Who Did it Matters: Executive Equity Compensation and Financial Reporting Fraud

Robert H. Davidson

Pamplin School of Business, Virginia Polytechnic Institute and State University

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Contact Information:

Email Address: rhdx@vt.edu
Address: Pamplin Hall, Suite 3098
Virginia Polytechnic Institute and State University
880 West Campus Drive
Blacksburg, VA 24061
Phone: 1-540-231-7352

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Abstract

In within-firm analysis of 1,805 executives, executives implicated in financial reporting fraud cases have significantly stronger equity incentives than their within-firm peers who are not implicated in the fraud. Executives implicated in fraud cases also have significantly stronger equity incentives than executives at non-fraud firms in similar roles. However, the equity incentives of non-implicated executives at fraud firms are no different than those for executives at non-fraud firms. The results are significant across executive roles and for equity incentives measured as wealth sensitivity to changes in stock price or stock price volatility. Executive-level analysis that considers which executives are implicated in the fraud may provide more precise measurement of the association and statistical significance of the relationship between equity incentives and fraud. Finally, firm-level measures that consider the equity incentives of all members of the top management team may better identify fraud firms than do measures focusing on one executive.

Keywords: Financial reporting fraud, equity compensation, executive equity incentives.

JEL Classification Codes: G30, G34, G38, G39.

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1. Introduction

I examine whether analysis of financial reporting fraud at the executive level and consideration of the specific executives implicated in the fraud provides stronger identification and higher-powered statistical tests of a possible association between executive equity incentives and reporting fraud. Prior research argues that while executive equity compensation increases firm value (Mehran 1995; Agrawal and Knoeber 1996) and reduces the agency conflict between managers and shareholders, it can also increase incentives to conceal bad news about future growth prospects and increase financial reporting risk (Benmelech et al. 2010). With this theoretical link in mind, the association between equity compensation and financial reporting risk has been extensively studied. However, no consistent pattern of results has emerged. Prior studies have found positive, negative, and no association between equity incentives and misreporting. An inability to replicate prior findings has left the following questions unanswered: are equity incentives associated with reporting risk? If so, then for which forms of equity and for which executives is there an association? And does this extend beyond legal earnings manipulation to reporting fraud?

Prior research has studied this question from many perspectives, but few studies analyze the equity incentives of the specific executives within the firm who commit the fraud. Research has largely focused on CEO equity incentives. However, in analysis prepared for the Committee of Sponsoring Organizations of the Treadway Commission, Beasley et al. (2010) find that CEOs are implicated in fraud cases approximately 70 percent of the time. Therefore, a sample strictly analyzing CEO equity incentives will have a 30 percent CEO-level false positive rate if the involvement of the CEO is not considered. Sources of potential measurement error in control groups (non-fraud firms) have been examined, but measurement error in identifying a more

precisely defined treatment group (i.e., individuals who perpetrate fraud versus firms where fraud occurs) has received less attention. A CEO-specific measure may not represent an accurate proxy for the equity incentives of the specific managers who commit fraud for several reasons. First, executives have idiosyncratic compensation preferences and compensation contracts are a negotiation between the manager and firm. Second, accumulated equity is significantly influenced by tenure, which can vary considerably across executives within the firm. Third, while subject to constraints, executives may manage their portfolios differently. For these reasons, equity incentives across executives in the same firm are often quite different.[1]

Further, executives in different roles may not respond similarly to equity incentives with respect to reporting fraud. Chava and Purnanandam (2010) find that CEO equity incentives are associated with firm leverage and cash balances, while CFO equity incentives are associated with debt maturity choices and earnings smoothing. Feng et al. (2011) and Friedman (2014) argue that non-CEOs may commit fraud because of pressure from the CEO. If this is the case, then while equity incentives may be associated with misreporting for CEOs, this may not be true for non-CEOs. Given that prior studies analyzing CFOs have found inconsistent results and that non-CEO/CFOs have not been individually analyzed in this context, this is an empirical question.

I perform several tests to examine the association between equity incentives and committing fraud. First, I compare the equity incentives of executives named and not named as fraudsters in SEC investigations within fraud firms. The results indicate that the executives who commit the fraud have significantly stronger equity incentives than their within-firm peers who

[1] For example, CEO delta has a correlation coefficient with delta for non-CEO/CFO executives of 0.50. CFO delta has a correlation coefficient with delta for other non-CEO executives of 0.30. These correlations are presented in Internet Appendix Table 1.

did not the commit fraud. The results are significant for CEOs and non-CEOs, and when measuring equity incentives estimating wealth sensitivity to stock price or stock price volatility. I perform two additional sets of tests to analyze whether equity incentives are stronger for executives implicated in frauds compared to peers in non-fraud firms. First, I form a size, industry, and year matched sample of fraud and non-fraud firms and find that the executives implicated in the fraud have significantly stronger equity incentives than executives in non-fraud firms. However, the equity incentives of executives not implicated in the fraud are no different than those of the control group. Second, in unmatched samples I find that CEOs, CFOs, and other executives implicated in frauds have stronger equity incentives than executives in the same roles at non-fraud firms.

Next, I attempt to replicate specific results from five prior studies (Erickson et al. 2006, Armstrong et al. 2010, Feng et al. 2011, Armstrong et al. 2013, and Johnson et al. 2009). The five studies all measure misreporting using SEC investigations' data and use matched samples of non-fraud firms for a portion of their analysis, so methodological differences are relatively few. However, the results from these studies do not consistently indicate whether there is an association between equity incentives and fraud. Following the approach outlined in each study, I am able to replicate the results in four of the five studies (Johnson et al. 2009 is the exception). Next, I modify the analysis to consider the equity incentives of only those executives the SEC has implicated in the fraud. When specifications are re-estimated analyzing these named executives, I find a positive and significant association between equity incentives and fraud in each sample.

Finally, based on these results I construct two firm-level measures of equity incentives that may be more powerful in identifying firm-level fraud risk. The first measure takes into consideration that any of the firm's top executives may perpetrate fraud and identifies the executive with the strongest within-firm, equity-rank adjusted equity incentives. This measure is positively

associated with fraud in unmatched sample analysis. The second measure takes into consideration that multiple executives within the firm are often implicated in fraud cases and identifies the number of executives within the firm with relatively strong equity incentives. The results suggest that fraud risk increases significantly once at least three members of the top management team have relatively strong equity incentives.

This paper contributes to the literature in several ways. First, it provides evidence that equity incentives from both firm-based wealth sensitivity to changes in stock price and changes in stock price volatility are associated with reporting fraud. This association is significant for CEOs, CFOs, and other top executives. Little is known about what motivates fraudulent reporting by non-CEO/CFOs and research comparing CEOs and CFOs finds inconsistent results. Second, the results suggest that analysis of fraud at the executive level provides stronger identification and higher-powered statistical tests of the association between equity incentives and fraud. This refinement may benefit future research through: more accurate measurement of involvement in fraud; the inclusion of firm fixed effects to control for unobservable endogenous covariates; and a larger sample for analysis of 1,800 executives with nearly 700 executives implicated in fraud. Third, the firm-level analysis suggests that incorporating data measuring the equity incentives of all top executives may prove valuable in measuring firm-level fraud risk more precisely in future studies.

2. Equity Incentives and Financial Reporting Risk

The theoretical links between equity compensation and reporting risk are well developed.[2] Tying the manager's wealth to the firm's performance is one way of addressing the agency conflict

[2] My study analyzes financial reporting fraud. The literature has examined fraud, restatements, and legal earnings management. So, when discussing the literature, I refer more generally to misreporting or reporting risk. It is not clear whether my results generalize to less egregious forms of misreporting.

between managers and owners by strengthening the manager's incentive to exert costly effort to improve firm performance. However, the manager can also inflate firm performance artificially by manipulating financial statements. To the extent that equity incentives promote informed risk taking in operating decisions, they can also promote risk taking in reporting decisions (Benmelech et al. 2010). The prediction that equity incentives are associated with reporting risk is consistent with the model of criminal behavior presented in Becker (1968), who argues that individuals rationally trade off the expected benefits of criminal activity with the expected penalty and the probability of detection. Holding the expected costs constant, managers with more firm-based wealth are predicted to be more likely to manipulate financial statements.

However, results from prior studies are mixed, with researchers finding positive, negative, or no association between equity incentives and misreporting. Several possible explanations for inconsistent results have been proposed, including differences in research design, measurement of misreporting, measurement of equity incentives, and which executives are analyzed.

For example, Armstrong et al. (2013) note that studies using a regression design (e.g. Cheng and Warfield 2005; Larcker et al. 2007) are more likely to find a significant association than studies using a matched pair design (e.g. Baber et al. 2007; Harris and Bromiley 2007). Another possible explanation is differences in measurement of reporting risk. Research analyzing restatements (e.g., Burns and Kedia 2006; Efendi et al. 2007) documents significant associations more often than research analyzing SEC Accounting and Auditing Enforcement Releases (e.g., Erickson et al. 2006; Armstrong et al. 2010). It may be that equity incentives are associated with certain forms of misreporting but not others. A third possibility is that certain forms of equity are associated with reporting risk while others are not. For example, Burns and Kedia (2006) find a positive association between misreporting and incentives from stock options while Johnson et al.

(2009) fail to find such an association and instead find a positive association between misreporting and incentives from unrestricted stock. Armstrong et al. (2013) argue that the directional prediction between reporting risk and an executive's portfolio delta is ambiguous but that the theoretical association between portfolio vega and reporting risk is strictly positive. They argue that while incentives to increase or maintain stock price can manifest from common shares or stock options, the increased risk of price decreases upon detection creates opposing incentives from share ownership that are generally not present in options. They find a positive association between vega and misreporting but no association with delta when both are included in the same model.

Still, academics find conflicting results even in similarly designed studies. For example, in matched sample analysis, Erickson et al. (2006) find no association between delta and misreporting, while Feng et al. (2011) find such an association for CEOs (but not CFOs). Armstrong et al. (2010) find evidence of a negative association between CEO delta and misreporting while Armstrong et al. (2013) find no association between misreporting and delta but a positive association between misreporting and vega.

Another possibility is that equity incentives are associated with misreporting by executives in certain roles, but not all executive roles. The literature focuses on CEO equity incentives; 14 of 17 studies analyzing the association between equity incentives and misreporting summarized in Appendix A and Internet Appendix Table 2 do not consider the equity incentives of any individual other than the CEO (three of these studies take an average of the top 5 paid executives). Two of the studies that consider equity incentives of other executives find conflicting results. Feng et al. (2011) find a positive association between delta and misreporting for CEOs but not for CFOs while Jiang et al. (2010) find the opposite, a positive association for CFOs and no association for CEOs. Focusing on CEO incentives is potentially limiting because CEOs are implicated in reporting fraud

cases in 56 percent of fraud firms with compensation data available through Execucomp. One explanation for mixed results in prior research is that different samples have different proportions of executives who perpetrate fraud.

Finally, any association between equity incentives and misreporting might simply be weak. In conducting multiple interviews with former executives who are convicted felons, Soltes (2016) finds that white-collar criminals may not always compute costs and benefits before breaking the law and instead appear to act quickly on intuition. Most of his interviewees felt that their behavior was illogical. Soltes (2016) cites a large literature in psychology and sociology, as well as historical evidence, that deviant behavior is often inconsistent with rational assessments of net benefits. Further, evidence in the insider trading literature (e.g. Bhattacharya and Marshall 2012) and in SEC Litigation Releases suggests that wealthy executives break insider trading laws for relatively small illegal profits (often under $50,000). The choice to manipulate financial statements may not always result from a rational net benefits analysis and because of this, some executives in misreporting samples may not be heavily influenced by their equity holdings.

