Journal of Accounting and Economics 48 (2009) 190–209

Contents lists available at ScienceDirect

Journal of Accounting and Economics

journal homepage: www.elsevier.com/locate/jae

Internal control and management guidance

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ARTICLE INFO

Article history:
Received 10 June 2008
Received in revised form
28 August 2009
Accepted 10 September 2009
Available online 19 September 2009

JEL classification:
M41
M43

Keywords:
Management guidance
Management forecast accuracy
Internal control over financial reporting

ABSTRACT

We examine the relation between internal control quality and the accuracy of management guidance. Consistent with managers in firms with ineffective internal controls relying on erroneous internal management reports when forming guidance, we document less accurate guidance among firms reporting ineffective internal controls. This relation extends to a change analysis, and the impact of ineffective internal controls on forecast accuracy is three times larger when the weakness relates to revenues or cost of goods sold—inputs particularly relevant to forecasting earnings. We conclude that internal control quality has an economically significant effect on internal management reports and thus decisions based on these figures.

1. Introduction

We examine the relation between internal control quality and the accuracy of management guidance. The disclosure of a material weakness in internal control is an acknowledgement by managers that their internal control system may not curtail material errors in their firm's financial reports.[1] Although prior research has focused mainly on the association between internal control quality and reported earnings (e.g., Ashbaugh-Skaife et al., 2008; Bedard, 2006; Chan et al., 2008; Doyle et al., 2007a), material weaknesses can also affect the accuracy of management guidance by reducing the quality of the internal management reports used to generate forecasts.

We investigate the association between internal control quality and the accuracy of management guidance for several reasons. First, managers have an incentive to produce accurate management forecasts as guidance is one of the key voluntary disclosure mechanisms that managers use to establish or change earnings expectations and reduce litigation risk. Accurate management guidance reduces information asymmetry (Coller and Yohn, 1997) and improves a firm's reputation for transparent and credible reporting (e.g., Graham et al., 2005; Williams, 1996). Thus, documenting hindrances to issuing accurate guidance is informative to managers, market participants and researchers. Second, prior research documents that auditors appear to partially mitigate the negative effects of internal control quality on reported earnings

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[1] Specifically, the disclosure of a material weakness in internal control acknowledges that "there is a reasonable possibility that a material misstatement of the company's annual or interim financial statements will not be prevented or detected on a timely basis" (PCAOB, 2007, p. 434). It is important to note that the firm's internal control system must prevent or detect the errors; identification and correction of an error by auditors is not sufficient (PCAOB, 2007, p. 420). Firms disclosing a material weakness in internal control must conclude that their internal controls are ineffective in their Section 404 report. Additional details regarding Section 404 are provided in Section 2.1.

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doi:10.1016/j.jacceco.2009.09.004

quality (e.g., Doyle et al., 2007a; Hogan and Wilkins, 2008), but management guidance is generally based on unaudited internal management reports. Thus, examining management guidance allows us to better document the effects of internal control quality on the financial reporting system. Finally, beyond issuing guidance, the internal management reports are also the basis for managers to make many day-to-day operational decisions. Hence, our findings on the effect of internal control quality on management guidance have potential implications for other management decisions based on internal reports.

We hypothesize that earnings guidance will be less accurate in the presence of material weaknesses in internal control, as managers are using lower quality financial inputs to form this guidance. We study 2994 firms that issued earnings guidance and filed Section 404 reports with the Securities and Exchange Commission (SEC) for fiscal years ending 2004–2006. Following prior literature (e.g., Ajinkya et al., 2005), we measure the accuracy of earnings guidance as the absolute value of realized management forecast errors (the scaled absolute value of the difference between actual earnings and management guidance; hereafter management forecast errors).[2] We find that firms that disclose ineffective internal controls have significantly larger management forecast errors than do firms that report effective internal controls. For example, the mean and median management forecast errors among firms reporting effective internal controls is 0.011 and 0.005, respectively, while the mean and median errors for firms reporting ineffective internal controls are approximately double, at 0.024 and 0.010, respectively. After controlling for known determinants of material weaknesses and management forecast accuracy, such as losses and volatility, firms reporting ineffective internal controls have management forecast errors that are 0.008 larger, on average, than firms reporting effective internal controls (p=0.001). This difference is 61.5% (133%) of the full sample mean (median) forecast error.

Although we control for a variety of determinants related to internal control quality and management forecast accuracy in our levels analysis, some underlying characteristics of the firm, such as innate volatility, are hard to measure and likely affect both internal control quality and management forecast accuracy. We conduct two tests to reduce the concerns of correlated omitted variables: a change analysis and a cross-sectional test based on the type of material weaknesses reported.

First, to the extent that potential correlated omitted variables are constant across years, a change analysis helps to mitigate this concern. We therefore investigate whether firms with changes in their internal control quality exhibit changes in their management forecast accuracy. Consistent with the results of our levels analysis, we find changes in internal control quality are significantly associated with corresponding changes in management forecast errors. Second, if the material weakness in internal control increases the management forecast errors, we expect the forecast errors to be more highly associated with material weaknesses that have the greatest impact on the information used by the managers when forming their guidance—weaknesses related to revenue and cost of goods sold (Fairfield et al., 1996; Lundholm and Sloan, 2006). Alternatively, if the innate volatility of the firm is driving the association, we would expect the errors to be larger for types of weaknesses that are more highly correlated with volatility or uncertainty. Consistent with managers relying on faulty inputs when forming their guidance, we find that weaknesses affecting revenue and cost of goods sold are more highly associated with management forecast errors than other weaknesses (the coefficient on revenue and cost of goods sold material weaknesses is more than triple the coefficient on other material weaknesses).[3]

Our results are consistent with the assertion that the quality of a firm's internal control system has an economically and statistically significant impact on the accuracy of management guidance. We cannot rule out, however, the possibility that some firm characteristics, such as innate volatility, drive our results, or that material weaknesses lead to errors in reported earnings, which leads to greater management forecast errors.[4]

Subject to these caveats, our paper contributes to both the literature on internal control over financial reporting and the management forecast literature. We first add to the debate on the merits of Section 404 (e.g., Cox, 2007; Gao et al., 2009; Ogneva et al., 2007). Although the empirical relation between internal control quality and earnings quality among Section 404 firms is weak (Chan et al., 2008; Doyle et al., 2007a), we document a robust association between internal control quality and the accuracy of management guidance, consistent with the argument that a good internal control system can

[2] We scale the difference between actual earnings per share and the manager's forecast of earnings per share, both reported by First Call, by total assets per share (we thank our reviewer for this suggestion). Our results do not change qualitatively when we use three alternate scalars: stock price, the absolute value of the management guidance, and the standard deviation of earnings per share (see Section 6.2.2). We also consider signed errors in Section 3.3.

[3] We investigate whether inherent volatility varies across weaknesses related to revenue/cost of goods sold and other weaknesses and find that there is no difference in volatility across firms reporting these two groups of weaknesses. Thus, finding a stronger association between management forecast errors and material weaknesses related to revenue and cost of goods sold is more consistent with managers relying on these inputs to the forecasting model than innate volatility of the firm driving the association.

[4] We discuss how material weakness-induced earnings management and errors in reported earnings affect management forecast accuracy in Section 3.2. To further explore the effect of material weakness-induced earnings management and errors in reported earnings, we examine (a) the difference between annual and quarterly forecast errors (where annual earnings, which are audited, are expected to contain fewer errors), and (b) only those material weakness firms that do not subsequently restate their reported earnings (again in an attempt to focus on reported earnings that contain fewer errors) in Section 6.2. The results from both of these tests are consistent with our conjecture that the lower management forecast accuracy among firms reporting ineffective internal controls is mainly driven by material weakness-induced errors in management forecasts, rather than errors in reported earnings.

help improve the accuracy of disclosures and other decisions made using internal financial data.[5] Our paper also contributes to the management forecast literature, which has previously focused primarily on how managers' incentives, such as litigation concerns and insider trading motives, affect characteristics of management guidance. We are not aware of prior studies that investigate how the quality of the financial information used by the manager affects characteristics of management guidance, such as forecast accuracy. Our findings indicate that the quality of the financial information used to form guidance is a significant determinant of management forecast accuracy. This finding is notable, given the importance placed on management guidance by investors and financial analysts.

In the next section we develop our hypothesis following a discussion of the background of Section 404 and the internal control literature. In Section 3, we discuss our data, sample selection, and main variable definitions, and provide descriptive statistics. In Section 4, we present the main tests and results of our hypothesis. We present additional analyses in Section 5, conduct robustness checks in Section 6, and conclude in Section 7.

2. Motivation and hypothesis development

2.1. Background and prior research on internal control quality

Disclosures of internal control deficiencies became widely available for the first time following the Sarbanes-Oxley Act of 2002. Section 404 of this regulation requires managers and their auditors to report on the effectiveness of the firm's internal controls over financial reporting.[6] Much research has followed the recent public disclosures of internal control quality under Sections 302 and 404. The initial papers are largely descriptive, providing evidence on the types of firms disclosing internal control deficiencies (e.g., Ashbaugh-Skaife et al., 2007; Bryan and Lilien, 2005; Doyle et al., 2007b; Ge and McVay, 2005). These papers find that firms with weak internal controls tend to be smaller, less profitable, more complex, or undergoing changes via rapid growth or restructurings. Subsequent studies examine the impact of internal control quality in various settings such as stock prices and cost of equity capital (e.g., Ashbaugh-Skaife et al., 2009; Beneish et al., 2008; Hammersley et al., 2008; Ogneva et al., 2007) and audit cost (e.g., Ettredge et al., 2006, 2007; Hogan and Wilkins, 2008; Hoitash et al., 2008; Raghunandan and Rama, 2006).

Examining earnings quality, Doyle et al. (2007a) document a negative relation between earnings quality and material weaknesses filed under Section 302, but find no relation, on average, between earnings quality and material weaknesses filed under Section 404. Ashbaugh-Skaife et al. (2008) and Bedard (2006) document evidence of improvements in earnings quality following remediations of material weaknesses for firms disclosing weaknesses under both Sections 302 and 404, although Bedard (2006) finds that these effects are greater for Section 302 disclosures than for 404 disclosures. This mixed evidence on the relation between internal control and earnings quality could be due to the existence of additional monitoring mechanisms (e.g., auditors, boards of directors, and institutional investors; Hogan and Wilkins, 2008; Krishnan, 2005; Tang and Xu, 2007). For example, auditors' substantive testing can act as a substitute for many internal controls, partially mitigating the negative effects of material weaknesses on earnings quality (Doyle et al., 2007a; Hogan and Wilkins, 2008).[7]

2.2. Hypothesis development

Management guidance has been shown to be an important and informative disclosure. The earnings surprise embedded in management guidance influences prices (e.g., Patell, 1976; Penman, 1980; Pownall and Waymire, 1989; Waymire, 1984) and alters investors' earnings expectations, as measured by subsequent revisions in analysts' forecasts (Baginski and Hassell, 1990; Jennings, 1987; Williams, 1996). Prior research on management forecast accuracy has largely focused on the incentives facing the managers and their firms (e.g., Rogers and Stocken, 2005). Regardless of a manager's incentives or ability to effectively compile information into a forecast, guidance based on poor-quality inputs will be less accurate. We expect, therefore, that the quality of internal control over financial reporting, through its effect on the accuracy of internal reports used by managers to form the guidance, affects the accuracy of management guidance.

