
Control Variables		Included		Included	
Year Dummies		Included		Included	
Industry Dummies		Included		Included	
Adj. R^2		0.208		0.170	
N		25,066		25,066	

Note:
abs (ERRORS) $_t$ = the absolute value of management forecast errors in year *t*. *abs (REVISIONS)* $_t$ = the absolute value of management forecast revisions in year *t*. VIX_{t-1} = the average value of the daily Nikkei Stock Average Volatility Index over the 20 operating days before the management forecast announcement date (deflated by 100). $DACC_t$ = discretionary accruals in year *t* estimated by Kothari et al. (2005) model. Other control variables are the same as those in model (1). All the variables except *VIX*, *LOSS*, and *POSUE* are winsorized at the 1st and 99th percentiles by year. The *t*-statistics in parentheses are based on standard errors clustered at the firm level (Rogers, 1993; Petersen, 2009). ***, **, and * indicate that the value is significantly different than 0 at the 1%, 5%, and 10% levels, respectively using a two-tailed *t*-test.

Table 10 The change in forecast accuracy during periods of financial crisis and the Great East Japan Earthquake

Panel A: Full sample					
		(1) Dependent variable = *Δabs (ERRORS)* $_t$		(2) Dependent variable = *Δabs (REVISIONS)* $_t$	
	Exp. Sign	Coef.	(*t*-stat.)	Coef.	(*t*-stat.)
Uncertainty Shock $_{t\text{-}1}$	(−)	-0.006***	(-10.707)	-0.006***	(-11.135)
Constant	(+/−)	0.028***	(12.867)	0.023***	(11.825)
Control Variables		Included		Included	
Industry Dummies		Included		Included	
Adj. R^2		0.280		0.233	
N		52,806		52,806	

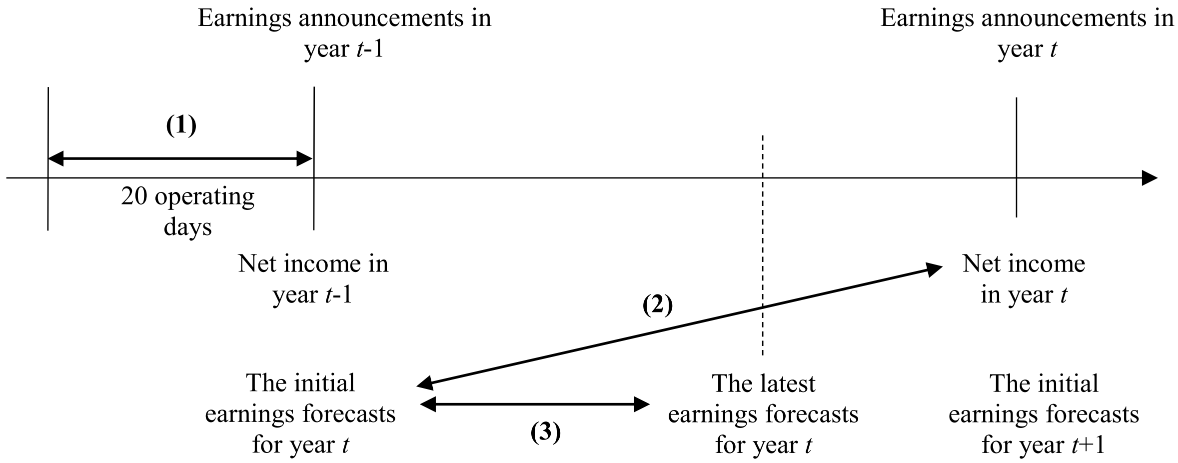
Panel B: Optimistic sample (Net income in year *t* < Net income forecast for year *t*)					
		(1) Dependent variable = *Δabs (ERRORS)* $_t$		(2) Dependent variable = *Δabs (REVISIONS)* $_t$	
	Exp. Sign	Coef.	(*t*-stat.)	Coef.	(*t*-stat.)
Uncertainty Shock $_{t\text{-}1}$	(−)	-0.009***	(-10.256)	-0.009***	(-10.773)
Constant	(+/−)	0.028***	(7.939)	0.022***	(6.656)
Control Variables		Included		Included	
Industry Dummies		Included		Included	
Adj. R^2		0.208		0.169	
N		27,740		27,740	

Panel C: Pessimistic sample (Net income in year *t* > Net income forecast for year *t*)					
		(1) Dependent variable = *Δabs (ERRORS)* $_t$		(2) Dependent variable = *Δabs (REVISIONS)* $_t$	
	Exp. Sign	Coef.	(*t*-stat.)	Coef.	(*t*-stat.)
Uncertainty Shock $_{t\text{-}1}$	(−)	0.001**	(2.176)	0.001**	(1.973)
Constant	(+/−)	0.022***	(13.602)	0.020***	(12.111)
Control Variables		Included		Included	
Industry Dummies		Included		Included	
Adj. R^2		0.225		0.257	
N		25,066		25,066	

Note:

Δabs (ERRORS) $_t$ = the change in the absolute value of management forecast errors in year *t*. *Δabs (REVISIONS)* $_t$ = the change in the absolute value of management forecast revisions in year *t*. *Uncertainty Shock* $_{t\text{-}1}$ = an indicator variable set to one if the year *t*-1 is 2009 or 2011. These years are affected by financial crisis or the Great East Japan Earthquake. Control variables are the same as those in model (1). All the variables except *LOSS*, and *POSUE* are winsorized at the 1st and 99th percentiles by year. The *t*-statistics in parentheses are based on standard errors clustered at the firm level (Rogers, 1993; Petersen, 2009). *** and ** indicate that the value is significantly different than 0 at the 1% and 5% levels, respectively using a two-tailed *t*-test.

Figure 1 Timetable of management forecasts



(1) Nikkei Stock Average Volatility Index in year t-1 (VIX_{t-1})
(2) Absolute value of management forecast errors in year t ($abs\ (ERRORS)_t$)
(3) Management forecast revisions in year t ($abs\ (REVISIONS)_t$)

Figure 2 Time series of the Nikkei Stock Average Volatility Index