An advantage of analyzing fraud at the executive level instead of the firm level is that a more precise treatment group of executives who perpetrate fraud can be identified. This is beneficial for several reasons. First, there is evidence that decision making varies depending on an executive's role. Chava and Purnanandam (2010) find that CEO equity incentives are associated with firm leverage and cash balances but find no such associations for CFO equity incentives. CFO equity incentives are instead associated with debt maturity and earnings smoothing. Kim et al. (2011) find that CFO delta is positively associated with crash risk, but that CEO delta is not. Hambrick and Wowak (2010) find that individual traits prompt different responses to incentive packages and that incentive compensation and executive traits work in tandem to affect firm

performance. As it relates to reporting risk, Friedman (2014) develops a model demonstrating that CEOs can influence CFOs to bias the firm's financial statements. Feng et al. (2011) make the same argument and find that CEO equity incentives are associated with fraud, but CFO equity incentives are not. In sum, prior research has found that CEOs and CFOs respond differently to equity incentives, has provided an alternative hypothesis for why CFOs become involved in reporting fraud, and has reported conflicting results regarding whether CEO or CFO equity incentives are associated with fraud. There is empirical evidence that an association between fraud and equity incentives may not be significant for different executive roles, but prior research has yet to comprehensively examine the equity incentives of executives by role and by whether they perpetrate the fraud.

Prior studies have found that executive traits are associated with financial misreporting. For example, Davidson et al. (2015) find that both CEOs and CFOs who have broken laws in their personal lives are more likely to commit fraud. Jia et al. (2014) find that CEO facial masculinity (a proxy for adolescent testosterone exposure) is associated with fraud and that within fraud firms, CEOs and CFOs with higher facial masculinity are more likely to be implicated in fraud.[3] Ham et al. (2017) find that CFO narcissism is associated with accounting restatements but that CEO narcissism is not. Ham et al. (2017) note that they cannot perform true within-firm analysis because of data limitations. These studies suggest that fraud research at the executive level is informative and that associations that hold for CEOs may not hold for non-CEOs and vice versa. The studies

[3] The within-firm analysis is limited to 29 firms. In larger sample analyses, Jia et al. (2014) find that CEO facial masculinity is associated with fraud risk when controlling for CFO facial masculinity; CFO facial masculinity is not associated with fraud risk in this analysis.

also highlight the potential increase in within-firm variation and potentially more powerful tests possible with executive-level analysis of a larger sample of executives at fraud firms.

Another benefit of executive-level analysis and identification of implicated executives is that accumulated equity and equity incentives can vary significantly across executives in the same firm. CEO equity incentives are often not a representative proxy for the equity incentives of other executives. Therefore, it is not only possible that executives will respond differently to similar levels of equity incentives based on their role, but also that executives in different roles have different levels of equity incentives. Compensation contracts are a negotiation between the firm and executive. Hermalin and Weisbach (1998) posit that an executive's negotiating power is related to the board's perception of the executive's ability relative to potential successors. Dow and Raposo (2005) note that executive compensation is renegotiated every year, creating differences over time. Page (2018) finds that executive traits are the primary determinant of pay. Francis et al. (2014) find that female CEOs receive less equity-based compensation and tie this to risk aversion. Further, despite explicit and implicit holding requirements, executives may manage their firm-based equity portfolios differently based on liquidity needs, diversification preferences, and risk aversion. Regarding specific differences across executive role, Aggarwal and Samwick (1999) find that the relation between pay for performance sensitivity and firm volatility is significantly different for CEOs and non-CEOs, while Gore et al. (2010) find that CFOs receive less incentive-based compensation when the CEO has a financial background.

Finally, only Hopkins et al. (2015) examine the association between compensation and reporting risk for non-CEO/CFOs. They find that having the General Counsel as one of the top 5 paid executives in the firm is positively associated with proxies for legal earnings management, but negatively associated with accounting restatements, suggesting an unclear association between

equity incentives and fraud for non-CEO/CFOs. While non-CEO/CFOs are implicated in fraud cases at a lower rate, there are still 1,184 non-CEOs/CFOs with compensation data at sample fraud firms with 312 of them implicated in frauds. Analyzing all top executives can provide insight into whether equity incentives are associated with fraud across executive roles.

In sum, while the association between equity incentives and reporting fraud has been examined, there is little consistency in the empirical evidence. One possible reason for this mixed evidence is that prior research has not analyzed the equity incentives of the specific executives who are implicated in fraud cases. Prior research finds evidence that executives in different roles respond differently to equity incentives, and equity incentives can vary considerably across executives in the same firm. I predict that there is a positive association between executive-level equity incentives and perpetrating reporting fraud. I predict that this association is significant for incentives related to wealth sensitivity to changes in stock price and changes in stock price volatility and that the results will be significant across the top 5 paid executives. However, this hypothesis is not without tension. It is possible that analyzing executives implicated in fraud may indicate that certain equity incentives are associated with fraud while others are not, or that the association is significant for executives in certain roles but not for all roles. Specifically analyzing fraud perpetrators should provide insight into these possibilities as well.

3. Sample and Summary Statistics

3.1. Sample

I use SEC Accounting and Auditing Enforcement Releases (AAERs) to create a sample of financial reporting fraud (hereafter fraud) firms. These releases summarize a subset of SEC investigations. To collect the sample, I read 4,192 AAERs released between April 15, 1982 and

October 29, 2020. Firms are only included in the sample when the following can be determined: whether the firm's financial statements were materially misstated; the year the fraud began; and the names of those who committed the fraud.

AAERs offer several advantages compared to other proxies for fraud. First, it is clear whether managers of firms in the AAER sample intentionally manipulated the firm's financial statements. Second, AAERs describe the charges brought against specific members of the management team, which is necessary for my identification strategy. Amiram et al. (2018) note that while samples based on SEC investigations will contain type II errors, the likelihood of type I errors is relatively small. As a result, samples based on SEC data will contain the most egregious misstatements (i.e., fraud) and exclude firms with legally managed earnings. That said, AAERs only document manipulations that are detected and enforced and the SEC does not always release an AAER after finding a firm has materially manipulated financial statements. An advantage of within-fraud firm analysis is that it does not rely on firm-level matches with control firms that may have undetected fraud. Other proxies used in the literature do not implicate specific executives within the firm, so despite AAERs' limitations, they are the best option to analyze executive-level involvement in fraud.

Table 1, Panel A provides details regarding sample construction. Over one third of AAERs make no mention of reporting fraud and over one quarter of AAERs are related to a fraud event documented in another AAER. Nearly 20 percent of AAERs that indicate fraudulent reporting do not have data available from common databases (e.g., Compustat, CRSP) or CIK numbers to link to SEC filings. The final sample consists of 404 fraud firms and 1,805 executives who were at the firms the year when the fraud began and have available compensation data. Table 1, Panel B provides more information about executive involvement in fraud. The SEC named 37 percent of

all top 5 paid executives, 60 percent of CEOs, and 55 percent of CFOs in these firms as perpetrators of fraud.[4] Over 300 non-CEO/CFO top 5 paid executives are implicated in fraud cases. So, while these executives are involved in fraud at a significantly lower rate than CEOs or CFOs, they still comprise 46 percent of named executives in the sample. Among these other named executives, 38 are listed as the COO, 90 as an Executive Vice President, 41 as a Senior Vice President, and 55 as a Vice President. Beyond that, no specific role appears often in the sample.

While AAERs clearly denote who was implicated in the fraud, the sample construction still involves judgement. Consider the fraud at Vitesse Semiconductor.[5] The case implicates CEO Louis R. Tomasetta, CFO Eugene F. Hovanec, Controller Yatin D. Mody, and Director of Finance Nicole R. Kaplan. The fraud began in 1995 and involved the CEO and CFO who initiated a large options backdating scheme. As a result, Vitesse failed to record compensation expense of $184 million during fiscal years 1995-2005 and in some years overstated pretax income (or understated loss) by up to 45%. The AAERs also note that beginning in September 2001, Tomasetta and Hovanec engaged in revenue recognition fraud via channel stuffing that involved two additional employees – Mody and Kaplan. This fraud continued through April 2006. I treat 1995 as the first year of the fraud and treat Tomasetta and Hovanec as named perpetrators of the fraud. As neither Mody nor Kaplan were involved in the fraud when it began (Kaplan was not even employed at the firm until 1998), they are not included as named perpetrators. The Vitesse case is extreme in that certain employees became involved in the fraud six years after it began (the average fraud lasts for approximately three years). This study examines the association between equity incentives and

[4] CFOs are top 5 paid executives in 53 percent of fraud firms. CFOs are implicated in 58 percent of fraud firms in which they are not top 5 paid executives.

[5] Links to AAERs, Litigation Releases, and DEF 14A filings for all frauds discussed in the paper are provided in Internet Appendix Table 3.

fraud at the time the fraud began, and therefore does not provide insight into why executives may join others years later in continuing fraud.

Nearly half of sample frauds include only one implicated top 5 paid executive and a majority include either one or two implicated executives. However, there are still 52 sample firms for which three or more top paid executives are implicated in the fraud. For example, the fraud at Brooke Corporation that began in 2007 involved six senior officials, including the CEO, CFO, and several Executive Vice Presidents. In this case, the senior officials pledged the same loans as collateral to multiple lenders, falsified loan performance reports, understated loan loss reserves, and failed to write down residual interests in credit facility assets. In this case, the only top 5 paid executive not implicated in the fraud was James H. Ingraham, the company's General Counsel and Secretary. Two executives implicated in the fraud, Michael S. Lowry and Travis W. Vrbas, are not included in my sample because they were not top 5 paid executives and compensation data are not available for them.

As noted above, non-top 5 paid executives are also implicated in fraud cases, but are not included in my sample because compensation data are often unavailable.[6] In the 404 sample fraud firms there are 263 non-top 5 paid executives implicated in the frauds.[7] While this suggests that the SEC is not targeting executives based on their compensation levels, it highlights that there are limits to what can be analyzed with executive-level compensation data. As such, I analyze variation in equity incentives among the top 5 paid executives but the results may not generalize to lower-ranked and compensated employees.

[6] Some firms occasionally disclose compensation information for six or seven executives. Results are not sensitive to the inclusion/exclusion of these executives.

[7] Most implicated non-top 5 paid executives are employed as Executive Vice Presidents, CFOs, or Controllers. Controllers are rarely implicated in cases that do not also involve either the CEO or CFO.

Table 1, Panel B also provides data on the number of fraud firms with certain combinations of named executives. For example, there are 55 cases in which the CEO is the only top 5 paid employee implicated in the fraud; there are 46 such cases for CFOs. Of note, there are 104 cases, representing 26 percent of sample firms, in which neither the CEO nor CFO are implicated in the fraud, suggesting that there are many fraud cases in which analyzing only CEO or CFO data may not provide strong insights. There is little information in the literature regarding why non-CEO/CFOs become involved in fraud or if their involvement is associated with equity incentives. One such fraud occurred at aaiPharma Inc., starting in the third quarter of the firm's fiscal year 2003. The fraud was perpetrated by David M. Hurley, who was an Executive Vice President and the President of the firm's pharmaceutical division. Hurley arranged four fraudulent sales transactions made on consignment but instructed employees to prepare invoices stating that the sales were final, and that payment was due within 60 days. As a result of these fraudulent transactions, aaiPharma overstated revenue in 2003 by $28.3 million, which was more than 10 percent of the firm's total revenue for the year.