[5] We do not attempt to speak to the net cost or benefit of Section 404. If managers are aware that their firms have poor internal controls, the decision of managers to maintain ineffective internal controls prior to the regulation suggests that the perceived value of the improved control system falls below the expected cost of improving the control system. Regardless, we document one possible benefit of maintaining strong internal controls: more informed decisions based on internal management reports, such as more accurate management guidance.

[6] Section 404 became effective for fiscal years ending after November 14, 2004, and the full rule currently applies only to the largest firms (accelerated filers). For non-accelerated filers, December 31, 2007 was the effective date for Section 404(a), the management assessment of internal control, while the auditor attestation component (404b) is currently scheduled to become effective for fiscal years ending after December 14, 2009. Section 302 became effective in August of 2002 and applies to all SEC registrants. Section 302 requires that officers certify the financial statements, including the effectiveness of internal control over financial reporting, and disclose any material changes in internal control (see also footnote 9).

[7] Specifically, Doyle et al. (2007a) find lower earnings quality (under both Sections 302 and 404) for material weaknesses that are less auditable (e.g., tone at the top), but not for material weaknesses that they deem to be more auditable (e.g., those related to financial statement accounts, such as problems reconciling accounts receivable). Similarly, Chan et al. (2008) also find stronger evidence of earnings management in firms with less auditable material weaknesses.

We anticipate that weak internal controls will affect the financial inputs to management guidance in at least two ways. First, we expect some material weaknesses to result in erroneous internal management reports. These reports are generally neither audited nor analyzed by audit committees, and thus any errors in these reports likely remain undetected in the short term. If managers rely on these erroneous internal reports to form their guidance, we expect them to issue less accurate management guidance. Consider the following material weakness disclosure provided by Penn Treaty American Corporation (whose main business is providing long-term care insurance) in its 10-K filing for the fiscal year ending December 31, 2005:

> The Company did not maintain adequate controls over the claims processing and payment areas to analyze and record appropriate adjustments to the claims payables and expense or monitor the proper determination and processing of claim payments. Numerous deficiencies were generally aggregated into two areas: claims processing (including claim maximum benefits, authority limits, check processing, and routine payment issues), and claims quality assurance department (responsible for the identification of errors and fraud).

Given the firm's business, the material weakness over claims noted above would clearly affect the internal numbers management uses to form earnings guidance, resulting in less accurate earnings guidance than if the forecast had been based on more accurate internal numbers.[8]

Second, material weaknesses can result in untimely, or stale, financial reporting information. For example, some companies lack personnel with adequate expertise to generate the information needed by management on a timely basis. Dana Corporation filed the following material weakness disclosure in its 10-K filing for the fiscal year ending December 31, 2005:

> Our financial and accounting organization was not adequate to support our financial accounting and reporting needs. Specifically, lines of communication between our operations and accounting and finance personnel were not adequate to raise issues to the appropriate level of accounting personnel and we did not maintain a sufficient complement of personnel with an appropriate level of accounting knowledge, experience and training in the application of GAAP commensurate with our financial reporting requirements. This control deficiency resulted in ineffective controls over the accurate and complete recording of certain customer contract pricing changes and asset sale contracts (both within and outside of the Commercial Vehicle business unit) to ensure they were accounted for in accordance with GAAP.

In this example, transactions were not fully recorded during the period, resulting in internal management reports that were incomplete. Managers relying on incomplete information face more uncertainty when forming guidance, and we expect their guidance to be less accurate.

Because we anticipate that managers in firms with ineffective internal controls are relying on inaccurate or incomplete internal management reports when forming their guidance, we posit that managers in firms with ineffective internal controls issue less accurate guidance. This leads to our hypothesis:

H1. Management forecast accuracy is lower among firms with ineffective internal controls.

To test this hypothesis, we first examine the association between internal control quality and management forecast errors, including control variables for known determinants of management forecast accuracy and internal control quality, as well as the inverse Mill's ratio to control for the choice to provide guidance (see footnote 8). We next examine how changes in internal control quality are associated with changes in management forecast errors. Finally, we partition the material weaknesses by type—concentrating on weaknesses affecting sales or cost of goods sold, which we expect to have a greater impact on management forecast accuracy than other weaknesses.

3. Data, sample selection, main variable definitions and descriptive statistics

3.1. Data and sample selection

We collect our data from Audit Analytics (Section 404 reports), First Call (management guidance, actual earnings, and analyst variables), Compustat (financial statement variables), and CRSP (stock returns to generate beta). Table 1 summarizes our sample construction. We begin with all 11,531 firm-year observations with Section 404 reports available on Audit Analytics for fiscal years 2004 through 2006.[9] We exclude 8060 firm-year observations that do not issue an annual

[8] It is possible that managers know their internal numbers are prone to error, and thus are less likely to provide guidance, leading to a sample selection bias by focusing on firms issuing guidance. We model the choice to provide guidance in Section 4.1 and include the inverse Mill's ratio in each of our tests. We also directly examine managers' responses to the public disclosure of internal control problems in Section 5.1.

[9] If there is a material weakness in internal control (see footnote 1), the internal control system is considered ineffective and the auditor provides an adverse opinion. Audit Analytics records the auditor's opinion (adverse or clean). We use the opinion to determine if the internal controls were effective or ineffective in the year of the Section 404 report. We focus on Section 404 reports, although material weaknesses are also disclosed under Section 302. The disclosure rules under Section 302 are more ambiguous (see Ashbaugh-Skaife et al., 2007) and require a less rigorous assessment of internal controls. For example, a Glass Lewis & Company report states that 94% of the firms reporting ineffective internal controls under Section 404 had not disclosed a

Table 1
Sample selection.

	Firm-year observations
Firm-years with section 404 reports for fiscal years 2004–2006	11,531
Less:	
Those without a point or range management earnings forecast issued in year t	8060
Firm-years with Section 404 reports and point or range management forecasts	*3471*
Less:	
Those missing financial information from Compustat	302
Those missing analyst information from First Call	155
Those missing stock information from CRSP	20
Number of firm-years in the final sample	*2994*

point or range forecast, per First Call, resulting in a sample of 3471 firm-year observations. We next remove observations without the necessary financial data from Compustat, analyst coverage from First Call, or stock return data from CRSP. Our final sample contains 2994 firm years.[10]

3.2. Main variable definitions

We create an indicator variable that is equal to one if the firm reports ineffective internal controls, and zero if the firm reports effective internal controls. Of the 2994 firm-years in our final sample, 313 (10.5%) report ineffective internal controls.[11] We define management forecast errors as the absolute value of the difference between reported earnings and management guidance scaled by assets per share at the beginning of the fiscal year:

$$\text{ABSERROR} = |\text{Realized Earnings} - \text{Management Guidance}|/\text{Lagged Assets per Share} \quad (1)$$

We focus on the absolute value of the management forecast error, as we are interested in the magnitude, rather than the direction, of the error.[12] ABSERROR can be influenced by erroneous guidance and erroneous reported earnings, both of which could be correlated with material weaknesses.[13] Our focus is on the effect of material weakness-induced errors in management guidance, however, these material weaknesses can also introduce errors into reported earnings directly (unintentional errors) or enable managers to override the accounting system and more easily manage earnings (intentional errors).[14] We expect, however, that material weaknesses influence management guidance more than reported earnings. First, as noted in Section 2, many material weaknesses are expected to result in incomplete internal management reports and thus lead to inaccurate forecasts. Reported earnings are less subject to this concern, as there is generally a 2-to-3-month lag between transactions and the final reporting of these transactions for annual earnings. Second, auditors' substantive testing is expected to partially mitigate the errors in reported earnings (e.g., Hogan and Wilkins, 2008), but is less likely to correct erroneous figures in internal management reports and any resulting management guidance based on these reports.

Even with the extra time and auditor scrutiny, reported earnings could still contain intentional and unintentional material weakness-induced errors. We expect material weakness-induced errors in reported earnings to reduce the realized management forecast error, biasing against finding an association between internal control quality and management forecast errors. Specifically, unintentional errors in reported earnings are likely to be positively related to material weakness-induced errors in management guidance, as both errors are caused by the same material weakness. For example, a failure to record credit purchases would be present in management's internal reports, when they form their guidance, and could also remain present at the time reported earnings are filed, if not detected and corrected by accounting

(*footnote continued*)
material weakness in internal control in the previous quarter, under SOX 302 (Townsend and Grothe, 2005). Nevertheless, we replicate our analyses on the initial Section 302 disclosures (from 2002 to 2004) and results are similar (not tabulated).

[10] We match all annual forecasts made in a given fiscal year to the Section 404 report issued for that year. We do not require the forecasted year to be the year of the material weakness disclosure. If a manager issues guidance more than once in the fiscal year, we take the average of all of the forecast errors. Our results are not sensitive to this research design choice; we replicate our analyses using both the first and last forecast issued in Section 6.2.

[11] This percentage, 10.5%, is slightly smaller than that found by existing studies examining Section 404 reports, however, we examine fiscal years 2004–2006, and the number of firms disclosing ineffective internal controls declines over this time period (139, 112, and 62 for 2004–2006, respectively).

[12] We compare signed management forecast errors between firms with effective and ineffective internal controls in Table 2, discussed in Section 3.3.

[13] It is possible that the definition of earnings used to form the management guidance differs from the definition used to form "actual" earnings within First Call, as analysts often adjust actual earnings to include or exclude specific charges (see Gu and Chen, 2004). If mismatches between management guidance and analyst-reported earnings are systematically associated with the existence of a material weakness, then it is possible that our larger error is induced by the analyst involvement. To investigate this possibility, we hand-collect a random sample of 100 press releases for both the initial guidance as well as the earnings release. We find four cases with a mismatch between the management guidance and actual earnings definition. More importantly, we do not find a greater concentration of mismatches among our material weakness firms relative to our control firms (not tabulated).

[14] The literature generally states that low-quality internal controls could result in both intentional and unintentional errors (e.g., Ashbaugh-Skaife et al., 2008; Doyle et al., 2007b); however, the findings of Ashbaugh-Skaife et al. (2008) suggest that errors due to weak internal controls are more likely to be unintentional.

personnel, the audit committee or auditors. Because the same error exists in the management guidance and reported earnings, the understatement of expenses in both components of our accuracy measure will net, and realized management forecast errors will be understated, biasing against finding evidence consistent with our hypothesis. As for intentional errors affecting reported earnings, if material weaknesses provide an additional opportunity for managers to manage earnings, we generally expect them to manage toward their guidance (Kasznik, 1999). This will also result in an understated realized management forecast error, again biasing against finding evidence consistent with our hypothesis. We investigate the effects of errors in reported earnings further in Section 6.2 by examining quarterly (unaudited) earnings and removing firm-years that are subsequently restated (ex post erroneous earnings).

3.3. Descriptive statistics

Table 2 presents descriptive statistics for the full sample, as well as the effective and ineffective internal control firm-years separately. On average, the absolute value of management forecast errors is 0.013 of lagged assets per share. The

Table 2
Descriptive statistics.

	Full sample					**Effective internal control**		**Ineffective internal control**			
	N=2994					*N*=2681		*N*=313		Diff.	Diff.
	Mean	Median	Q1	Q3	Std. dev.	Mean	Median	Mean	Median	*t*-stat.	*Z*-stat.
$ABSERROR_t$	0.013	0.006	0.002	0.014	0.020	0.011	0.005	0.024	0.010	10.43	5.20
$NEGERROR_t$	−0.015	−0.006	−0.018	−0.002	0.022	−0.013	−0.005	−0.027	−0.015	8.44	4.70
$POSERROR_t$	0.008	0.005	0.002	0.010	0.011	0.008	0.004	0.009	0.004	0.53	0.41
$ABSERROR_{t-1}$	0.011	0.004	0.002	0.012	0.020	0.010	0.004	0.019	0.008	5.03	4.26
$NEGERROR_{t-1}$	−0.013	−0.005	−0.015	−0.002	0.021	−0.012	−0.004	−0.019	−0.009	3.59	1.81
$POSERROR_{t-1}$	0.008	0.003	0.001	0.009	0.011	0.007	0.003	0.012	0.006	2.99	1.69
CHGROA	−0.004	0.001	−0.019	0.017	0.085	−0.000	0.002	−0.034	−0.013	−6.71	−6.15
TA (in millions)	6557	1258	415	4084	18,545	6603	1365	6156	563		
LN_TA	21.073	20.953	19.845	22.130	1.677	21.140	21.034	20.503	20.149	−6.39	−6.03
BIG4	0.928	1.000	1.000	1.000	0.258	0.937	1.000	0.856	1.000	−5.23	−5.21
BETA	1.184	1.132	0.849	1.471	0.476	1.177	1.126	1.247	1.208	2.47	1.85
LN_AGE	2.520	2.485	1.946	3.219	0.986	2.538	2.485	2.363	2.303	−2.99	−2.91
ABSCHGROA	0.046	0.018	0.007	0.045	0.083	0.043	0.017	0.071	0.029	5.72	3.88
DISPFOR	0.069	0.046	0.026	0.083	0.074	0.070	0.046	0.064	0.041	−1.32	−1.73
VOLATILITY	−0.028	−0.185	−0.508	0.281	0.730	−0.051	−0.198	0.162	−0.063	4.89	3.05
ORG. CHANGE	0.021	−0.147	−0.363	0.172	0.729	0.014	−0.146	0.080	−0.151	1.50	−0.42
COMPLEXITY	0.032	−0.071	−0.679	0.617	0.722	0.026	−0.082	0.084	0.050	1.35	1.61
FIN. CHALL.	−0.284	−0.378	−0.534	−0.243	0.543	−0.311	−0.388	−0.058	−0.272	7.88	6.03
HORIZON	209.11	204.00	181.17	243.00	67.72	208.54	203.60	214.00	209.00	1.35	1.46
ABSREVISION	0.004	0.002	0.001	0.005	0.007	0.004	0.002	0.005	0.002	1.21	2.21

Variable definitions:

MW: An indicator variable that is equal to one if the firm discloses ineffective internal controls in year *t*, and zero if the firm discloses effective internal controls in year *t*.
ABSERROR: The absolute value of the management forecast error [|(realized earnings less management guidance)|/lagged assets per share].
CHGROA: The change in ROA (earnings before extraordinary items scaled by lagged total assets) from year $t-1$ to year *t*.
LN_TA: The natural logarithm of total assets (Compustat #6).
BIG4: An indicator variable that is equal to one if the auditor is a Big 4 auditor, and zero otherwise.
BETA: The slope coefficient from estimating Sharpe's (1964) market model using daily return data from year $t-1$.
LN_AGE: The natural logarithm of the number of years that a firm is covered by CRSP.
ABSCHGROA: The absolute value of the change in ROA (earnings before extraordinary items scaled by lagged total assets) from year $t-1$ to year *t*.
DISPFOR: The standard deviation of the individual analyst forecasts for year *t*, prior to the management guidance in year *t*.
VOLATILITY: A factor comprised of cash flow volatility, earnings volatility, and sales volatility (see the appendix).
ORG. CHANGE: A factor comprised of asset growth, sales growth, leverage, and merger and acquisition activity (see the appendix).
COMPLEXITY: A factor comprised of the number of segments, the existence of foreign transactions, and the existence of a restructuring (see the appendix).
FINANCIAL CHALLENGES: A factor comprised of return on assets, losses, research and development, and special items (see the appendix).
HORIZON: The number of days prior to the fiscal period-end that the management guidance is issued, where a larger number indicates more timely guidance. Guidance issued after the fiscal period-end is not excluded, and thus HORIZON can be negative.
ABSREVISION: The absolute value of the revision implied by the management guidance: [|(management guidance less the pre-existing median consensus analyst forecast)|/lagged assets per share].

Note: We winsorize the top and bottom 1% of each of our continuous variables to mitigate the influence of outliers.

management forecast errors are twice as large among firm-years with ineffective internal controls compared to those with effective internal controls (for example, the means are 0.024 and 0.011, respectively), and this difference is statistically significant, providing initial support for our hypothesis. Although our main analysis focuses on the absolute value of the management forecast error, which offers an aggregate measure of management forecast errors associated with ineffective internal controls, we also partition the variable by sign to determine if the errors are more concentrated among either positive or negative forecast errors.

In year t, the year of the Section 404 report, the difference between firms with and without material weaknesses appears to be concentrated among negative forecast errors (where management guidance exceeds reported earnings); positive forecast errors are not statistically different between the two subsamples. To provide some insight into why the positive forecast errors do not differ in year t, we first examine the change in return on assets (CHGROA). We find that firms disclosing ineffective internal controls have significantly more negative changes in return on assets. Specifically, realized earnings are lower than earnings from the prior year, on average, for firms disclosing ineffective internal controls. This is consistent with the unexpectedly low reported earnings among these firms shifting the distribution of forecast errors to the left, exaggerating the difference in negative forecast errors and mitigating the difference in positive forecast errors. The lower-than-expected earnings could be due to general poor performance among material weakness firms (Ge and McVay, 2005) or additional scrutiny applied by audit committees and auditors in the year of the public disclosure of ineffective internal controls (Elder et al., 2009).

If the lack of positive forecast errors is largely a result of lower-than-expected earnings in year t, we should observe a significant difference among positive management forecast errors when we examine forecast errors in year $t-1$, where earnings were less likely to be unexpectedly low and the material weaknesses were likely still in place (e.g., Doyle et al., 2007a).[15]

Consistent with our expectations, we find that the absolute value of management forecast errors is significantly larger among material weakness firms in year $t-1$, and this difference extends to both negative and positive forecast errors (see Table 2). For example, in the positive forecast error subsample, the mean (median) absolute forecast error for firms reporting ineffective internal controls is 0.012 (0.006), which is about 70% (100%) greater than that for firms reporting effective internal controls. This finding is consistent with our hypothesis that weak internal controls contribute to erroneous internal management reports and thereby larger management forecast errors.

Table 2 also reports the descriptive statistics of variables that we expect to be associated with internal control quality and management forecast accuracy; we include these control variables in our multivariate tests and discuss their expected relations with internal control quality and management forecast accuracy in Section 4. Generally, material weakness firms tend to be smaller and younger, with more volatile reported earnings and higher betas. They are also less likely to be audited by the Big 4.

4. Test design and results

4.1. The choice to provide guidance

Our hypothesis is that managers in firms with ineffective internal control have greater forecast errors (lower forecast accuracy). Because the provision of management guidance is voluntary, it is possible that our sample is systematically biased. Thus, we use a Heckman (1979) two-stage model to control for the endogeneity of providing management guidance. In the first stage, we estimate the following probit regression of the choice to provide management guidance:

$$\begin{aligned}\text{GUIDANCE} = {} & b_0 + b_1\text{LN\_TA} + b_2\text{BIG4} + b_3\text{BETA} + b_4\text{ABSCHGROA} + b_5\text{STD\_AF} + b_6\text{VOLATILITY} \\ & + b_7\text{ORGANIZATIONAL CHANGE} + b_8\text{COMPLEXITY} + b_9\text{FINANCIAL CHALLENGES} + b_{10}\text{MW} \\ & + b_{11}\text{LN\_ANALYSTS} + \sum b_i \text{ Industry and Year Indicators} \end{aligned} \quad (2)$$

where GUIDANCE is an indicator variable that is equal to one if the manager issues guidance in year t, and zero otherwise. Our determinants are based on the model of guidance provided by Ajinkya et al. (2005). We also include the disclosure of a material weakness, as it is possible that managers know they have a material weakness and thus are less likely to provide guidance. As we discuss in greater detail in Section 5.1, it is not clear when managers become aware of internal control problems. In Eq. (2) above, guidance may be issued prior to the manager learning of ineffective internal controls. As such, we do not have an expected sign on MW.

Both Larcker and Rusticus (2008) and Francis and Lennox (2008) emphasize that to successfully control for endogeneity, at least one independent variable needs to be identified that is correlated with the dependent variable in the first-stage model, but is not associated with the dependent variable in the second-stage model. In Eq. (2), this variable is the logarithm of the number of analysts following the firm (LN_ANALYSTS). Previous studies have documented that analyst following is positively related to voluntary disclosure frequency (e.g., Lang and Lundholm, 1996), and that this extends to management

[15] Firms reporting ineffective (effective) internal controls in year t have a change in return on assets (CHGROA) from year $t-2$ to year $t-1$ of 0.018 (0.011); the difference in CHGROA between effective and ineffective controls is not statistically significant (not tabulated).

Table 3
Probit regression of the choice to issue management guidance.