3.2. Summary Statistics

I collect compensation data from definitive proxy statements (filing DEF 14A) available from the SEC. Specifically, all person-level data necessary to calculate an executive's portfolio delta and vega are collected. Popular subscription databases (e.g., Execucomp, Equilar) also provide compensation data, but exclude approximately two hundred fraud firms with available data. Hand collecting this data generates a sample with 1,805 executive fraud-year observations.[8]

[8] To verify the accuracy of the hand collected data, I compare data for executives in the sample who also have data available through Execucomp and calculate equity incentives for those executives following Coles et al. (2013). I find that the correlation coefficients for delta and vega for these executives are 0.98 and 0.99, respectively.

Following Core and Guay (2002), I calculate *Delta* as the portfolio delta, defined as the (risk-neutral) dollar change in the value of an executive's equity portfolio for a one percent change in the firm's stock price. The value of stock and restricted stock is assumed to change dollar-for-dollar with changes in the price of the stock. The value of stock options is assumed to change according to the option's delta, which is the derivative of its Black-Scholes value with respect to the price of the underlying stock. Following Core and Guay (2002), I calculate *Vega* as the dollar change in the value of an executive's equity portfolio for a one percent change in the firm's stock price volatility. Formal definitions are provided in Internet Appendix Table 4. I calculate *Delta* and *Vega* based on equity held at the beginning of the year the fraud began (compensation data are provided on an annual basis). I use stock price at the beginning of the fiscal quarter the fraud began. In some cases (e.g., the Vitesse case described above) AAERs only note the year the fraud began and not the quarter, or do not distinguish between fiscal and calendar quarters. In these cases, I use stock price at the beginning of the year the fraud began.

Table 2, Panel A, presents summary statistics for *Delta* and *Vega* for executives at fraud firms. Named CEOs, CFOs, and other top 5 paid executives have significantly higher deltas and vegas than non-named executives. The distributions of *Delta* and *Vega* are right skewed, with mean values that are significantly larger than median values.[9] But the differences between named and non-named executives do not appear to be driven solely by extreme values in the named executive sample. Named executives have stronger equity incentives at the 25th percentile, the median, and the 75th percentile across executive roles. Not surprisingly, CEOs have stronger equity

[9] All continuous variables utilized in this study are winsorized at the 1 and 99 percent levels.

incentives than non-CEOs. CFOs have weaker equity incentives at the mean than other non-CEOs, but they are nearly the same at the median.

Table 2, Panel B, provides summary statistics for firm-level control variables for fraud and non-fraud firms matched by size (total assets) and industry (2 digit SIC code) at the beginning of the year reporting fraud begins. Fraud firms are significantly different in many ways; they are younger, have lower market capitalizations and return on assets, and have higher leverage, growth, accounts receivable, and financing needs. Table 2, Panel C, provides values for executive-level variables for all fraud and non-fraud firm executives. Data were collected from Boardex and supplemented with information in proxy filings for the fraud firm executives to compute these variables. Data were available for 65 percent of fraud firm executives and 50 percent of non-fraud firm executives. Fraud firm executives are statistically more likely to be male, are less likely to hold an MBA degree, have less education, and are younger. All variables are defined and data sources listed in Appendix B.

4. Empirical Analysis

4.1. Within-Fraud Firm Analysis

I test the prediction that executives with stronger equity incentives are more likely to commit fraud by estimating logistic regressions with firm fixed effects of the following form: [10]

$$Named_{i,j} = \alpha + \beta_1 Delta_{i,j} + \beta_2 Vega_{i,j} + \beta_3 CEO_{i,j} + \beta_4 CFO_{i,j} + Firm\ FE + \varepsilon_{i,j} \qquad (1)$$

[10] In this sample with multiple executives and one year of data per firm, logistic regressions with firm fixed effects produce virtually identical results as conditional logistic regressions. Standard errors are bootstrapped.

The dependent variable, *Named,* is an indicator variable equal to 1 if executive *i* was implicated in fraud at firm *j,* and 0 otherwise. *Delta* and *Vega* are as defined in Section 3.[11] *CEO* is an indicator variable equal to 1 for CEOs, and 0 otherwise; *CFO* is an indicator variable equal to 1 for CFOs, and 0 otherwise.[12] The model is estimated including all top 5 paid executives at the firm at the beginning of the first fraud year.

Table 3 presents the results. *Delta* and *Vega* are both positively associated with perpetrating fraud.[13] To assess the economic significance of the results, I estimate the marginal effects and find that a one standard deviation increase in *Delta* (*Vega*) is associated with a 12 (16) percent increase in the likelihood of perpetrating fraud.[14] The results are of similar statistical and economic significance when excluding the CEO (column 2), CFO (column 3), or controlling for both roles (column 4), suggesting that the results are not driven solely by the executive who generally has the strongest equity incentives (CEO) or the two executives who most often perpetrate fraud.[15]

Prior research has found that executive characteristics and demographics are associated with fraud. Schrand and Zechman (2012) collect demographic information for 75 executives at

[11] Results are robust to other measures of equity incentives used in prior studies including *Gamma* (Burns and Kedia 2006), and *Incentive Ratio* (Bergstresser and Philippon 2006) and are presented in Internet Appendix Table 5.

[12] In firms without a CFO as a top 5 paid executive I treat the following roles as the CFO: Treasurer, Controller, Senior Vice President – Finance, Executive Vice President – Finance. Results are not sensitive to this choice.

[13] Prior research (e.g., Efendi et al. 2007, Burns and Kedia 2006) also models the association between components of equity incentives (shares, unexercisable options, and exercisable options) and misreporting. Results analyzing the components of *Delta* and *Vega* separately are significant for each component. When all components are included in the regression the results are strongest for incentives from unexercisable options. Results are presented in Internet Appendix Tables 6 and 7.

[14] The marginal effects are computed for both *Delta* and *Vega* at the mean. The regression is not linear and the magnitude of the association between *Delta* or *Vega* and fraud may not be constant across the distribution. I estimate marginal effects for both *Delta* and *Vega* at the 25th percentile, median, and 75th percentile as well. Depending on the point in the distribution at which marginal effects are estimated, a one standard deviation increase in *Delta* (*Vega*) is associated with an increase in the probability of committing fraud of between 10-13 (15-17) percent.

[15] There are fewer observations when excluding the CEO or CFO because in some cases they are the only executive implicated in the fraud and excluding them eliminates within-firm variation.

fraud firms and document differences in tenure, education, CPA licensure, and whether the executive was a founder of the firm for executives implicated in fraud. To incorporate these findings, I collect data to compute variables capturing the executive's gender, education, work experience, founding family status, and age.[16] I re-estimate equation (1) including these variables and present the results in column 5 of Table 3. The coefficients on *Delta* and *Vega* remain positive and statistically significant at the 0.05 level with coefficient estimates that are slightly larger than those reported in columns 1 through 4. Additionally, I find that executives with an MBA degree, a CPA license, and who are younger are more likely to be implicated in fraud.

Table 4 presents results from four robustness tests of the baseline results presented in Table 3. Friedman (2014) develops a model under which powerful CEOs pressure CFOs to manipulate financial statements. Consistent with that model, Feng et al. (2011) find that CEO equity incentives are associated with fraud but that CFO equity incentives are not. Even in cases where CFOs, or more broadly all non-CEOs, have strong equity incentives it is possible that these executives face pressure from the CEO to participate in the fraud. If this is true, then results for non-CEOs may be concentrated in firms in which the CEO commits fraud and pressures other executives to assist. To address this possibility, I re-estimate equation (1) for the subset of fraud cases that do not involve CEO misconduct and exclude CEOs from the regression. The implicit assumption is that if the CEO is not implicated in the fraud, then it is unlikely that he or she coerced others to commit fraud. The results are presented in column 1; both *Delta* and *Vega* are positively associated with committing fraud for non-CEOs in fraud cases not involving CEO misconduct.[17]

[16] Schrand and Zechman (2012) also include information on the executive's tenure. This information is available far less often for non-CEOs.

[17] Since none of the CEOs in this subsample are named in AAERs, their inclusion in the regression generates a theoretical coefficient of negative infinity for the CEO indicator (the estimated log odds were negative 31). The other coefficients are unchanged when CEOs are included and the regression is estimated this way.

Prior research examining the association between equity incentives and fraud has focused predominately on CEOs and finds mixed results. Given these findings, one possibility is that the association between equity incentives and fraud is relatively weaker for CEOs than for non-CEOs. To test this possibility, I re-estimate equation (1) including only named and non-named fraud firm CEOs. Firm fixed effects are excluded as the regression now has one observation per firm. The results are presented in column 2 and indicate that named CEOs have stronger equity incentives measured by both delta and vega than do non-named fraud firm CEOs.

The last two columns of Table 4 present results analyzing whether the Sarbanes Oxley Act (SOX) has a moderating effect on the association between equity incentives and fraud. SOX was enacted to protect stakeholders from reporting errors and fraud and prior research finds that the dollar magnitude of frauds decreased after the passage of SOX. It is possible that equity incentives are no longer associated with fraud in the post-SOX economy. If this is true, then at least with respect to fraud risk, boards may have little need to deviate from otherwise desirable compensation contracts that include large equity grants. Of the 17 studies summarized in Appendix B and Internet Appendix Table 2, 12 do not analyze frauds beginning after 2003 (SOX was enacted on July 30, 2002). Only Jiang et al. (2010) has explicitly examined the association between equity incentives and reporting risk in the post-SOX period; the authors fail to find an association between equity incentives and reporting risk since the passage of SOX.

To examine the potential moderating effect of SOX, I re-estimate equation (1) and include the variable *Post*, an indicator variable equal to 1 for frauds that began after August 29, 2002 (the date Section 302 of SOX was enacted), and 0 otherwise, and interaction terms *Delta * Post*, *Vega * Post*, *CEO * Post*, and *CFO * Post*. The results in column 3 of Table 4 suggest no difference in the association between equity incentives and fraud for top executives who perpetrate fraud in the

pre- and post-SOX periods. The coefficients for *Delta* and *Vega* remain statistically significant and the interaction terms *Delta * Post* and *Vega * Post* are not significantly different from 0. The results suggest that the association between equity incentives and fraud did not change post SOX.[18] Section 302 of SOX explicitly requires CEOs and CFOs to personally attest to the accuracy of annual financial statements. This requirement significantly increased the cost of reporting failures for CEOs and CFOs relative to other top executives in the firm. With this in mind, it is possible that the association between equity incentives and fraud is relatively weaker for CEOs and CFOs compared to other executives post SOX. To test this, I re-estimate equation (1) including only CEOs and CFOs and include *Post* and the interaction terms *Delta * Post* and *Vega * Post*. The results are presented in column 4 of Table 4 and indicate that the association between equity incentives and fraud did not significantly change for CEOs or CFOs post SOX. Even in the post-SOX regulatory environment, equity incentives remain positively associated with fraud for the executives who face the highest expected cost from detection.[19]

The results indicate that within fraud firms, executives with stronger equity incentives are more likely to be implicated in the fraud. While the results are consistent with the interpretation that executives perpetrate fraud in part because of concerns over their firm-based wealth, the analysis is unable to establish causality. One alternative explanation is that executives with stronger equity incentives are implicated in fraud cases more often because the SEC targets firms or executives based on high levels of firm-based wealth. For this to be the case, one of three things needs to occur. One, the SEC targets firms for investigation because executives in these firms have

[18] Jiang et al. (2010) examine generally legal forms of earnings management. It is not clear why any change in the association between equity incentives and misreporting post SOX would be observed in estimates of legal earnings management but not in cases of fraud, but the results must be considered with this in mind.

[19] SOX may have reduced the probability that executives commit fraud without affecting the association between equity incentives and fraud.

higher levels of firm-based wealth. I cannot rule out this possibility, but an advantage of my research design is that the unit of observation is the executive, not the firm, and it exploits variation in which executives are implicated within the fraud firm. This disentangles the decision to pursue a fraud investigation from the individuals implicated conditional on finding fraud. As a resource constrained entity, the SEC may avoid investigating or prosecuting certain potential frauds for a variety of reasons, but that should not influence the within-firm variation in equity incentives across executives for the cases that are pursued.