	Dependent variable=GUIDANCE		
	Coefficient	χ^2-statistic	p-value
Intercept	−3.640	114.947	0.001
LN_TA	0.094	44.780	0.001
BIG4	0.096	3.323	0.068
BETA	−0.074	6.002	0.014
ABSCHGROA	−0.447	6.326	0.012
STD_AF	−1.276	99.411	0.001
VOLATILITY	−0.011	0.173	0.678
ORGANIZATIONAL CHANGE	0.022	1.228	0.268
COMPLEXITY	−0.046	3.127	0.077
FINANCIAL CHALLENGES	−0.294	137.556	0.001
MW	0.067	1.994	0.158
LN_ANALYSTS	0.297	196.164	0.001
Industry and year indicators		Included	
Number of observations		8591	
Likelihood ratio		2152.120	
Pseudo-R^2		0.301	
Partial R^2		0.025	

Variable definitions:
GUIDANCE: An indicator variable that is equal to one if managers issue earnings guidance in year t, and zero otherwise.
LN_TA: The natural logarithm of total assets.
BIG4: An indicator variable that is equal to one if the auditor is a Big 4 auditor, and zero otherwise.
BETA: The slope coefficient from estimating Sharpe's (1964) market model using daily return data from year $t-1$.
ABSCHGROA: The absolute value of the change in ROA (earnings before extraordinary items scaled by lagged total assets) from year $t-1$ to year t.
STD_AF: The standard deviation of the individual analyst forecasts at the beginning of year t.
VOLATILITY: A factor comprised of cash flow volatility, earnings volatility, and sales volatility (see the appendix).
ORG. CHANGE: A factor comprised of asset growth, sales growth, leverage, and merger and acquisition activity (see the appendix).
COMPLEXITY: A factor comprised of the number of segments, the existence of foreign transactions, and the existence of a restructuring (see the appendix).
FINANCIAL CHALLENGES: A factor comprised of return on assets, losses, research and development, and special items (see the appendix).
MW: An indicator variable that is equal to one if the firm discloses ineffective internal controls in year t, and zero if the firm discloses effective internal controls in year t.
LN_ANALYSTS: The natural logarithm of the number of analysts following the firm at the beginning of year t.

Note: p-values are based on two-tailed tests. We winsorize the top and bottom 1% of each of our continuous variables to mitigate the influence of outliers.

guidance (Ajinkya et al., 2005). Importantly, analyst following and management forecast accuracy are not significantly associated (see Ajinkya et al., 2005). Regression results and variable definitions are presented in Table 3.

Consistent with the literature, management guidance is more prevalent among larger firms with higher audit quality (e.g., Ajinkya et al., 2005). In addition, riskier firms and firms with harder-to-estimate earnings are less likely to provide guidance (e.g., Waymire, 1984). MW is positive with a p-value of 0.158. We explore this positive association further in Section 5.1, where we condition on managers knowing about an internal control problem and examine their responses to this knowledge.

Finally, consistent with the literature, the coefficient on LN_ANALYSTS (our exogenous instrument) is 0.297 with a p-value of 0.001. The model has a pseudo-R^2 of 30.1% and a partial R^2 for LN_ANALYSTS of 2.5%, which is significantly greater than zero, suggesting that LN_ANALYSTS is a reasonable exogenous variable (Larcker and Rusticus, 2008).

4.2. Main test of the hypothesis

To test the hypothesis that internal control problems are associated with larger management forecast errors, we estimate the following equation, and include the inverse Mill's ratio (IMR) calculated based on the estimation results from Eq. (2):

$$\begin{aligned}\text{ABSERROR} = {} & b_0 + b_1\text{MW} + b_2\text{LN\_TA} + b_3\text{BIG4} + b_4\text{BETA} + b_5\text{LN\_AGE} + b_6\text{ABSCHGROA} + b_7\text{DISPFOR} \\ & + b_8\text{VOLATILITY} + b_9\text{ORGANIZATIONAL CHANGE} + b_{10}\text{COMPLEXITY} \\ & + b_{11}\text{FINANCIAL CHALLENGES} + b_{12}\text{HORIZON} + b_{13}\text{ABSREVISION} + b_{14}\text{IMR} \\ & + \sum b_i \text{ Industry and Year Indicators} + \varepsilon \end{aligned} \quad (3)$$

Table 4
Internal control quality and management forecast accuracy.

	Dependent variable=ABSERROR											
	Full sample			**2004**			**2005**			**2006**		
	Coeff.	*t*-stat.	*p*-value	Coeff.	*t*-stat.	*p*-value	Coeff.	*t*-stat.	*p*-value	Coeff.	*t*-stat.	*p*-value
Intercept	0.026	3.09	0.002	−0.001	−0.04	0.966	0.041	2.04	0.041	0.028	1.61	0.109
MW	**0.008**	**8.07**	**0.001**	**0.008**	**5.07**	**0.001**	**0.010**	**5.37**	**0.001**	**0.004**	**2.24**	**0.025**
LN_TA	−0.002	−4.35	0.001	−0.001	−1.41	0.160	−0.002	−2.96	0.003	−0.001	−2.57	0.010
BIG4	−0.002	−1.66	0.098	0.003	1.40	0.161	−0.005	−2.06	0.039	−0.003	−1.48	0.139
BETA	0.002	2.98	0.003	0.005	4.00	0.001	0.000	−0.17	0.868	0.002	1.45	0.149
LN_AGE	0.001	1.53	0.127	0.000	0.71	0.480	0.001	1.27	0.205	0.000	0.53	0.597
ABSCHGROA	0.033	7.68	0.001	0.044	6.00	0.001	0.012	1.44	0.150	0.033	4.65	0.001
DISPFOR	0.024	4.93	0.001	0.009	1.08	0.278	0.035	3.89	0.001	0.023	2.79	0.005
VOLATILITY	0.002	4.64	0.001	0.001	1.38	0.168	0.003	3.09	0.002	0.004	4.03	0.001
ORG. CHANGE	0.000	−1.12	0.261	−0.001	−1.89	0.059	0.001	0.83	0.406	−0.001	−1.36	0.175
COMPLEXITY	0.000	−0.14	0.887	−0.002	−2.07	0.039	0.000	0.20	0.839	0.001	0.96	0.336
FIN. CHALL.	0.005	5.49	0.001	0.003	1.93	0.054	0.007	4.59	0.001	0.004	2.95	0.003
HORIZON	0.000	9.19	0.001	0.000	4.20	0.001	0.000	5.46	0.001	0.000	5.49	0.001
ABSREVISION	1.035	22.17	0.001	1.071	11.91	0.001	1.175	13.80	0.001	0.919	12.88	0.001
IMR	−0.001	−0.59	0.556	−0.001	−0.22	0.830	0.002	0.39	0.696	−0.003	−0.94	0.346
Industry indicators	Included			Included			Included			Included		
Year indicators	Included			Not included			Not included			Not included		
Total obs.	2994			933			1052			1009		
MW obs.	313			139			112			62		
Adjusted R^2	0.386			0.380			0.402			0.388		

Note: *p*-values are based on two-tailed tests and the variable of interest is in bold. ABSERROR is the absolute value of the management forecast error (realized earnings less management guidance) scaled by lagged assets per share. MW is an indicator variable that is equal to one if the firm discloses ineffective internal controls in year *t*, and zero if the firm discloses effective internal controls in year *t*. IMR is the inverse Mill's ratio from the first-stage model of the choice to issue management guidance (see Eq. (2)); the estimation is provided in Table 3. See Table 2 for additional variable definitions.

where ABSERROR is the absolute value of the management forecast error (scaled by lagged total assets per share) and MW is an indicator variable that is equal to one if the firm discloses ineffective internal controls in year *t*, and zero if the firm discloses effective internal controls in year *t*. The additional variables in the model are intended to control for factors that could affect the management forecast error, and could also be correlated with the existence of a material weakness; we discuss these control variables below.

Results are presented in Table 4. The first column of results pools all firm-years. In the subsequent three columns, we parse out our sample by fiscal year, so that each firm is included only once in the estimation procedure, to control for the potential serial correlation within each firm. Across each of the four regression estimations, MW is positive and significant (b_1=0.008, *p*-value=0.001 for the full sample). This indicates that firms disclosing ineffective internal controls exhibit significantly larger management forecast errors; the economic significance is large, at 61.5% (133%) of the mean (median) forecast error in the full sample (see Table 2).

Turning to our control variables, we first include four controls for management forecast accuracy. Firm size (LN_TA) is expected to be associated with management forecast accuracy (e.g., Kasznik and Lev, 1995), as larger firms tend to have more experienced and knowledgeable staff, and is also a known determinant of internal control quality (e.g., Ge and McVay, 2005). Consistent with our expectations, the larger the firm, the lower the management forecast errors in three of our four specifications. Audit quality (BIG4) is also expected to be associated with the quality of disclosure (Ajinkya et al., 2005), and it is associated with lower forecast errors in two of the four specifications (the full sample and fiscal 2005). We also control for BETA, as Ajinkya et al. (2005) expect BETA to be associated with management forecast errors, and firms reporting material weaknesses tend to have higher BETA (Bryan and Lilien, 2005). We find that BETA is associated with larger forecast errors in two of our four estimations (the full sample and fiscal 2004). Finally, we include the logarithm of age (LN_AGE), as younger firms might be less experienced at providing guidance and are more likely to report material weaknesses; this variable is not statistically significant in our estimations.

Our next set of variables is related to the expected difficulty of predicting earnings. We include ABSCHGROA, the absolute value of the change in return on assets, as shocks to earnings are expected to be more difficult to predict. Consistent with this, ABSCHGROA is associated with larger forecast errors in three of our four estimations. Next, DISPFOR is the standard deviation of analysts' forecasts prior to the issuance of management guidance; greater uncertainty among analysts likely signals that earnings are more difficult to predict. We find this variable is positively associated with larger forecast errors in three of our four estimations.

We also consider an additional 14 variables selected to proxy for the firm's underlying volatility and innate uncertainty, as firms with high volatility and uncertainty are expected to report larger management forecast errors and be more likely to have material weaknesses. As the level of correlation among some of these 14 variables is high, we perform a principal component analysis and identify four factors: VOLATILITY, ORGANIZATIONAL CHANGE, COMPLEXITY, and FINANCIAL CHALLENGES (see the Appendix A for additional detail). VOLATILITY is associated with larger forecast errors in three of the four estimations, consistent with managers in firms with more volatile earnings having a harder time predicting earnings, while ORGANIZATIONAL CHANGE is weakly associated with lower forecast errors in fiscal 2004. COMPLEXITY is insignificant across three of the four estimations, loading, like ORGANIZATIONAL CHANGE, only in fiscal 2004. Finally, our factor FINANCIAL CHALLENGES is associated with higher forecast errors in all four of our estimations, consistent with managers facing financial challenges allocating fewer resources to guidance formation.[16]

We control for two additional determinants of management forecast accuracy that could also be correlated with internal control quality. We control for when in the year the forecast is issued (HORIZON) and the magnitude of the revision suggested by the management guidance (ABSREVISION). In both instances, we expect and find larger values associated with larger errors across all four estimations (Ajinkya et al., 2005). Finally, we include the inverse Mill's ratio, generated from Eq. (2), as well as industry and year indicator variables. The inverse Mill's ratio is insignificant across all four estimations, indicating that self-selection does not significantly affect management forecast accuracy after controlling for material weaknesses and other determinants of forecast accuracy.[17]

To summarize, after controlling for known determinants of ex post management forecast accuracy and potentially correlated determinants of internal control quality, we find evidence consistent with H1—firms reporting ineffective internal controls issue less accurate management guidance, consistent with the managers in these firms relying on lower quality internal management reports when forming their guidance.

4.3. Internal control quality change analysis

The second test of our hypothesis examines how management forecast accuracy changes as internal control quality changes. Because there is a concern of correlated omitted variables in our setting, the change analysis allows us to control for inherent features of the firm that do not change over time. If it is internal control quality that affects management forecast accuracy, we expect the magnitude of the management forecast error to increase (decrease) as the internal control quality deteriorates (improves). The change in internal control quality, ΔMW, is defined as the difference in the MW indicator variable in year $t+1$ and the MW indictor variable in year t, while the change in management forecast error, ΔABSERROR, is defined as the difference in ABSERROR in year $t+1$ and ABSERROR in year t. We expect a positive coefficient on ΔMW. Table 5 presents the results of our change analysis, conditional on the firm having issued a point or range forecast in both years t and $t+1$. Consistent with our expectations, ΔMW is positively associated with the change in management forecast errors from year t to year $t+1$.[18]

4.4. Material weaknesses by type

As the third test of the hypothesis, we conduct a cross-sectional test based on the type of material weakness disclosed. We expect some weaknesses to have more of an effect on the accuracy of guidance than other weaknesses and partition our weaknesses accordingly.[19] We expect the greatest impact on management forecast accuracy to be via material weaknesses

[16] To further control for the effect of performance, we also exclude all loss firms (in year t as well as in year $t-1$ through year t) and continue to find systematically higher management forecast errors among firms reporting ineffective internal controls. We also include either a loss indicator variable or the change in return on assets (signed, in addition to the absolute value presented in our tables), and results continue to support our inferences. Finally, we create a matched control sample, matching on year, two-digit SIC code and the nearest change in return on assets from year $t-1$ to year t. Results are similar (b_1=0.006, p-value=0.002 for the full sample; not tabulated).

[17] If we exclude the control variables from the estimation, MW continues to load (coefficient=0.012, p-value=0.001) and the inverse Mill's ratio is positive and significant (coefficient=0.013, p-value=0.001) [not tabulated].

Francis and Lennox (2008) point out that an absence of "exclusion restrictions" in the first stage can lead to severe multicollinearity in the second stage. Our inverse Mill's ratio is less likely to be subject to this problem, because our first stage includes LN_ANALYSTS and thus meets this restriction. Nevertheless, we check for multicollinearity and find that the highest VIF score (for the inverse Mill's ratio) is 7.31, which is less than the cutoff point of 10.

To examine the robustness of our Heckman two-stage results, we first estimate Eq. (3) excluding IMR. The coefficient on MW is 0.008 with a p-value of 0.001. Following Frank (2000) and Larcker and Rusticus (2008), we next assess how closely an unobservable confounding variable would have to be correlated with ABSERROR and MW to change the OLS results. The Impact Threshold for a Confounding Variable (ITCV) is 0.116. To put this number in perspective, the highest ITCV based on our identified control variables is 0.018 (for FINANCIALLY CHALLENGED). This suggests that we would need an omitted variable with an impact of more than six times that of any of our control variables to change our results. Thus, there is unlikely to be a confounding variable that will overturn the positive association between ABSERROR and MW.

[18] Although we control for changes in each of our control variables in Table 5, it is possible that the underlying *level* of a firm's volatility affects a firm's ability to remediate the material weakness, and it is this underlying volatility that is driving the association in Table 5. To investigate this possibility, we correlate the level of analyst forecast dispersion, volatility, complexity, organizational change, and financial challenges with changes in internal control quality; none of the variables is significantly correlated with changes in internal control quality. Thus, we conclude that the underlying level of innate volatility or uncertainty is not driving the association between the change in internal control quality and the change in management forecast errors.

[19] Not all material weaknesses would be expected to reduce the quality of the financial information inputs; for example, consider weaknesses related to balance sheet classification, segment disclosure, or cash flow statement classification. We are precluded from testing for a null result for these

Table 5
The change in internal control quality and the change in management forecast accuracy.

	Dependent variable=ΔABSERROR$_{t+1}$		
	Coefficient	*t*-statistic	*p*-value
Intercept	0.000	0.23	0.816
ΔMW	**0.003**	**2.37**	**0.018**
ΔLN_TA	0.000	−0.10	0.921
ΔBIG4	−0.002	−0.58	0.563
ΔBETA	0.000	0.29	0.772
ΔABSCHGROA	0.020	3.34	0.001
ΔDISPFOR	−0.006	−0.79	0.431
ΔVOLATILITY	−0.002	−0.64	0.523
ΔORGANIZATIONAL CHANGE	0.002	2.83	0.005
ΔCOMPLEXITY	−0.002	−1.19	0.234
ΔFINANCIAL CHALLENGES	0.003	1.86	0.062
ΔHORIZON	0.000	10.94	0.001
ΔABSREVISION	0.879	12.05	0.001
ΔIMR	0.002	0.59	0.554
Industry indicators		Included	
Total observations		1442	
Number of MW=−1		111	
Number of MW=0		1262	
Number of MW=1		69	
Adjusted R^2		0.242	

Note: *p*-values are based on two-tailed tests and the variable of interest is in bold. Our variables are defined as follows: ΔMW is equal to negative one if the firm reports ineffective internal controls in year *t* but effective internal controls in year *t*+1, zero if the effectiveness does not change from year *t* to *t*+1, and one if the firm reports effective internal controls in year *t* and ineffective controls in year *t*+1. ΔIMR is the change in the inverse Mill's ratio (IMR) from the first-stage model of the choice to issue management guidance (see Eq. (2)); the estimation of IMR is provided in Table 3. Additional variable definitions are provided in Table 2; Δ denotes change.

affecting sales and cost of goods sold. These two items are very important inputs to a manager's earnings forecast. For example, Lundholm and Sloan (2006) note that sales is the single most important input to a forecasting model, and Fairfield et al. (1996) conclude that a component's importance corresponds roughly to its placement on the income statement, and sales and cost of goods sold are the first two line items on the income statement. For this reason, we expect inaccuracies in internal management reports within these two line items to result in the largest management forecast errors.

Table 6 compares how management forecast errors are affected by weaknesses within revenue or cost of goods sold versus all other weaknesses. Consistent with our expectations, the coefficient on weaknesses affecting revenue or cost of goods sold is 0.014, which is more than three times as large as the coefficient on other material weaknesses, 0.004. The difference between these two types of weaknesses is also statistically significant (p=0.001; not tabulated). Moreover, this difference extends to our change analysis (not tabulated). Specifically, the coefficient on ΔREV/COGS is 0.005 and significant (p=0.007), while the coefficient on ΔOTHER is 0.002 and not significantly different from zero (p=0.157). In sum, forecast errors are significantly larger when the material weakness is related to the accounts that managers are expected to rely on to form their guidance.[20]

In sum, the cross-sectional differences based on the type of material weakness support the notion that material weaknesses affecting revenue and cost of goods sold, which we predict to have the greatest impact on the internal numbers used by managers when forming their guidance, exhibit the greatest association with realized management forecast accuracy. Overall, across each of our tests, results are consistent with H1, that internal control quality has a statistically and economically significant association with the accuracy of management guidance.

(*footnote continued*)
weaknesses, however, as virtually every firm reporting one of the above weaknesses also has other weaknesses that could feasibly affect management guidance.

[20] It is possible that firms with more innate volatility or uncertainty are also more likely to have material weaknesses specifically related to revenue or cost of goods sold (versus other weaknesses), and this innate volatility could be driving the cross-sectional difference. To investigate this possibility, we compare the dispersion of analyst forecasts and our four factors of innate volatility or uncertainty between firms with material weaknesses affecting revenue or cost of goods sold versus firms with other material weaknesses and do not find significant differences between these two groups (not tabulated). Therefore, our cross-sectional results are unlikely to be driven by differences in innate volatility between firms with material weaknesses affecting revenue or cost of goods sold and other weaknesses.

Table 6
The relation between types of material weaknesses and management forecast accuracy.

	Dependent variable=ABSERROR		
	Coefficient	*t*-statistic	*p*-value
Intercept	0.027	2.46	0.014
REV/COGS	**0.014**	**9.36**	**0.001**
OTHER	**0.004**	**3.55**	**0.001**
LN_TA	−0.002	−4.21	0.001
BIG4	−0.002	−1.84	0.066
BETA	0.002	2.80	0.005
LN_AGE	0.001	1.59	0.111
ABSCHGROA	0.032	7.44	0.001
DISPFOR	0.024	4.99	0.001
VOLATILITY	0.003	4.96	0.001
ORGANIZATIONAL CHANGE	0.000	−1.04	0.299
COMPLEXITY	0.000	−0.12	0.902
FINANCIAL CHALLENGES	0.005	5.48	0.001
HORIZON	0.000	9.23	0.001
ABSREVISION	1.036	22.31	0.001
IMR	−0.001	−0.49	0.624
Industry and year indicators		Included	
Total observations		2994	
REV/COGS observations		115	
OTHER observations		198	
Adjusted R^2		0.391	

Note: *p*-values are based on two-tailed tests and the variables of interest are in bold. Our variables are defined as follows: REV/COGS is an indicator variable that is equal to one if the firm reports a material weakness in the revenue/accounts receivable or cost of goods sold/inventory accounts, and zero otherwise. OTHER is an indicator variable that is equal to one if the firm reports a material weakness in internal control and none of these weaknesses are related to the revenue/accounts receivable or cost of goods sold/inventory accounts, and zero if the firm reports a material weakness in the revenue/accounts receivable or cost of goods sold/inventory accounts or does not report a material weakness. IMR is the inverse Mill's ratio from the first-stage model of the choice to issue management guidance (see Eq. (2)); the estimation is provided in Table 3. Additional variable definitions are provided in Table 2.

5. Additional analyses

5.1. Managers' response to the disclosure of a material weakness

In this section, we examine managers' guidance behavior following the public disclosure of internal control problems. Though we document an economically significant association between management forecast errors and the quality of internal control (see Table 4), we do not find that managers with internal control problems are less likely to issue management guidance (Table 3). As we noted previously, this seemingly incongruous finding might be a function of when we measure internal control quality. Prior to Sarbanes-Oxley, managers were not required to document their internal control procedures. Although they likely had some idea of the internal control quality of their firm, they had not been required to conduct a detailed evaluation, and thus they might not have known the extent of their deficiencies in internal control. Moreover, even if they were aware of material weaknesses in internal control, they were not required to publicly disclose the effectiveness of their internal controls prior to Sarbanes-Oxley.[21] After identifying and publicly disclosing a material weakness; however, managers could change their guidance behavior, either because they hesitate to rely on potentially faulty figures, or they feel the market will discount their guidance in the presence of material weaknesses.