Two, the data may contain false negatives if the SEC less aggressively pursues cases against specific executives with less firm-based wealth when there is evidence of their guilt. This also cannot be ruled out, but as discussed in Section 3, there are over 260 non-top 5 paid executives implicated in the sample fraud cases. Given that in all of these cases, at least one top 5 paid executive was also implicated, it doesn't appear that conditional on finding evidence of fraud the SEC ignores evidence related to specific executives' involvement on the basis of their firm-based wealth. In the Vitesse fraud the AAERs note that Yatin Mody and Nicole Kaplan received reduced penalties because of their cooperation in the investigation, but the AAERs still fully describe their involvement in the fraud. This suggests that even when executives with weaker equity incentives cooperate and receive leniency in judgments (and when their involvement in the fraud began six years after the more senior executives who initiated the fraud), the SEC still pursues charges in court and the AAERs still provide information on these individuals' involvement in fraud.

Three, the data may contain false positives if executives with the strongest within-firm equity incentives are falsely convicted of fraud. There is little evidence suggesting that corporate executives are falsely convicted of fraud, and in many cases the evidence described in the AAERs

is thorough and clearly indicates the actions taken by specific executives.[20] In the Vitesse case the evidence provided includes fabricated cash receipts provided by the CEO and CFO to auditors, fabricated meeting minutes provided by the CEO and CFO to the board of directors, and sworn testimony from two other former employees involved in the fraud.

4.2. Matched Sample Analysis

Comparing the equity incentives of the executives who do and do not commit fraud within fraud firms allows for the inclusion of firm fixed effects and controls for unobservable covariates that potentially affect the probability of committing fraud and the strength of equity incentives. However, the analysis is conditional on fraud occurring and therefore does not answer whether the equity incentives of fraud perpetrators are stronger than the equity incentives of executives at non-fraud firms. To address this question, I follow prior research (Armstrong et al. 2010; Denis et al. 2006; Erickson et al. 2006) and create a size (total assets), industry (2 digit SIC code), and year (year prior to fraud) matched sample of fraud and non-fraud firms and estimate the following logistic regression in event time for all top 5 paid executives at these firms:

$$Fraud_{i,j} = \alpha + \beta_1 Delta_{i,j} + \beta_2 Vega_{i,j} + \beta_{3-17} controls_{i,j} + Industry\ FE + \varepsilon_{i,j} \qquad (2)$$

As with equation (1), the model is estimated at the executive level and includes all top 5 paid executives at the firm at the beginning of the fraud year (match year in the case of non-fraud firms). All variables are measured as of the beginning of the fraud year. The dependent variable, *Fraud*, is an indicator variable equal to 1 for executives at fraud firms, and 0 otherwise. *Delta* and *Vega*

[20] Former Enron CEO Kenneth Lay had his conviction overturned due to *abatement ab initio,* a doctrine under which the death of the defendant during an appeal results in a vacated judgement. Related to the Enron fraud, in Arthur Andersen LLP v. United States, the U.S. Supreme Court overturned Andersen's conviction for obstruction of justice on the basis that the jury instructions did not properly portray the crime Andersen was charged with.

are as defined above. I estimate three versions of equation (2). In the first specification, similar to prior research, I do not differentiate between named and non-named executives at fraud firms; all executives are included in the regression. In the second (third) specification I only include the executives at the fraud firm who are implicated (not implicated) in the fraud and executives at the matched non-fraud firm matched by accumulated equity rank. For example, in the reporting fraud at Aerosonic Corporation, CEO John M. Nabors and CFO Eric J. McCracken were implicated by the SEC. They ranked first and fourth in accumulated equity in the year prior to the fraud. Both are included in the second specification, which includes executives from the matched non-fraud firm who were ranked first and fourth in accumulated equity. David A. Baldini, P. Mark Perkins, and William C. Parker were the other top 5 paid executives at Aerosonic and were not implicated in the fraud. They are included in the third specification along with the executives ranked second, third, and fifth by accumulated equity at the matched non-fraud firm. To control for potentially endogenous covariates, I include firm-level control variables drawn from the prior literature in all specifications.[21] These variables are defined in Appendix B. The regressions also include industry (2 digit SIC code) fixed effects to control for industry-level factors that could influence the association between equity incentives and fraud.

The results are presented in Table 5. When comparing all fraud and non-fraud firm executives (column 1) the coefficient on *Delta* is not significant and the coefficient on *Vega* is positive and significant at the 0.10 level. However, when isolating the equity incentives of the executives who commit fraud (column 2), the coefficients on *Delta* and *Vega* are both positively associated with fraud at the 0.01 level and are more than three times larger than those reported in

[21] Executive-level control variables are not included in these regressions because data were not always available for all executives at fraud firms and when available, often missing for the equity-ranked matched executives at non-fraud firms, resulting in a much larger loss of matched pairs than individual executives.

column 1. I observe no difference in the equity incentives of non-named fraud-firm executives and executives at non-fraud firms (column 3).[22] The results suggest that wealth sensitivity to changes in stock price and changes in stock price volatility are associated with fraud.

4.3. Unmatched Sample Analysis

Prior studies also analyze unmatched samples including misreporting firms and the rest of the sample population (e.g., Cornett et al. 2008; Cheng and Farber 2008). While matching can theoretically find a similar control firm to compare with the treatment firm, given the difficulty in identifying fraud it is not clear how well-matched control firms are on important characteristics. In order to investigate whether the results for named executives remain significant when analyzing unmatched samples, I estimate the following Cox proportional hazards model:

$$Fraud_{i,j,t} = \alpha + \beta_1 Delta_{i,j,t} + \beta_2 Vega_{i,j,t} + \beta_{3-24} controls_{i,j,t} + Industry\ FE + \varepsilon_{i,j,t} \quad (3)$$

In this model, *Fraud* is an indicator variable equal to 1 for executives at fraud firms at the beginning of the year reporting fraud begins, and 0 otherwise. All other variables are as defined above. As there is no matching on the fraud year in this sample, all years with required data are included in the analysis, but fraud firms are excluded from the model after the fraud begins. As with the matched sample analysis, I estimate three versions of equation (3), one including all executives, one including only named executives in fraud firms and one including only non-named executives in fraud firms. All executives in non-fraud firms are included in each model.[23] All firm-

[22] To specifically compare CEOs who commit fraud to non-fraud firm CEOs, I re-estimate equation (2) for named and non-named CEOs and their counterpart in matched non-fraud firms. The results confirm those presented in Table 5 and are presented in Internet Appendix Table 8. CFOs are top 5 paid executives in 53 percent of sample firms. Therefore, compensation data are often not available for CFOs at either the fraud firm or the matched non-fraud firm. CFO-specific tests are reported in section 4.3 when analyzing unmatched samples.

[23] Excluding either named or non-named executives at fraud firms is the reason for the small decrease in sample size noted in columns 3 through 6. Alternatively, the dependent variable *Fraud* can be replaced by *Named* (or *Non-*

level variables described in Section 4.2 are included in this model as are industry fixed effects. I estimate the model with and without all executive-level control variables described in Section 4.1. The inclusion of executive-level variables decreases the sample size by approximately 40 percent, but still leaves a sample of over 126,000 executive-year observations with nearly 23,000 unique executives to analyze.

The results are presented in Table 6. When including all fraud firm executives (columns 1 and 2), the coefficient estimates for *Delta* and *Vega* are not significantly different from zero. However, both coefficients are positive and significant when including only those executives at fraud firms who are implicated in the fraud (columns 3 and 4). In column 3, the coefficient estimates of 0.028 and 0.003 on *Delta* and *Vega,* respectively, indicate that a one standard deviation increase in either is associated with a 29 percent increase in the probability of being implicated in fraud.[24] When excluding named executives (columns 5 and 6) there is no association between equity incentives and fraud.

An advantage of time-series panel data in this setting is that it permits inclusion of over 206,000 executive-year observations in the model without executive-level control variables. This sample is large enough to examine CEOs, CFOs, and other executives separately. To consider the association between equity incentives and fraud across different executive roles, I re-estimate equation (3) separately for named and non-named CEOs, CFOs, and non-CEO/CFOs. Table 7 presents the results. *Delta* and *Vega* are significantly larger for named CEOs, CFOs, and other executives (at the 0.05 level or better) than for executives at non-fraud firms but are not different

Named, an indicator variable equal to 1 for fraud firm executives who are not implicated in the fraud, and 0 otherwise). The sample size will remain the same across models and the coefficients are virtually unchanged from those presented.

[24] The logarithm of the hazard rate is tabulated as the coefficient estimate.

when comparing executives at fraud firms who did not commit the fraud with executives at non-fraud firms. The results provide evidence that equity incentives are associated with perpetrating fraud for CEOs, CFOs, and non-CEOs/CFOs. The results also provide evidence that both matched and unmatched samples yield similar results when analyzing the equity incentives of those who perpetrate fraud.

5. Replications

In this section I replicate specific tests from five prior studies; these tests report inconsistent results when examining the association between equity incentives and fraud. I then estimate regressions using the equity incentives for named executives to assess whether focusing on those implicated in the fraud provides consistent results following the approach outlined in each study. All five studies analyze AAERs, examine a variant of delta, and construct size, industry, and year matched samples of fraud and non-fraud firms in the tables I replicate.

While the research design is similar across studies in the specific tests I replicate, it is important to note that each paper also has significant differences that my methodology cannot speak to. For example, Armstrong et al. (2013) also test associations between equity incentives and both discretionary accruals and accounting restatements. In neither case are specific executives implicated, so differentiating between executives based on their involvement cannot be done. My replications do not necessarily call into question the theoretical motivation or the broader interpretation of the full set of results in these studies. All replications are tabulated using the format of the original paper and all variables (including controls) are defined in Internet Appendix Table 9. Details of these studies are summarized in Appendix A.

5.1. Replication of Table 5 from Erickson, Hanlon, and Maydew (2006)

The first replication is of Table 5 from Erickson et al. (2006). Following their methodology, I form a size (total assets), industry (2 digit SIC code), and year (year before the fraud began) matched sample of 50 AAER firms and their two closest matched non-fraud firms. Erickson et al. (2006) list the 50 fraud firms examined in their study so the same firms are analyzed in the replication.[25] Erickson et al. (2006) measure firm-level equity incentives by computing the sum of the deltas for all top 5 paid executives and refer to this measure as *Sensitivity.* To test whether equity incentives for named executives are significantly associated with fraud, I compute the sum of the deltas for all named executives and the corresponding non-fraud firm executives matched by accumulated equity rank.

The results from logistic regressions from Erickson et al. (2006), the replication, and analysis of equity incentives of named executives are presented in Table 8, Panel A. The replication produces the same key result, an insignificant coefficient for *Sensitivity*. However, re-estimating the regression using only the equity incentives of named executives produces a positive and statistically significant coefficient for *Sensitivity*.

5.2. Replication of Table 7 from Armstrong, Jagolinzer, and Larcker (2010)

The second replication is of Table 7 from Armstrong et al. (2010). They estimate conditional logistic regressions on a size (total assets), industry (2 digit SIC code), and year (year before the fraud began) matched sample of 131 AAER firms and 131 matched non-AAER firms between 2001 and 2005. After matching my sample of AAER firms to the Equilar compensation

[25] Compensation data for Diagnostek, Inc. were not available from either Execucomp or the SEC. So, the replication includes 147 firms, not 150. Kmart Corporation and Bausch & Lomb Incorporated do not have firm-level data for the relevant year available from Compustat, so accounting variables are collected from SEC 10-K filings. Fabri-Centers of America, Inc. does not have a proxy filing in the fraud year (1992) so data are collected from the 1993 filing which contains the necessary compensation data for 1992.

database, the replication sample has 129 AAER firms. Armstrong et al. (2010) measure equity incentives by ranking delta for CEOs into quintiles. They include several control variables provided in proprietary datasets available from Equilar. I collect this data from Morgan Stanley Capital International or from DEF 14A filings. I replace *Fraud* with *Named* to test whether equity incentives for named CEOs are significantly associated with fraud.