To examine the effect of internal control quality on disclosure policy, we partition our firms by those that report ineffective internal controls in both years t and $t+1$ (IC_NO IMPROVE=1) and those that remediate their material weaknesses and report ineffective controls only in year t (IC_IMPROVE=1); we benchmark both of these groups of firms against firms reporting effective internal controls in year t. We expect managers in the group disclosing ineffective internal controls in both years to be the most likely to change their disclosure policy. Specifically, these managers would know throughout year $t+1$ that the firm has a material weakness, and that by issuing guidance in year $t+1$ they are relying on potentially inaccurate internal figures.[22]

[21] A number of material weaknesses were disclosed under Section 302 of Sarbanes-Oxley. Results are similar if we (1) exclude firms that disclosed material weaknesses under Section 302 from our analysis, or (2) replicate our analysis using only Section 302 disclosures reported from 2002 to 2004. The latter test, focusing on Section 302 disclosures, provides a strong test of management's response to the disclosure of material weaknesses, however, as noted in footnote 9, focusing on Section 404 disclosures ensures there was a rigorous evaluation of internal control.

Presumably, managers of firms reporting ineffective internal controls might cease to provide guidance, issue less precise guidance, or perhaps delay issuing guidance until after the material weakness has been remediated or internal management reports are more complete. The following models are used to examine these possibilities:

$$\begin{aligned}\Delta\text{GUIDANCE} = {} & b_0 + b_1\text{IC\_IMPROVE} + b_2\text{IC\_NOIMPROVE} + b_3\Delta\text{LN\_TA} + b_4\Delta\text{BIG4} + b_5\Delta\text{LN\_ANALYSTS} \\ & + b_6\Delta\text{BETA} + b_7\text{DABSCHGROA} + b_8\Delta\text{VOLATILITY} + b_9\Delta\text{ORGANIZATIONAL CHANGE} \\ & + b_{10}\Delta\text{COMPLEXITY} + b_{11}\Delta\text{FINANCIAL CHALLENGES} + \varepsilon \end{aligned} \tag{4}$$

$$\begin{aligned}\Delta\text{SPECIFICITY} = {} & b_0 + b_1\text{IC\_IMPROVE} + b_2\text{IC\_NOIMPROVE} + b_3\Delta\text{LN\_TA} + b4\Delta\text{BIG4} + b5\Delta\text{LN\_ANALYSTS} \\ & + b6\Delta\text{BETA} + b7\text{DABSCHGROA} + b8\Delta\text{VOLATILITY} + b9\Delta\text{ORGANIZATIONAL CHANGE} \\ & + b10\Delta\text{COMPLEXITY} + b11\Delta\text{FINANCIAL CHALLENGES} + b12\Delta\text{DISPFOR} + b13\Delta\text{HORIZON} + \varepsilon \end{aligned} \tag{5}$$

$$\begin{aligned}\Delta\text{HORIZON} = {} & b_0 + b_1\text{IC\_IMPROVE} + b_2\text{IC\_NOIMPROVE} + b_3\Delta\text{LN\_TA} + b_4\Delta\text{BIG4} + b_5\Delta\text{LN\_ANALYSTS} + b_6\Delta\text{BETA} \\ & + b_7\text{DABSCHGROA} + b_8\Delta\text{VOLATILITY} + b_9\Delta\text{ORGANIZATIONAL CHANGE} + b_{10}\Delta\text{COMPLEXITY} \\ & + b_{11}\Delta\text{FINANCIAL CHALLENGES} + b_{12}\Delta\text{DISPFOR} + \varepsilon \end{aligned} \tag{6}$$

where ΔGUIDANCE is an indicator variable that is equal to one if the manager issued guidance in year t+1 but did not in year t, negative one if the manager did not issue guidance in year t+1 but did in year t, and zero if there was no change in the issuance of guidance. ΔSPECIFICITY is the change in the average forecast specificity, where specificity has a value of one if the forecast is qualitative, two if the forecast is a minimum or maximum, three if the forecast is a range, and four if the forecast is a point estimate. ΔHORIZON is the change in the average number of days between the end of the period and the issuance of the management forecast, where a positive number indicates that the forecasts are issued in a more timely fashion. We estimate Eq. (4) using an ordered probit model, and estimate Eqs. (5) and (6) using ordinary least squares. Our control variables mirror those in Eq. (3), but are in annual changes, rather than levels; these control variables largely follow Ajinkya et al. (2005), who examine occurrence and specificity, as well as accuracy, which we examine in Eq. (3).[23]

Turning to Table 7, managers in firms reporting ineffective internal controls in year t followed by effective internal controls in year t+1 (IC_IMPROVE) do not appear to change their likelihood of issuing guidance (ΔGUIDANCE), the specificity of their guidance (ΔSPECIFICITY), or when they issue the guidance during the year (ΔHORIZON). Conversely, managers in firms reporting ineffective internal controls in both year t and year t+1 (IC_NO IMPROVE) are more likely to stop issuing guidance, and, if they do issue guidance, tend to provide less specific and less timely guidance. Moreover, the differences between the two groups (IC_IMPROVE and IC_NO IMPROVE) are statistically significant across all three tests (not tabulated).

It is possible that the reduction in guidance, precision and timeliness is caused, not by the anticipated reliance on faulty internal numbers, but by the re-allocation of scarce managerial time and resources. If this is the underlying driver of our findings, however, we would also expect to find a reduction in guidance, in guidance precision, and in guidance timeliness among those firms that remediated their material weaknesses, as the remediation would arguably also consume management's time and resources. Thus, it seems likely that these responses by management are a result of reduced confidence in the numbers managers rely on to form their guidance. Our findings point to an unintended consequence of Section 404 (Gao et al., 2009): the reduction of the frequency, precision, and timeliness of voluntary disclosures among firms consistently reporting ineffective internal controls.

5.2. The informativeness of management guidance

We argue that material weaknesses in internal controls result in larger errors in management guidance, and that these errors are economically important, both in magnitude and to the disclosure policy of the firm (see Sections 4.1 and 5.1). If, however, investors and analysts discount management guidance provided by firms with weak internal controls, this reduces the economic significance of our findings. In this section, we investigate the extent that analysts incorporate management guidance and test if this incorporation is lower for firms reporting ineffective internal controls relative to those reporting effective internal controls.

[22] We do not conduct our main analysis in year t, as it is not clear when in year t the material weakness was discovered. Note that here we are focusing on the change in guidance behavior by specific groups from year t to t+1, while in Table 3 we examine the general association between internal control quality and the choice to issue guidance in year t. Table 3 illustrates that results differ if the firm has not yet publicly disclosed the ineffective internal control problems; it appears that either managers were not aware of the internal control problems, or managers change their behavior when the ineffective internal controls are publicly disclosed.

It is possible that managers believe the material weakness has been remediated, and a new material weakness arises in year t+1; this should bias against rejecting the null.

[23] We also consider two additional control variables in these tests that might explain the change in management forecasting behavior. The first is an executive turnover, which is associated with both ineffective internal controls (Li et al., 2008) and the existence and specificity of guidance (Brochet et al., 2009). We also consider restatements (RESTATE). If there is a pending restatement, managers might wait to issue guidance until the restatement is resolved. Neither of these variables is statistically significant, and our inferences remain unchanged (not tabulated). As an additional robustness check, we also include these additional controls in Tables 4–6; again results are not sensitive to their inclusion (not tabulated).

Table 7
The change of internal control quality and the change in management forecast behavior.

	Dependent variable								
	ΔGUIDANCE			**ΔSPECIFICITY**			**ΔHORIZON**		
	Coeff.	χ^2-statistic	*p*-value	Coeff.	*t*-statistic	*p*-value	Coeff.	*t*-statistic	*p*-value
Intercept1	1.425	33.83	0.001	0.031	0.18	0.857	−34.251	−0.84	0.403
Intercept2	−3.122	6000.50	0.001						
IC_IMPROVE	**−0.068**	**0.88**	**0.348**	**0.020**	**0.68**	**0.499**	**−10.086**	**−1.47**	**0.141**
IC_NO IMPROVE	**−0.411**	**17.03**	**0.001**	**−0.115**	**−2.67**	**0.008**	**−28.528**	**−2.80**	**0.005**
ΔLN_TA	0.180	2.58	0.108	−0.050	−1.08	0.280	−2.091	−0.19	0.850
ΔBIG4	−0.011	0.01	0.932	−0.007	−0.11	0.916	14.213	0.92	0.359
ΔLN_ANALYSTS	0.141	7.84	0.005	0.005	0.27	0.791	−3.083	−0.64	0.521
ΔBETA	0.128	8.17	0.004	−0.021	−1.10	0.272	2.376	0.53	0.599
ΔABSCHGROA	−0.309	2.38	0.123	−0.006	−0.06	0.949	−30.365	−1.28	0.201
ΔVOLATILITY	0.006	0.00	0.958	−0.043	−0.98	0.325	12.280	1.19	0.236
ΔORG. CHANGE	−0.014	0.26	0.611	0.012	1.06	0.288	6.336	2.38	0.017
ΔCOMPLEXITY	−0.044	0.33	0.565	0.056	1.97	0.049	3.377	0.51	0.612
ΔFIN. CHALLENGES	−0.012	0.04	0.833	−0.076	−3.24	0.001	22.538	4.09	0.001
ΔDISPFOR				−0.070	−0.58	0.564	194.624	6.89	0.001
ΔHORIZON				0.000	−0.85	0.397			
Industry indicators		Included			Included			Included	
Total Observations		4852			1648			1648	
IC_IMPROVE Obs.		443			121			121	
IC_NO IMPROVE Obs.		221			53			53	

Note: *p*-values are based on two-tailed tests and the variables of interest are in bold. Our variables are defined as follows: ΔGUIDANCE is an indicator variable that is equal to one if the manager issued guidance in year t+1 but did not in year t, negative one if the manager did not issue guidance in year t+1 but did in year t, and zero if there was no change in the issuance of guidance. ΔSPECIFICITY is the change in average forecast specificity, where specificity has a value of one if the forecast is qualitative, two if the forecast is a minimum or maximum, three if the forecast is a range, and four if the forecast is a point forecast. ΔHORIZON is the change in the average number of days between the issuance of the management guidance and the end of the period, where a positive number indicates that the guidance is issued in a more timely fashion. IC_IMPROVE is an indicator variable that is equal to one if the firm reports ineffective internal controls in year t and effective internal controls in year t+1. IC_NO IMPROVE is an indicator variable that is equal to one if the firm reports ineffective internal controls in both year t and year t+1. Additional variable definitions are provided in Table 2; Δ denotes change.

We limit our sample to the first year the firm reports its internal control quality under Section 404 (e.g., analyst revisions during 2004 for a firm subsequently disclosing its internal control quality for 2004).[24] We exclude observations that have an earnings announcement in the 3-day window around the management guidance to avoid any confounding effects of concurrent earnings announcements. These sample selection criteria result in 964 management earnings forecasts with necessary data. Unlike our main analysis, where we consider the average forecast error of all guidance issued in a given year, in this analysis we retain each instance of guidance, as we want to measure analysts' responsiveness following each specific event. Because some firms issue multiple earnings forecasts each year, we report *t*-statistics based on robust standard errors to control for firm clustering effects (Petersen, 2009).