The results from conditional logistic regressions from Armstrong et al. (2010), the replication, and a logistic regression analyzing equity incentives for named CEOs are presented in Table 8, Panel B.[26] Consistent with Armstrong et al. (2010), the replication produces a statistically insignificant coefficient for each of the four equity incentive quintiles, though the coefficient estimate for quintile 2 is positive. When analyzing equity incentives for named CEOs, I find a positive and significant association for quintiles 4 and 5. Moreover, the coefficient estimates for quintiles 4 and 5 are significantly larger than those for quintiles 2 or 3. Moving from the first to the fifth quintile is associated with a 38 percent increase in the probability of perpetrating fraud.

5.3. Replication of Table 4 from Feng, Ge, Luo, and Shevlin (2011)

The third replication is of Table 4 from Feng et al. (2011). Following their methodology, I form a size (total assets), industry (SIC code following Frankel et al. 2002), and year (year before the fraud began) matched sample of AAER firms and the two closest non-AAER firms.[27] Their final sample includes 74 AAER firms while the replication sample includes 76 AAER firms. Feng et al. (2011) measure equity incentives by computing delta for CEOs and CFOs and scaling delta

[26] I cannot estimate a conditional logistic regression for the entire sample using *Named* because the dependent variable for many matched pairs (45 percent) takes a value of 0 for the CEO at both the fraud and non-fraud firm. Results are robust to estimating a conditional logistic regression using the sub-sample of fraud firms with named CEOs and the corresponding CEO of the matched firm.

[27] I use AAERs issued over their defined time period (May 17th, 1982 – June 10th, 2005) and exclude firms for which only quarterly financial statements were manipulated.

by the sum of delta, cash salary, and bonus and refer to this measure as *CEO(CFO) Sensitivity*. I replace *Fraud* with *Named* to test whether equity incentives for named CEOs or CFOs are significantly associated with fraud.

The results from conditional logistic regressions from Feng et al. (2011), the replication, and analysis of equity incentives for named CFOs and CEOs are presented in Table 8, Panel C. Consistent with Feng et al. (2011), I find an insignificant association between *CFO Sensitivity* and fraud and a positive and significant association between *CEO Sensitivity* and fraud. The specification analyzing equity incentives for named CFOs produces a positive and significant coefficient for *CFO Sensitivity*, while *CEO Sensitivity* is insignificant. The specification analyzing equity incentives for named CEOs produces a positive and significant coefficient for *CEO Sensitivity*, while *CFO Sensitivity* is now insignificant.[28]

5.4. Replication of Table 6 from Armstrong, Larcker, Ormazabal, and Taylor (2013)

The fourth replication is of Table 6 from Armstrong et al. (2013). Following Armstrong et al. (2013), I form a size (total assets), industry (Fama-French 48 industry classification), and year (year before the fraud began) matched sample of AAER and non-AAER firms.[29] Their final sample includes 361 AAER firm-years while my sample includes 356 AAER firm-years.[30] Their size and industry matched sample analysis is a test of differences in means and medians across fraud and

[28] Specifications analyzing named executives have fewer observations because a conditional logistic regression requires that the dependent variable differs for the control and treatment firms. Non-named CFOs and matched control firm CFOs both have values of 0 for *Named* (the same is true for CEOs). Results are robust when estimating a logistic regression and including all observations. For this same reason, analyzing CFO involvement in fraud conditional on CEO participation further reduces the sample size when estimating conditional logistic regressions.

[29] Armstrong et al. (2013) analyze firms over the period 1992-2009 and use Execucomp data to compute equity incentives. I therefore construct the sample of AAER firms using all AAERs indicating an overstatement of net income or net assets during this period with available compensation data from Execucomp.

[30] The small difference in sample sizes in the replications could be due to differences in coding firms as fraud firms when hand-collecting data from AAERs.

non-fraud firms. Armstrong et al. (2013) measure equity incentives by taking the natural logarithm of 1 plus the average delta (or vega) for the firm's top 5 paid executives. To test whether equity incentives for named executives are significantly associated with fraud, I analyze the equity incentives of the sub-sample of executives implicated in the fraud by the SEC (and the accumulated equity-rank matched executives in non-fraud firms).

The results from tests of differences in means and medians from Armstrong et al. (2013), the replication, and analysis of implicated executives are presented in Table 8, Panel D. Consistent with Armstrong et al. (2013) I find a significant difference in the mean and median *Vega* between fraud and non-fraud firms. When computing equity incentives using only those executives implicated in the fraud, I find a positive and significant difference in the mean and median values of both *Delta* and *Vega*.

5.5. Replication of Table 5 from Johnson, Ryan, and Tian (2009)

The final replication is of Table 5 from Johnson et al. (2009). Following Johnson et al. (2009), I form a size (total revenue), industry (four digit SIC code; three digit SIC code when no size appropriate match is found), and year (year before the fraud began) matched sample of AAER and non-AAER firms. Their final sample includes 68 AAER firms while my sample includes 80 AAER firms.[31] Johnson et al. (2009) measure equity incentives by disaggregating delta into component deltas from restricted stock, unrestricted stock, vested options, and unvested options. I

[31] Johnson et al. (2009) analyze fraud firms with compensation data available from Execucomp during the years 1990-2005 (they backfill data to 1990 when available). One possible reason for the difference in sample size is whether only possible matches with all available data were considered. I collected data used to compute control variables from Institutional Shareholder Services (ISS), Boardex, and DEF 14A filings and required firms to have necessary data before matching firms. It is possible that Johnson et al. (2009) first matched fraud and non-fraud firms and then lost observations because of data availability.

replace *Fraud* with *Named* to test whether equity incentives for named CEOs are significantly associated with fraud.

The results from conditional logistic regressions from Johnson et al. (2009), the replication, and analysis of fraud firms where the CEO was implicated are presented in Table 8, Panel E. My replication fails to produce the key result from Johnson et al. (2009), a positive and significant coefficient on delta from unrestricted stock. However, when considering the sub-sample of fraud firms for which the CEO is named, I find a positive and significant (0.10 level) coefficient on delta from unrestricted stock and a positive and significant (0.01 level) coefficient on delta from unvested options. While I am unable to replicate the original findings in this table, the results are still consistent with executive-level analysis and differentiating between executives based on whether they were implicated in the fraud producing higher-powered statistical tests.

The attempted replications produce the same key results in four of five cases. In three cases, I fail to find significant associations between equity incentives and fraud. When analyzing the executives implicated in the fraud, I find positive and significant associations between equity incentives and fraud in all five cases. The results suggest that executive-level analysis may provide more statistical power in this setting and that the association particularly between delta and fraud may be more robust than documented in prior studies.

6. Firm-Level Analysis of Equity Incentives and Fraud

The results of executive-level analysis suggest a positive association between equity incentives and committing fraud. However, this methodology relies on the identification of implicated executives and therefore cannot be implemented to measure ex ante firm-level fraud risk. Based on the executive-level results, firm-level variables that incorporate information

regarding the equity incentives of all of the individual members of the top management team may better identify fraud firms or firms with high future fraud risk than do variables measuring the equity incentives of one executive. To assess this possibility, I re-estimate equation (3) at the firm level, replacing *Fraud* with *Fraud Firm*, an indicator variable equal to 1 for fraud firms at the beginning of the year reporting fraud begins, and 0 otherwise, and include two firm-level measures of delta and vega that incorporate insights from Sections 3 through 5.

As noted in Table 1, Panel B, over 300 non-CEO/CFO top 5 paid executives are implicated in fraud cases and the results in Table 7 suggest that non-CEO/CFO equity incentives are positively associated with being implicated in fraud. Prior research has generally not considered the equity incentives of these executives in firm-level analyses. It is possible that fraud risk is higher in firms when *any* executive has relatively strong equity incentives, regardless of their role. To test this, at the firm-level I define *Standardized Delta* (*Vega*) as the highest executive-level standardized delta (vega) within the firm, measured as follows:

$$Standardized\ Delta(Vega)_j = \max_{j \in [n]} \left(\frac{Delta(Vega)_{i,j} - mean\ Delta(Vega)_{year,\,ind,\,rank}}{\sigma Delta(Vega)_{year,ind,rank}} \right) \quad (4)$$

where the subscripts *i* and *j* refer to executive and firm, respectively, while *year*, *ind*, and *rank* refer to the year, industry (measured by 2 digit SIC code), and an executive's within-firm delta (vega) rank, respectively. For example, the delta of an executive with the second highest delta in his or her firm is compared to the mean delta of other executives ranked second in delta in their respective firms in the same year and industry. The results of firm-level estimates of equation (3) with these proxies for equity incentives are presented in Table 9. The coefficient on both *Standardized Delta* and *Vega* is positive and significant. The coefficient estimates indicate that a one standard deviation increase in *Standardized Delta (Vega)* is associated with a 53 (50) percent

increase in the probability of fraud. The results suggest that identifying the executive with the (relatively) strongest equity incentives in the firm may better identify fraud risk than does focusing on a specific executive role.

Table 1, Panel B also notes that 37 percent of all top 5 paid executives are implicated in sample fraud cases and that over half of sample cases involve more than one top 5 paid executive. Based on this, fraud risk may be increasing in the number of executives in the firm with relatively strong equity incentives and firm-level variables incorporating this information may more accurately identify fraud firms. To consider this possibility, I compute the within year, industry, and within-firm delta-(vega) rank percentile rank for all executives. Then, at the firm level, I define *Delta* (*Vega*) *N-X*, as a series of indicator variables equal to 1 if the firm has at least N executives with year, industry, within-firm delta-(vega) ranked deltas (vegas) above the Xth percentile, and 0 otherwise. For example, *Delta 2-90* is an indicator variable equal to 1 if the firm has at least two executives with a year, industry, within-firm delta-ranked delta above the 90th percentile, and 0 otherwise. I estimate separate regressions considering whether the firm has at least 1, 2, 3, 4, or 5 executives above the 95th, 90th, 85th, 80th, 75th, 70th, and 65th percentiles (totaling 35 separate regressions). The results are presented in Table 10. Delta is significantly associated with fraud only when at least three executives have relatively high deltas. Vega is significantly associated with fraud when at least one executive has a vega above the 90th percentile. Moreover, vega is significantly associated with fraud when at least three executives have vegas above the 75th percentile. Firms in which all five executives have relatively high deltas or vegas are more likely to experience fraud across nearly all percentile ranks.[32] The results suggest that at the firm level,

[32] The percentage of firm-years with at least N executives above the Xth percentile is presented in Internet Appendix Table 10. The percentages increase at a fairly consistent rate with each five percent decrease in percentile rank.

fraud risk may increase significantly once at least three executives within the firm have relatively strong equity incentives. The results also suggest that fraud risk may not be linearly increasing in equity incentives and that fraud firms may disproportionately have executives with equity incentives above the 90th percentile.[33]

The results are economically meaningful. The coefficient estimate of 0.511 for *Vega 1-95* translates to a hazard rate of approximately 1.6, suggesting that firms with at least one executive with a vega above the 95th percentile are 1.6 times more likely to be fraud firms. Firms with all five executives with a vega above the 95th percentile are 2.9 times more likely to be fraud firms. At lower percentile ranks, firms with all five executives with vegas above the 85th and 75th percentiles are 1.7 and 1.5 times more likely to be fraud firms, respectively. In comparison, firms with all five executives with deltas above the 95th, 85th, and 75th percentiles are 2.4, 1.7, and 1.7 times more likely to be fraud firms, respectively. Internet Appendix Table 11 tabulates the conditional probability that firm-years with at least N executives above the Xth equity incentive percentile will be fraud years. The raw probabilities are often similar to the hazard rates, though the inclusion of a full set of control variables is meaningful. The unconditional probability that fraud occurred in a random firm-year is approximately 0.9 percent. However, 1.2 percent of firm-years with at least one executive with a vega above the 95th percentile are fraud years. While this is only 0.3 percentage points higher than the unconditional probability, it does represent a 31 percent increase in the probability of fraud. Firms with all five executives with deltas (vegas) above the 95th percentile have a 3.1 (2.6) times greater chance of being fraud firms.

[33] I exclude firms that report compensation information for fewer than five executives as this artificially decreases the probability of having N executives above a percentile equity incentive rank. I also exclude executives ranked sixth or lower in compensation rank, for whom firms occasionally provide data, as this would artificially increase the probability of having N executives above a percentile equity incentive rank.

While the analysis in this section is exploratory, the firm-level measures of equity incentives analyzed in Tables 9 and 10 consider the fact that any top executive, regardless of role, may commit accounting fraud and the fact that in most cases multiple executives are implicated in the frauds. These measures, or future refinements, may prove more powerful in identifying high fraud risk firms and therefore prove valuable to future fraud research.

7. Summary and Conclusions

I examine the association between executive equity incentives and financial reporting fraud. First, I find that in within-firm analysis holding firm-level and environmental factors constant, executives implicated in fraud cases have significantly stronger equity incentives than executives in the same firm who are not implicated in the fraud. This is true whether equity incentives are measured as wealth sensitivity to changes in stock price or as wealth sensitivity to changes in stock price volatility. I find that equity incentives are positively associated with fraud regardless of whether the executive is the CEO, CFO, or holds another role. Second, I find that executives who commit fraud have stronger equity incentives than their peers in non-fraud firms in both matched and unmatched sample analyses. However, non-named executives in fraud firms do not have significantly different equity incentives than their peers in non-fraud firms. Third, I replicate specific tests from five prior studies that all analyze AAERs and use matched sample research designs. When measuring the equity incentives of the executives implicated in the fraud, I find positive, significant, and consistent results for each specification. The results suggest that analyzing the association between fraud and equity incentives at the executive level and focusing on the specific executives implicated in the fraud can provide more precise measurement of the association and statistical significance of the relationship between equity incentives and fraud. Finally, results from firm-level analyses suggest that equity incentive proxies that more broadly

incorporate information for all members of the top management team may be valuable in measuring firm-level fraud risk. These refinements could prove valuable in future studies examining financial reporting fraud.

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Table 1, Panel A
Fraud Sample Composition

This table provides summary statistics on the number of sample financial reporting fraud firms and executives with available compensation data.

AAERs (issued between 4/15/1982 - 10/29/2020)	4,192
Less: missing AAERs/AAERs not involving financial reporting fraud	(1,448)
Less: AAER firms with missing database identifiers	(803)
Less: duplicate AAERs related to the same fraud	(1,175)
Less: AAER firms with missing compensation data in fraud year t-1	(341)
Less: AAER firms with no top 5 paid executives implicated	(16)
Less: AAER firms with fraud related to asset/earnings understatement	(5)
AAER firms charged with financial reporting fraud with DEF 14A filings containing compensation data for fraud year t-1	**404**
Executives in the 404 fraud firms with compensation data in DEF 14A filings for fraud year t-1	**1,805**

Table 1, Panel B
Executive Involvement in Financial Reporting Fraud

This table provides summary statistics on the number of top 5 paid executives in financial reporting fraud firms, their roles within the firm, and how often they are named by the SEC as perpetrators of the fraud.

Fraud Firm Sample Executives	Total	Named	Percentage Named
CEOs	408	246	60%
CFOs	213	117	55%
Other top 5 paid executives	1,184	312	26%
Total	1,805	675	37%

Number of firms with exactly:	Firms
One top 5 paid executive named	192
Two top 5 paid executives named	160
Three top 5 paid executives named	46
Four top 5 paid executives named	5
Five top 5 paid executives named	1
Total	404

Number of fraud firms with:	Firms
Only CEO named	55
Only CEO and CFO named	34
Only CEO and non-CFO executives named	128
CEO, CFO, and other executives named	25
Only CFO named	46
Only CFO and non-CEO executives named	12
Only non-CEO and non-CFO executives named	104
Total	404

Table 2, Panel A
Summary Statistics: Equity Incentives - Fraud Firm Sample

This table provides summary statistics for the distribution of values of equity incentive variables for named and non-named executives at fraud firms measured at the beginning of the period the fraud began. *Delta* is the change in value of an executive's common stock and option portfolio for a one percent change in common share price (expressed in hundreds of thousands); *Vega* is the change in value of an executive's option portfolio for a one percent change in common share price volatility (expressed in thousands). ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.10 levels, respectively, of tests of differences in means and medians between named and non-named executives at fraud firms.

	Named Executive					Non-Named Executive				
	Mean	Median	25th Percentile	75th Percentile	Standard Deviation	Mean	Median	25th Percentile	75th Percentile	Standard Deviation
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Delta										
All top 5 paid executives	4.74***	0.62***	0.14	2.26	12.70	2.44	0.29	0.05	1.23	7.75
CEO	8.76***	1.65**	0.49	6.40	17.20	5.60	1.13	0.22	4.28	11.69
CFO	2.24***	0.41**	0.17	0.95	4.67	1.00	0.23	0.05	0.88	2.27
Non-CEO/CFO executives	3.17***	0.39***	0.10	1.75	10.01	1.88	0.21	0.04	0.93	6.77
Vega										
All top 5 paid executives	75.53***	9.83***	1.03	48.17	182.74	42.16	4.67	0.20	28.22	129.36
CEO	112.93***	16.88***	0.41	89.87	233.78	72.12	8.19	0.17	47.86	183.81
CFO	47.64***	8.82**	0.67	27.94	119.43	27.44	5.76	0.40	21.15	80.07
Non-CEO/CFO executives	64.75***	8.78***	1.46	39.43	154.23	36.21	4.14	0.20	22.81	116.97

Table 2, Panel B
Summary Statistics: Firm-Level Variables - Matched Firm Sample

This table provides means, medians, and standard deviations for firm-level variables for fraud firms and non-fraud firms matched by size (total assets) and industry (2 digit SIC code) at the beginning of the year reporting fraud begins. *Market Cap* is the natural logarithm of the firm's market capitalization; *MTB* is the ratio of the firm's market value of equity to book value of equity; *Leverage* is the total book value of debt scaled by the total book value of equity; *ROA* is net income scaled by total assets; *Capital* is net property, plant, and equipment scaled by total assets; *Receivables* is accounts receivable scaled by total assets; *Intangible* is research and development expense plus advertising expense all scaled by sales; *Growth* is sales in year t less sales in year t-1 all scaled by sales in year t-1; *Financing* is the sum of equity and debt issued in the current period scaled by total assets; *Acquisition* is an indicator variable equal to 1 if current period acquisitions are more than 20 percent of sales, and 0 otherwise; *Constraint* is the financial constraint proxy developed in Kaplan and Zingales (1997); *Return* is the buy and hold return for the previous 12 months; *Firm Age* is the number of years the firm has been listed on CRSP. ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.10 levels, respectively, of tests of differences in means and medians between fraud and non-fraud firms.

	Fraud Firms			Matched Non-Fraud Firms		
	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.
	(1)	(2)	(3)	(4)	(5)	(6)
Market Cap	6.19***	6.08**	2.21	6.58	6.24	1.63
MTB	4.62	2.59	7.16	3.82	2.47	4.95
Leverage	0.85***	0.31**	2.00	0.40	0.18	1.07
ROA	-0.17***	0.04***	0.82	0.01	0.05	0.33
Capital	0.31**	0.19	0.37	0.27	0.19	0.27
Receivables	0.32***	0.24***	0.32	0.25	0.19	0.23
Intangible	0.10*	0.02	0.26	0.17	0.02	0.85
Growth	0.54***	0.22***	1.17	0.20	0.12	0.55
Financing	0.71***	0.10***	1.51	0.25	0.03	0.90
Acquisition	0.09	0.00	0.29	0.06	0.00	0.24
Constraint	0.62	0.83	3.05	0.60	0.74	2.00
Return	0.32	0.15	0.92	0.30	0.17	0.81
Firm Age	12.73***	8.00***	12.21	16.70	13.00	12.73

Table 2, Panel C
Summary Statistics: Executive-Level Variables - Unmatched Firm Sample

This table provides means, medians, and standard deviations for executive-level variables for executives at fraud firms and an unmatched sample of executives at non-fraud firms. *Female* is an indicator variable equal to 1 for female executives, and 0 otherwise; *MBA* is an indicator variable equal to 1 for executives with an MBA degree, and 0 otherwise; *CPA* is an indicator variable equal to 1 for executives with a CPA license, and 0 otherwise; *Auditor* is an indicator variable equal to 1 for executives with professional audit experience, and 0 otherwise; *Education* is a discrete variable equal to 3 for executives who have a PhD, 2.5 for executives with multiple Master's degrees, 2 for executives with one Master's degree, 1 for executives with a Bachelor's degree, and 0 for executives without a college degree; *Founder* is an indicator variable equal to 1 for executives who founded or are members of the family that founded the company, and 0 otherwise; *Age* is the age of the executive. ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.10 levels, respectively, of tests of differences in means and medians between executives at fraud and non-fraud firms.

	Fraud Firms			Non-Fraud Firms		
	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.
	(1)	(2)	(3)	(4)	(5)	(6)
Female	0.07**	0.00	0.24	0.09	0.00	0.26
MBA	0.24***	0.00	7.16	0.28	0.00	0.45
CPA	0.13	0.00	0.33	0.12	0.00	0.34
Auditor	0.05	0.00	0.22	0.04	0.00	0.23
Education	1.24***	1.00	1.00	1.32	1.00	1.00
Founder	0.01	0.00	0.06	0.01	0.00	0.05
Age	50.06***	50.00***	8.12	51.62	51.00	7.70

Table 3
Equity Incentives and Reporting Fraud: Within-Fraud Firm Analysis

This table provides results for estimates of logistic regressions of equation (1) analyzing the association between equity incentives and perpetrating financial reporting fraud. The dependent variable, *Named*, is an indicator variable equal to 1 for executives implicated in reporting fraud, and 0 otherwise. All other variables are defined in Appendix B. ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.10 levels, respectively. Standard errors are bootstrapped.