Following prior research, we regress the revision made by analysts (ANALYST_REV) on the change suggested by managers (REVISION) and control variables, as follows:

$$\begin{aligned}\text{ANALYST\_REV} = {} & b_0 + b_1\text{REVISION} + b_2\text{MW} + b_3\text{DOWN} + b_4\text{REPUTATION} + b_5\text{AGREE} + b_6\text{REVISION MW} \\ & + b_7\text{REVISION DOWN} + b_8\text{REVISION REPUTATION} + b_9\text{REVISION AGREE} + \varepsilon \end{aligned} \quad (7)$$

where REVISION is the revision implied by the management forecast (management guidance less the pre-existing median consensus analyst forecast) scaled by lagged total assets per share. The pre-existing consensus analyst forecast is the most recent consensus available before the management forecast (within 2–30 days). ANALYST_REV is the analyst forecast revision (the revised consensus analyst forecast less the pre-existing consensus analyst forecast) scaled by lagged total assets per share. The revised consensus analyst forecast is the updated consensus forecast following the management forecast (within 15 days). If there is not a revised analyst forecast, ANALYST_REV is zero.

[24] We consider only the first year of the internal control reports, as our intent is to determine if analysts discount these managers' forecasts before the public announcement of ineffective internal controls. After the public announcement, analysts might rely on this guidance to a lesser degree, confounding our tests. Prior research has examined both price reactions and analyst forecast revisions to management guidance. We opt to examine analyst revisions rather than price reactions, as price reactions reflect both the change in expectations in the numerator, and the discount rate (or risk of the firm) in the denominator, and firms with weak internal controls have systematically different risk characteristics (e.g., Ogneva et al., 2007; Bryan and Lilien, 2005).

Table 8
Analyst revisions in response to management guidance.

	Dependent variable=ANALYST_REV					
	Coeff.	*t*-statistic	*p*-value	Coeff.	*t*-statistic	*p*-value
Intercept	0.000	0.22	0.827	0.000	0.98	0.326
REVISION	0.508	5.29	0.001	0.002	0.02	0.983
MW	−0.001	−1.86	0.064	−0.001	−2.65	0.008
DOWN				0.000	0.41	0.681
REPUTATION				0.000	−0.86	0.388
AGREE				0.000	0.62	0.534
REVISION × MW	**0.081**	**0.45**	**0.656**	**−0.166**	**−0.86**	**0.390**
REVISION × DOWN				0.313	2.15	0.032
REVISION × REPUTATION				0.219	2.77	0.006
REVISION × AGREE				0.416	3.85	0.001
Total observations		964			964	
MW observations		116			116	
Adjusted R^2		0.474			0.581	

Note: *t*-statistics are calculated using robust standard errors to control for firm clustering effects and *p*-values are based on two-tailed tests. The variable of interest is in bold and we winsorize the top and bottom 1% of each of our continuous variables to mitigate the influence of outliers. Our variables are defined as follows: REVISION is the revision implied by the management guidance (management guidance—pre-existing median consensus analyst forecast) scaled by lagged total assets per share. ANALYST_REV is the analyst forecast revision (the revised median consensus analyst forecast—the pre-existing median consensus analyst forecast) scaled by lagged total assets per share. The pre-existing consensus analyst forecast is the most recent consensus before the management guidance (within 2–30 days). The revised consensus analyst forecast is the updated consensus forecast following the management guidance (within 15 days). If there is not a revised analyst forecast, ANALYST_REV is zero. MW is an indicator variable that is equal to one if the firm discloses ineffective internal controls in year *t*, and zero if the firm discloses effective internal controls in year *t*. DOWN is an indicator variable that is equal to one if the management guidance falls below the pre-existing consensus analyst forecast, and zero otherwise. REPUTATION is the average accuracy of management guidance over the preceding 3 years, where the accuracy is equal to 1, 0 and −1, respectively, if the absolute value of the pre-existing analyst forecast error is greater than, equal to or less than the absolute value of the management forecast error. AGREE is an indicator variable that is equal to one if the 3-day abnormal return around the management guidance (−1, +1) has the same sign as the direction of the revision implied by the management guidance, and zero otherwise. The abnormal return is equal to the difference between the firm return and the value-weighted return.

A positive and significant coefficient on REVISION implies that analysts incorporate management guidance. Our variable of interest is REVISION × MW, the incremental incorporation made by analysts for firms disclosing ineffective internal controls. A negative and significant coefficient on this interaction term would be consistent with analysts discounting guidance provided by managers in firms with ineffective internal controls. We include three control variables that have been shown to affect the incorporation of guidance, DOWN, REPUTATION, and AGREE (e.g., Baginski and Hassell, 1990; Cotter et al., 2006; Williams, 1996). DOWN is an indicator variable that is equal to one if the management forecast falls below the pre-existing consensus analyst forecast, and zero otherwise. REPUTATION is the average management forecast accuracy over the preceding 3 years, where the accuracy is equal to 1, 0, and −1, respectively, if the absolute value of the pre-existing analyst forecast error is greater than, equal to, or less than the absolute value of the management forecast error, following Hutton and Stocken (2009). AGREE is an indicator variable that is equal to one if the 3-day abnormal return around the management forecast (−1, +1) has the same sign as the direction of the revision implied by the management guidance, and zero otherwise. The abnormal return is equal to the difference between the firm return and the value-weighted market return. We interact each of these controls with REVISION and expect each interaction term to be positive—we expect analysts to incorporate more of the management guidance when the guidance is downward, when the firm has historically issued more accurate guidance, and when the market reaction is in the same direction as the guidance.

Table 8 reports the regression results. The first column of results excludes the control variables. The coefficient on REVISION is positive and significant, consistent with prior research (0.508 with a *p*-value of 0.001). The coefficient on the main effect of MW is negative and significant, consistent with analysts revising their forecasts downward more for MW firms, which tend to be performing poorly. Finally, the coefficient on the interaction of REVISION and MW, our variable of interest, is not significantly different from zero at conventional levels, with a coefficient of 0.081 and a *p*-value of 0.656, indicating that analysts' revision behavior to management guidance does not differ based on whether or not the firm later discloses ineffective internal controls.

Turning to the second column of results, where we include the three control variables from prior literature, the main effect of REVISION becomes insignificant, consistent with the bulk of the analyst revision being explained by the credibility and informativeness of the management guidance. The main effect of MW remains significant, still consistent with analysts revising their expectations downward for poorly performing firms, and each of the control variables' main effects is insignificant. This is reasonable as these controls speak to the characteristics of the management guidance, and thus become informative when interacted with management guidance. The coefficient on REVISION × MW continues to be indistinguishable from zero, at −0.166 with a *p*-value of 0.390, while each of the three control variables interacted with REVISION are positive and significant as predicted. In sum, analysts do not appear to discount management guidance issued

by firms with ineffective internal controls, indicating that material weakness-induced errors in management guidance are likely to be incorporated into analyst forecasts (Pinello and Skaife, 2009) prior to the disclosure of the material weakness.

6. Robustness analyses

To investigate the robustness of our main results, we conduct various sensitivity tests related to possible omitted variables, errors in reported earnings, and measurement of management forecast accuracy. The association between internal control weaknesses and management forecast accuracy is robust to these sensitivity tests.

6.1. Correlated omitted variables

Although we include control variables in our analyses, some firm and manager characteristics, such as innate volatility and managerial ability, are hard to measure and can affect both internal control quality and management forecast accuracy. In this section, we conduct additional tests to investigate the effect of these potential omitted variables on our results.

6.1.1. Innate volatility

To control for innate volatility, we (1) include four factors based on 14 variables to capture this construct, (2) conduct a change analysis, and (3) perform a cross-sectional test based on the type of the weakness. In this section, we further explore the possibility of endogeneity caused by the possible omission of the construct, innate volatility. First, we employ the "omitted variables" variant of the Hausman (1978, 1983) test to determine if our independent variable, material weakness, exhibits evidence of endogeneity after controlling for a multitude of variables.[25] The test is unable to reject the null condition of no endogeneity.

Second, similar to DeFond et al. (2002), we implement a two-stage procedure from Nelson and Olson (1978) to estimate a simultaneous equations model. In the first stage, we estimate a probit model of internal control quality on its exogenous determinants (excluding management forecast accuracy; see footnote 25) and calculate the predicted probability of reporting ineffective internal controls. We also estimate a linear regression model of management forecast accuracy on its exogenous determinants (excluding internal control quality; see Eq. (3)) and calculate the predicted management forecast accuracy. In the second stage, we estimate a system of two structural models: a model of internal control quality on its exogenous determinants and the predicted management forecast accuracy estimated by the first-stage linear model, and a model of management forecast accuracy on its exogenous determinants and the predicted probability of ineffective internal controls estimated using the first-stage probit model. The results of estimating the second-stage model of management forecast accuracy are consistent with those presented in Table 4. The coefficient on the predicted probability of ineffective internal controls is significantly positive at 0.013, with a p-value of 0.003 (not tabulated). Thus, even after controlling for potential simultaneity bias that may have been induced by innate firm variability or complexity, we continue to find a positive association between internal control quality and management forecast accuracy.

6.1.2. Managerial ability

It is possible that a more able manager is both more likely to support and develop strong internal controls, and more likely to issue more accurate forecasts. To examine this alternative explanation, we consider two measures of managerial ability. First, to the extent that ability and tenure are associated, we replicate our main analysis including CEO tenure as an additional control variable; we calculate tenure as the number of years the executive has been employed per Execucomp (current year less initial year the CEO joined the firm). Second, we include an empirical measure of managerial ability developed by Demerjian et al. (2006) as an alternative control variable.[26] Our results hold after including each measure of managerial ability. Including the CEO tenure control, the coefficient on MW is 0.004 with a p-value of 0.001. Including the managerial ability score from Demerjian et al. (2006), the coefficient on MW is 0.007 with a p-value of 0.001 (not tabulated).

[25] To conduct the Hausman test, we consider the following equation: $\text{MW}=b_0+b_1\text{LN\_TA}+b_2\text{BIG4}+b_3\text{BETA}+b_4\text{LN\_AGE}+b_5\text{ABSCHGROA}+b_6\text{VOLATILITY}+b_7\text{ORGANIZATIONAL CHANGE}+b_8\text{COMPLEXITY}+b_9\text{FINANCIAL CHALLENGES}+b_{10}\text{LN\_ANALYSTS}+b_{11}\text{OPERATING CYLCLE}+\varepsilon$, where OPERATING CYCLE is measured as the natural logarithm of [360/(sales/accounts receivable)+360/(cost of goods sold/inventory)]. LN_ANALYSTS and OPERATING CYCLE are the instrumental variables in the first stage. Larcker and Rusticus (2008) show that, when there are more instrumental variables than endogenous variables, an over-identifying restriction test is needed before conducting the Hausman test. We thus perform an over-identifying test by regressing the second-stage residual on all exogenous variables, including the two instrumental variables. The R^2 from the model is 0.008, which is not significantly different from zero, providing some support for the use of our instruments.

[26] Demerjian et al. (2006) use data envelopment analysis to identify the efficiency of managers based on the revenues a manager produces from a given level of resources.

Table 9
The relation between internal control quality and management forecast accuracy for quarterly guidance.

	Dependent variable=ABSERROR$_q$		
	Coeff.	*t*-stat.	*p*-value
Intercept	0.004	1.39	0.164
MW	**0.001**	**3.63**	**0.001**
LN_TA	0.000	−2.64	0.008
BIG4	0.001	1.53	0.127
BETA	0.001	3.14	0.002
LN_AGE	0.000	−2.41	0.016
ABSCHGROA	0.009	5.73	0.001
DISPFOR	0.008	2.12	0.034
VOLATILITY	0.000	2.12	0.034
ORGANIZATIONAL CHANGE	0.000	1.16	0.247
COMPLEXITY	0.000	1.34	0.181
FINANCIAL CHALLENGES	0.000	−0.13	0.895
HORIZON	0.000	10.85	0.001
ABSREVISION	0.458	21.51	0.001
IMR	0.000	0.06	0.954
Industry and year indicators		Included	
Total observations		2345	
MW observations		290	
Adjusted R^2		0.321	

Note: *p*-values are based on two-tailed tests and the variable of interest is in bold. ABSERROR$_q$ is the absolute value of the quarterly management forecast error (realized quarterly earnings less quarterly management guidance) scaled by lagged assets per share, where the quarterly guidance is issued in year *t*. MW is an indicator variable that is equal to one if the firm discloses ineffective internal controls in year *t*, and zero if the firm discloses effective internal controls in year *t*. IMR is the inverse Mill's ratio from the first-stage model of the choice to issue management guidance (see Eq. (2)); the estimation is provided in Table 3. See Table 2 for additional variable definitions.

6.2. Measurement of management forecast accuracy

6.2.1. Errors in reported earnings

As noted above, ineffective internal controls can lead to erroneous forecasts and erroneous reported earnings, both of which affect our measure of forecast accuracy. We rely on two mechanisms to at least partly correct actual reported earnings. First, we expect errors related to incomplete information to be mitigated, as there is a lag between the end of the reporting period and when earnings are reported. Second, we expect auditors to conduct substantive testing, correcting some detectable errors (Hogan and Wilkins, 2008).

We expect both of these mitigating factors to have reduced applicability in a quarterly earnings setting, where there is a smaller lag time between the end of the period and the required SEC filing date, and where earnings are reviewed rather than audited. Without these mitigating factors, we expect both management guidance and quarterly reported earnings to contain similar material weakness-induced errors, resulting in smaller realized forecast errors. Thus, we expect to find a weaker association between internal control quality and *quarterly* management forecast accuracy if our main results are largely a function of errors in management guidance (rather than reported earnings).

We replicate our main tests using quarterly guidance and present the results in Table 9. Results are consistent with our expectations. The coefficient on MW for quarterly management forecast errors is 0.001; this value extrapolated to an annual figure is 0.004, which is only half of the coefficient for annual management forecast errors, 0.008.

It is possible that auditors and others are not able to identify and correct earnings management (e.g., Guidry et al., 1999). To further alleviate concerns of errors in reported earnings, we eliminate from the analysis material weakness firms that ex post restated their earnings. Arguably, among those with ineffective internal controls, these firms had larger errors in reported earnings than those not restating earnings. Results continue to hold when we consider only material weakness firms that do not subsequently restate earnings (as of the end of 2008), with a coefficient on MW of 0.008 and a *p*-value of 0.001, not tabulated.[27]

Finally, the larger errors we document do not appear to be due to managers slightly exceeding their own guidance; we replicate our main test after excluding positive management forecast errors of one to two cents per share, and results are similar (not tabulated).

[27] In addition, if we exclude all firms that subsequently restate (both material weakness and control firms), results also continue to hold; the coefficient is 0.008 with *p*-value of 0.001.

6.2.2. Alternative measures of management forecast accuracy

There are several alternative ways to calculate our measure of forecast accuracy—the absolute value of the realized management forecast error. We explore these variations below. First, as noted in footnote 10, we take the average error of all forecasts issued by a firm during the fiscal year. We re-estimate Eq. (3) using the last forecast issued in each fiscal year, and results are similar (the coefficient on MW is 0.007 with a corresponding *p*-value of 0.001). Similarly, if we use the first forecast issued in each fiscal year, the coefficient on MW is 0.006, and the corresponding *p*-value is 0.001 (not tabulated).

Second, throughout the paper, we scale the management forecast error by lagged total assets per share. We consider three alternative scalars. The first is lagged price per share, following the bulk of prior research. We opt not to use this as our main scalar because material weakness firms are likely to have lower stock prices than firms without material weaknesses. We also replicate our main analysis using the absolute value of the management guidance as the scalar. Finally, we scale the forecast errors by the standard deviation of earnings per share over the past 7 years (the same period over which we form our factors). For all three alternative scalars, our conclusions remain unchanged (not tabulated).

To summarize, based on the above robustness checks, we conclude that innate volatility, managerial ability, errors in reported earnings, and measurement choice do not appear to drive the relation between internal control quality and management forecast accuracy. Overall, the evidence consistently supports our contention that ineffective internal controls lead to larger management forecast errors, as managers in firms with weak internal controls appear to rely on less accurate internal reports when forming their guidance.

7. Conclusion

We examine the relation between internal control quality and the accuracy of management guidance using Section 404 disclosures issued by accelerated filers for fiscal years 2004–2006. We argue that the quality of internal control not only has implications for reported earnings, as previously examined, but also likely affects internal reports used by management to form projections such as earnings expectations. Consistent with this, we find that within firms reporting ineffective internal controls, management forecast accuracy is significantly lower, both statistically and economically. Our results hold using a change analysis specification, and we find stronger results when the weaknesses affect revenue or cost of goods sold, consistent with these balances being particularly relevant for forecasting earnings (Fairfield et al., 1996).

Our study has several limitations. First, it is possible that firms reporting ineffective internal controls also have greater volatility or uncertainty that we have not captured in our analysis, and this volatility or uncertainty could be driving our results. Although we include various control variables in our analysis, estimate a change analysis, and explicitly test for endogeneity using a Hausman test, we cannot completely rule out this alternative explanation. Second, although our focus is on the guidance provided by management, if the material weaknesses also affect reported earnings, the errors in reported earnings could be driving the association. We conduct several tests to investigate the validity of this concern, including examining quarterly versus annual guidance and excluding material weakness firms that subsequently restate reported earnings.

Overall, our results suggest that internal control quality has broader implications than previously documented. Internal controls not only affect reported earnings; they also affect the quality of internal management reports and thus management guidance. Although our focus is on management guidance, weak internal controls also have the potential to affect managers' decisions related to production, capital investment, mergers and acquisitions, research and development, advertising, and hiring or expansion decisions. Future research might investigate these alternate settings to provide additional insights and evidence on the underlying causal relation between internal control quality and decisions based on internal management reports.

Acknowledgements

We would like to thank Brian Cadman, Asher Curtis, Mike Ettredge, Harry Evans, Weili Ge, Rachel Hayes, Karla Johnstone, Adam Koch, Andy Leone (the referee), Ross Watts, Joe Weber, Jerry Zimmerman (the editor), and workshop participants at the 2008 Minnesota Empirical Conference, Michigan State University, MIT, the University of Pittsburgh, the University of Utah, and the University of Waterloo for their helpful comments.

Appendix A. Factor formation

Firms with ineffective internal controls tend to be systematically different from firms with effective internal controls. For example, they tend to be smaller, less profitable, more highly leveraged, and growing rapidly or experiencing a restructuring (Ashbaugh-Skaife et al., 2007; Doyle et al., 2007b; Ettredge et al., 2007; Ge and McVay, 2005). The bulk of these variables are expected to be associated with the underlying innate variability and uncertainty facing the firm, and thus it is crucial to control for innate volatility and uncertainty, which could also lead to larger management forecast errors. We first compile 14 control variables that we expect to be associated with innate volatility: cash flow volatility, earnings volatility, sales volatility, asset growth, sales growth, leverage, merger and acquisition activity, the number of segments, the existence of foreign transactions, the existence of a restructuring, return on assets, losses, research and development, and

Table A1

Factors	Component loading
VOLATILITY	
CASH FLOW VOLATILITY	0.654
EARNINGS VOLATILITY	0.568
SALES VOLATILITY	0.567
ORGANIZATIONAL CHANGE	
ASSET GROWTH	0.751
SALES GROWTH	0.514
LEVERAGE	0.508
M&A	0.317
COMPLEXITY	
SEGMENTS	0.614
FOREIGN TRANSACTIONS	0.579
RESTRUCTURING	0.364
FINANCIAL CHALLENGES	
ROA	−0.834
LOSSES	0.739
R&D	0.601
SI	0.401

Variable definitions:

CASH FLOW VOLATILITY: The standard deviation of quarterly operating cash flows over the prior 7 years (requiring at least three non-missing observations).
EARNINGS VOLATILITY: The standard deviation of quarterly ROA over the prior 7 years (requiring at least three non-missing observations).
SALES VOLATILITY: The standard deviation of quarterly sales over the prior 7 years (requiring at least three non-missing observations).
ASSET GROWTH: Asset growth from year $t-1$ to year t ((assets (Compustat #6) in year $t-$assets in year $t-1$)/assets in year $t-1$).
SALES GROWTH: Sales growth from year $t-1$ to year t ((sales (Compustat #12) in year $t-$sales in year $t-1$)/sales in year $t-1$).
LEVERAGE: Total liabilities (Compustat #181)/lagged total assets (Compustat #6).
M&A: An indicator variable that is equal to one if the firm undertook a large merger or acquisition (Compustat AFTNT1="AA") in year t, and zero otherwise.
SEGMENTS: The natural logarithm of the total number of geographic and operating segments.
FOREIGN TRANSACTIONS: An indicator variable that is equal to one if the firm has foreign transactions (Compustat #150) in year t, and zero otherwise.
RESTRUCTURING: An indicator variable that is equal to one if the firm recognized restructuring charges (Compustat #376) in year t, and zero otherwise.
ROA: Earnings before extraordinary items (Compustat #18)/lagged total assets (Compustat #6).
LOSSES: An indicator variable equal to one if earnings before extraordinary items (Compustat #18) in year t and $t-1$ sum to less than zero, and zero otherwise.
R&D: Research and development expense (Compustat #46)/lagged total assets (Compustat #6).
SI: The absolute value of special items (Compustat #17)/lagged total assets (Compustat #6).

Note: We winsorize the top and bottom 1% of each of our continuous variables to mitigate the influence of outliers.

special items (Ashbaugh-Skaife et al., 2007; Dechow and Dichev, 2002; Dhaliwal et al., 2008; Doyle et al., 2007b; Ettredge et al., 2007; Ge and McVay, 2005). Using principle component analysis we aggregate these 14 variables into four factors, representing volatility, organizational change, complexity, and financial challenges (see Table A1). For succinctness and clarity, we present these four factors to proxy for innate volatility as well as industry and year indicator variables in the tabulated regression results; however, our results are not sensitive to the choice of including the four factors versus the 14 individual controls (not tabulated).

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