	All Executives	Excluding CEO	Excluding CFO	All Executives	
	(1)	(2)	(3)	(4)	(5)
Delta	0.021***	0.019**	0.031***	0.020***	0.035**
	(2.80)	(2.32)	(3.05)	(2.67)	(2.30)
Vega	0.003***	0.003***	0.002**	0.003***	0.004**
	(3.38)	(2.62)	(2.50)	(2.90)	(2.46)
CEO				0.858***	0.856***
				(6.79)	(3.57)
CFO				1.651***	1.255***
				(8.94)	(3.82)
Female					-0.190
					(-0.48)
MBA					0.443*
					(1.85)
CPA					1.099***
					(3.89)
Auditor					0.012
					(0.34)
Education					-0.222
					(-1.59)
Founder					0.515
					(0.28)
Age					-0.038**
					(-2.52)
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes
Firms	404	349	358	404	304
Executives	1,805	1,210	1,458	1,805	1,188
Pseudo R-Squared	0.03	0.05	0.06	0.10	0.20

Table 4
Equity Incentives and Reporting Fraud: Within-Fraud Firm Analysis - Robustness Tests

This table provides results for estimates of logistic regressions of equation (1) analyzing the association between equity incentives and perpetrating financial reporting fraud. The first column presents results analyzing firms in which the CEO was not implicated in the reporting fraud; CEOs are not included in this regression. The second column presents results comparing named and non-named CEOs in fraud firms. The last two columns both present results comparing the pre- and post-Sarbanes Oxley Act periods. The dependent variable, *Named*, is an indicator variable equal to 1 for executives implicated in reporting fraud, and 0 otherwise. All other variables are defined in Appendix B. ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.10 levels, respectively. Standard errors are bootstrapped.

	Firms where CEO Not Named	CEOs Only	Pre/Post Sarbanes Oxley	Pre/Post Sarbanes Oxley: CEO/CFO Only
	(1)	(2)	(3)	(4)
Delta	0.041**	0.040**	0.025***	0.028**
	(2.01)	(2.37)	(2.90)	(2.18)
Vega	0.011***	0.004***	0.002***	0.004***
	(3.48)	(2.70)	(3.01)	(2.68)
CEO			1.106***	
			(7.93)	
CFO	1.573***		1.549***	
	(5.50)		(7.12)	
Post			-0.194	-0.261
			(-1.27)	(-1.36)
Delta * Post			-0.005	-0.007
			(-0.30)	(-0.25)
Vega * Post			-0.001	-0.001
			(-0.43)	(-1.29)
CEO * Post			-0.158	
			(-0.59)	
CFO * Post			-0.152	
			(-0.43)	
Intercept		-0.505***	-1.120***	-0.007
		(-3.85)	(-14.86)	(-0.07)
Firm Fixed Effects	Yes	No	No	No
Firms	162	404	404	404
Executives	646	408	1,805	621
Pseudo R-Squared	0.30	0.11	0.08	0.07

Table 5

Equity Incentives and Reporting Fraud: Matched Sample Analysis

This table provides results for estimates of logistic regressions of equation (2) analyzing the association between equity incentives and perpetrating financial reporting fraud for a size, industry, and year matched sample of fraud and non-fraud firms. The first column includes all top 5 paid executives at fraud and non-fraud firms; the second column includes executives at fraud firms implicated in the fraud and executives at matched non-fraud firms matched by accumulated equity rank; the third column includes executives at fraud firms not implicated in the fraud and executives at matched non-fraud firms matched by accumulated equity rank. The dependent variable, *Fraud*, is an indicator variable equal to 1 for executives at fraud firms, and 0 otherwise. All other variables are defined in Appendix B. ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.10 levels, respectively. Standard errors are clustered by firm.

	All Fraud Firm Executives	Named Executives	Non-Named Executives
	(1)	(2)	(3)
Delta	0.009	0.035***	0.007
	(0.91)	(2.77)	(0.68)
Vega	0.001*	0.004***	0.001
	(1.89)	(3.60)	(1.09)
Market Cap	-0.070	-0.289***	-0.047
	(-1.14)	(-3.58)	(-0.75)
MTB	-0.009	-0.035	-0.005
	(-0.41)	(-1.47)	(-0.21)
Leverage	0.242***	0.345***	0.215***
	(2.91)	(2.86)	(2.74)
ROA	-1.470**	-0.796*	-1.145**
	(-2.52)	(-1.91)	(-2.07)
Capital	-1.081**	-0.714	-0.975*
	(-2.17)	(-1.36)	(-1.87)
Receivables	1.193**	1.453**	1.273**
	(2.10)	(2.52)	(2.20)
Intangible	-1.044*	-0.758*	-0.898*
	(-1.92)	(-1.83)	(-1.95)
Growth	0.595**	0.539**	0.540**
	(2.22)	(2.35)	(2.02)
Financing	0.299	0.285	0.243
	(1.63)	(1.55)	(1.26)
Acquisition	0.039	0.386	-0.196
	(0.09)	(0.87)	(-0.47)
Constraint	0.171***	0.204***	0.144**
	(2.62)	(2.60)	(2.42)
Return	-0.009	0.200	-0.048
	(-0.07)	(1.57)	(-0.38)
Firm Age	-0.022**	-0.032***	-0.026***
	(-2.39)	(-3.01)	(-2.74)
CEO	-0.115*	0.345***	-0.277**
	(-1.70)	(2.63)	(-2.51)
CFO	-0.480***	0.592***	-1.198***
	(-5.10)	(3.32)	(-8.16)
Intercept	1.667	1.578	0.931
	(1.16)	(0.90)	(0.74)
Industry Fixed Effects	Yes	Yes	Yes
Firms	716	716	716
Executives	3,396	1,328	2,068
Pseudo R-Squared	0.13	0.20	0.13

Table 6
Equity Incentives and Reporting Fraud: Unmatched Sample Analysis

This table provides results for estimates of Cox proportional hazards models of equation (3) analyzing the association between equity incentives and perpetrating financial reporting fraud. The first two columns include all top 5 paid executives at fraud and non-fraud firms; the third and fourth columns exclude executives at fraud firms not implicated in the fraud; the final two columns exclude executives at fraud firms implicated in the fraud. All non-fraud firm executives are included in every specification. The dependent variable, *Fraud*, is an indicator variable equal to 1 for executives at fraud firms in the year reporting fraud begins, and 0 otherwise. All other variables are defined in Appendix B. ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.10 levels, respectively. Standard errors are clustered by firm.

	All Fraud Firm Executives		Named Fraud Firm Executives		Non-Named Fraud Firm Executives	
	(1)	(2)	(3)	(4)	(5)	(6)
Delta	0.008	0.003	0.028***	0.025**	0.005	-0.001
	(0.79)	(0.28)	(2.90)	(2.53)	(0.46)	(-0.06)
Vega	0.001	0.001	0.003***	0.003***	-0.000	-0.000
	(1.43)	(1.01)	(3.90)	(3.48)	(-0.02)	(-0.17)
Firm-Level Controls	Yes	Yes	Yes	Yes	Yes	Yes
Executive-Level Controls	No	Yes	No	Yes	No	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Executives	46,182	22,966	45,035	22,393	45,524	22,648
Executive-Year Observations	206,836	126,421	202,134	123,610	204,070	124,851
Pseudo R-Squared	0.57	0.51	0.70	0.73	0.48	0.44

Table 7

Equity Incentives and Reporting Fraud: Unmatched Sample Analysis by Executive Role

This table provides results for estimates of Cox proportional hazards models of equation (3) analyzing the association between equity incentives and perpetrating financial reporting fraud. The first two columns only include CEOs; the second two columns only include CFOs; the final two columns only include non-CEO/CFOs. Columns 1, 3, and 5 exclude executives at fraud firms not implicated in the fraud. Columns 2, 4, and 6 exclude executives at fraud firms implicated in the fraud. The dependent variable, *Fraud*, is an indicator variable equal to 1 for executives at fraud firms in the year reporting fraud begins, and 0 otherwise. All other variables are defined in Appendix B. ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.10 levels, respectively. Standard errors are clustered by firm.

	Excluding Executive-Level Control Variables					
	CEOs		CFOs		Non-CEO/CFOs	
	Named	Not Named	Named	Not Named	Named	Not Named
	(1)	(2)	(3)	(4)	(5)	(6)
Delta	0.034***	0.002	0.071**	0.020	0.043***	0.009
	(3.50)	(0.15)	(2.54)	(0.48)	(3.55)	(0.61)
Vega	0.002***	0.001	0.003***	0.000	0.004***	0.001
	(3.56)	(0.50)	(3.62)	(0.13)	(4.16)	(0.86)
Firm-Level Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Executives	5,885	6,035	6,751	6,864	32,528	32,456
Executive-Year Observations	27,414	26,993	29,542	29,517	145,815	147,694
Pseudo R-Squared	0.65	0.51	0.58	0.49	0.61	0.40

	Including Executive-Level Control Variables					
	CEOs		CFOs		Non-CEO/CFOs	
	Named	Not Named	Named	Not Named	Named	Not Named
	(1)	(2)	(3)	(4)	(5)	(6)
Delta	0.035**	0.003	0.064**	0.022	0.053**	0.020
	(2.50)	(0.22)	(2.28)	(1.24)	(2.40)	(1.08)
Vega	0.002***	-0.001	0.003***	-0.001	0.004***	-0.000
	(2.87)	(-0.69)	(3.20)	(-0.64)	(3.63)	(-0.24)
Firm-Level Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Executives	3,349	3,365	4,548	4,598	19,376	19,887
Executive-Year Observations	18,095	18,190	22,009	22,283	90,819	92,358
Pseudo R-Squared	0.66	0.53	0.56	0.60	0.70	0.33

Table 8, Panel A
Replication of Erickson, Hanlon, and Maydew (2006), Table 5

This table provides results for estimates of logistic regressions analyzing the association between equity incentives and financial reporting fraud following the methodology of Erickson et al. (2006). The dependent variable is *Fraud*, an indicator variable equal to 1 for executives at fraud firms, and 0 otherwise. In the first two columns *Sensitivity* is computed using all top 5 paid executives; in the third column *Sensitivity* is computed using only named executives in fraud firms and the corresponding non-fraud firm executives matched by accumulated equity rank. All other variables are defined in Internet Appendix Table 9. ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.10 levels, respectively.

	Erickson et al. (2006)	Replication	Named Executives
	(1)	(2)	(3)
Sensitivity	0.001	0.001	0.002**
	0.721	0.374	0.029
CEO Chair	0.146	0.022	0.028
	0.391	0.970	0.867
Number of Meetings	-0.033	-0.098	-0.089
	0.306	0.258	0.330
Financing	0.478	0.358	0.000
	0.376	0.744	0.949
Leverage	2.250*	1.215	1.059
	0.084	0.444	0.511
MV Equity	0.000	0.000	0.000
	0.942	0.808	0.311
Altman's Z	-0.310	-0.122	-0.137*
	0.130	0.103	0.089
Book to Market	-0.351	0.225	0.159
	0.621	0.742	0.825
Earnings to Price	2.227	-2.187	-2.275
	0.443	0.401	0.384
Return on Assets	-0.120	0.266	1.529
	0.935	0.908	0.521
Sales Growth	0.807*	0.164	0.548
	0.096	0.606	0.248
Age of Firm	-0.013	-0.033	-0.032
	0.209	0.236	0.291
M&A in First Year of Fraud	0.474	0.228	0.207
	0.169	0.659	0.697
Stock Volatility	2.729**	1.019	2.344
	0.017	0.520	0.316
CEO Tenure	-0.012	-0.019	-0.033
	0.770	0.588	0.366
Missing CEO Tenure	1.393*	0.834	0.328
	0.057	0.348	0.733
Intercept	-2.047	0.597	0.495
	0.107	0.667	0.728
Observations	150	147	147
Likelihood ratio	34.45	28.05	29.64
P-value	0.005	0.024	0.020

Table 8, Panel B
Replication of Armstrong, Jagolinzer, and Larcker (2010), Table 7

This table provides results from estimates of conditional logistic and logistic regressions analyzing the association between equity incentives and financial reporting fraud following the methodology of Armstrong et al. (2010). The dependent variable in the first two columns is *Fraud*, an indicator variable equal to 1 for executives at fraud firms, and 0 otherwise. The dependent variable in the third column is *Named*, an indicator variable equal to 1 for executives implicated in reporting fraud, and 0 otherwise. All other variables are defined in Internet Appendix Table 9. ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.10 levels, respectively.

	Armstrong et al. (2010)	Replication	Named CEOs
	(1)	(2)	(3)
EqIncQuint 2 = 1	-0.794	0.045	0.859
	(-0.72)	(0.18)	(0.99)
EqIncQuint 3 = 1	-0.412	-0.122	0.443
	(-0.36)	(-0.12)	(0.40)
EqIncQuint 4 = 1	-0.174	-0.077	2.254***
	(-0.17)	(-0.18)	(3.04)
EqIncQuint 5 = 1	-1.382	-0.286	1.979***
	(-1.09)	(-0.67)	(2.67)
Controls	Yes	Yes	Yes
Matched CEO-firm year observations	262	258	258
Pseudo R-squared	0.43	0.38	0.49
Tests of Coefficients	P-value	P-value	P-value
EIQ2 = 1 ≠ EIQ3 = 1	0.38	0.70	0.37
EIQ2 = 1 ≠ EIQ4 = 1	0.32	0.95	0.02
EIQ2 = 1 ≠ EIQ5 = 1	0.52	0.73	0.04
EIQ3 = 1 ≠ EIQ4 = 1	0.75	0.74	0.01
EIQ3 = 1 ≠ EIQ5 = 1	0.31	0.68	0.01
EIQ4 = 1 ≠ EIQ5 = 1	0.13	0.55	0.41

Table 8, Panel C
Replication of Feng, Ge, Luo, and Shevlin (2011), Table 4

This table provides results from estimates of conditional logistic regressions analyzing the association between equity incentives and financial reporting fraud following the methodology of Feng et al. (2011). The dependent variable in the first two columns is *Fraud*, an indicator variable equal to 1 for executives at fraud firms, and 0 otherwise. The dependent variable in the last two columns is *Named,* an indicator variable equal to 1 for executives implicated in reporting fraud, and 0 otherwise. All other variables are defined in Internet Appendix Table 9. ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.10 levels, respectively.

	Feng et al. (2011)	Replication	Named CFO	Named CEO
	(1)	(2)	(3)	(4)
CFO Sensitivity	-2.171	1.499	4.435***	0.710
	(-0.92)	(1.26)	(2.98)	(0.48)
CEO Sensitivity	4.234***	1.323**	0.350	2.642***
	(3.50)	(2.03)	(0.41)	(3.23)
Cash Sales	0.284	0.412*	0.346	0.623**
	(1.42)	(1.90)	(1.11)	(2.17)
Earnings	-1.487	-1.430	-1.366	-2.934
	(-1.31)	(-1.05)	(-0.61)	(-1.56)
Inventory	4.031	2.623	-1.252	0.319
	(1.64)	(1.00)	(-0.34)	(0.09)
Receivables	3.117	3.690*	5.585*	3.422
	(1.05)	(1.79)	(1.80)	(1.31)
RSST Accruals	-2.437***	0.394	0.844	0.183
	(-2.94)	(0.48)	(0.71)	(0.18)
Observations	303	299	157	179
Likelihood ratio Chi-square	25.20***	35.30***	35.35***	36.48***

Table 8, Panel D

Replication of Armstrong, Larcker, Ormazabal, and Taylor (2013), Table 6

This table provides results from tests of differences in means and medians analyzing the association between equity incentives and financial reporting fraud following the methodology of Armstrong et al. (2013). The dependent variable is *Fraud*, an indicator variable equal to 1 for executives at fraud firms, and 0 otherwise. The compensation variables in the first two sets of tests are computed using all top 5 paid executives. In the last set of tests the compensation variables are computed using only named executives in fraud firms and the corresponding non-fraud firm executives matched by accumulated equity rank. All other variables are defined in Internet Appendix Table 9. ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.10 levels, respectively.

	Armstrong et al. (2013)							
	Misreporting Firms		Matched Firms		Difference in Means		Difference in Medians	
	Observations (N = 361)		Observations (N = 361)					
	Mean	Median	Mean	Median	Difference	P-value	Difference	P-value
Cash Comp	6.53	6.46	6.52	6.46	0.01	0.87	0.00	0.97
Delta	5.11	5.20	4.99	5.02	0.12	0.40	0.18	0.30
Vega	3.80	3.82	3.48	3.43	0.32**	0.02	0.39**	0.04
	Replication							
	Misreporting Firms		Matched Firms		Difference in Means		Difference in Medians	
	Observations (N = 356)		Observations (N = 356)					
	Mean	Median	Mean	Median	Difference	P-value	Difference	P-value
Cash Comp	6.39	6.35	6.44	6.44	-0.05	0.61	-0.09	0.47
Delta	5.04	5.06	4.94	4.98	0.10	0.44	0.08	0.48
Vega	3.67	3.63	3.44	3.42	0.23**	0.03	0.21**	0.05
	Named Executives							
	Misreporting Firms		Matched Firms		Difference in Means		Difference in Medians	
	Observations (N = 356)		Observations (N = 356)					
	Mean	Median	Mean	Median	Difference	P-value	Difference	P-value
Cash Comp	6.43	6.38	6.42	6.43	0.01	0.94	-0.05	0.64
Delta	5.21	5.22	4.96	4.99	0.25**	0.02	0.23**	0.04
Vega	3.76	3.74	3.47	3.44	0.29***	0.01	0.30***	0.01

Table 8, Panel E

Replication of Johnson, Ryan, and Tian (2009), Table 5

This table provides results for estimates of conditional logistic regressions analyzing the association between equity incentives and financial reporting fraud following the methodology of Johnson et al. (2009). The dependent variable in the first two columns is *Fraud*, an indicator variable equal to 1 for executives at fraud firms, and 0 otherwise. The dependent variable in the third column is *Named*, an indicator variable equal to 1 for executives implicated in reporting fraud, and 0 otherwise. All other variables are defined in Internet Appendix Table 9. ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.10 levels, respectively.

	Johnson et al. (2009)	Replication	Named CEOs
	(1)	(2)	(3)
Incentives - Restricted Stock	-0.0107	0.2838	0.1937
	(1.00)	(0.21)	(0.51)
Incentives - Unrestricted Stock	0.8967**	-0.0160	0.1754*
	(0.03)	(0.38)	(0.09)
Incentives - Unvested Options	-0.2162	0.1896	1.2622***
	(0.89)	(0.15)	(0.01)
Incentives - Vested Options	0.8424	0.0422	-0.2308
	(0.62)	(0.70)	(0.34)
Log (Sales)	-1.0937	0.3607	1.0180
	(0.26)	(0.16)	(0.31)
Pre-Fraud Three-Year Sales Growth	5.0374**	0.1788	5.1761***
	(0.03)	(0.29)	(0.01)
Log (1 + Board Size)	-0.6013	-1.0154	-0.8658
	(0.66)	(0.16)	(0.60)
Percentage Board Insiders	2.0307	-1.6767	-1.9911*
	(0.38)	(0.24)	(0.07)
Log (1 + Board Meetings)	1.9865*	0.0215	0.2524
	(0.09)	(0.77)	(0.29)
CEO Chairman	0.8499	0.2780	-0.6580
	(0.14)	(0.39)	(0.47)
Outside Blockholders	-1.4950	0.6921	1.7628**
	(0.65)	(0.17)	(0.02)
Log (1 + Audit Committee Size)	2.1497	-0.2240	-0.7638
	(0.13)	(0.70)	(0.83)
Percentage Audit Committee Insiders	5.4694**	0.8888	-3.0897
	(0.05)	(0.49)	(0.36)
Log (1 + Audit Committee Meetings)	0.3464	-0.0131	-0.0270
	(0.55)	(0.86)	(0.95)
Financing Need	-3.0532	-2.4515***	-3.7420
	(0.37)	(0.01)	(0.25)
Leverage	2.3620	0.6057	-1.4843
	(0.47)	(0.65)	(0.64)
Log (1 + CEO Tenure)	0.4293	0.0626***	0.3510**
	(0.36)	(0.01)	(0.02)
Log (1 + Age)	-1.5726	-1.7484	-5.3931
	(0.36)	(0.22)	(0.41)
CEO Founder	-0.6992	-0.5723	-0.7415
	(0.33)	(0.77)	(0.58)
Number of Other Boards	0.2226	0.0064	-0.9541
	(0.40)	(0.89)	(0.18)
Observations	136	160	98
Pseudo R Squared	0.39	0.33	0.68

Table 9
Equity Incentives and Reporting Fraud: Firm-Level Analysis

This table provides results for a firm-level Cox proportional hazards model estimate of equation (3) analyzing the association between equity incentives and financial reporting fraud. The dependent variable, *Fraud Firm*, is an indicator variable equal to 1 for fraud firms at the beginning of the year reporting fraud begins, and 0 otherwise. *Standardized Delta* is the highest executive-level standardized delta in the firm where executive-level standardized delta is the executive's delta less the mean of the year, industry, within-firm rank delta all scaled by the standard deviation of the year, industry, within-firm rank delta. *Standardized Vega* is the highest executive-level standardized vega in the firm where executive-level standardized vega is the executive's vega less the mean of the year, industry, within-firm rank vega all scaled by the standard deviation of the year, industry, within-firm rank vega. All other variables are defined in Appendix B. ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.10 levels, respectively. Standard errors are clustered by firm.

	Standardized Equity Incentives
	(1)
Standardized Delta	0.081**
	(2.06)
Standardized Vega	0.133***
	(3.22)
Market Cap	-0.098
	(-1.53)
MTB	-0.009
	(-0.72)
Leverage	0.083**
	(2.33)
ROA	-0.191**
	(-2.26)
Capital	-1.006***
	(-3.80)
Receivables	0.976***
	(4.06)
Intangible	-0.096
	(-0.72)
Growth	0.171*
	(1.90)
Financing	0.205***
	(3.03)
Acquisition	0.509**
	(2.37)
Constraint	0.040
	(1.42)
Return	0.018
	(0.19)
Firm Age	-0.012*
	(-1.86)
Firm-Year Observations	32,630
Pseudo R Squared	0.30

Table 10
Equity Incentives and Reporting Fraud: Firm-Level Analysis - Number of Executives with Relatively Strong Equity Incentives

This table provides results for firm-level Cox proportional hazards model estimates of equation (3) analyzing the association between equity incentives and financial reporting fraud. The dependent variable, *Fraud Firm*, is an indicator variable equal to 1 for fraud firms at the beginning of the year reporting fraud begins, and 0 otherwise. *Delta N-X* is an indicator variable equal to 1 if the firm has at least N executives with a year, industry, within-firm delta-ranked delta above the Xth percentile, and 0 otherwise. *Vega N-X* is an indicator variable equal to 1 if the firm has at least N executives with a year, industry, within-firm vega-ranked vega above the Xth percentile, and 0 otherwise. Coefficient estimates for *Delta N-X* and *Vega N-X* from each estimation are presented. All other variables are defined in Appendix B. ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.10 levels, respectively. Standard errors are clustered by firm.

	Equity Incentive Xth Percentile Rank						
	95th	90th	85th	80th	75th	70th	65th
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Delta - at least 1 above Xth	0.110	0.092	0.113	0.045	0.044	-0.009	-0.085
Vega - at least 1 above Xth	**0.511***	**0.446****	0.204	0.079	0.021	0.059	0.113
Delta - at least 2 above Xth	0.338	0.289	0.116	0.018	0.180	0.064	0.037
Vega - at least 2 above Xth	**0.592****	**0.464****	**0.342***	0.211	0.080	0.076	0.081
Delta - at least 3 above Xth	**0.517***	**0.506****	**0.311***	0.083	0.072	**0.243***	0.152
Vega - at least 3 above Xth	**0.719****	**0.415***	**0.341***	**0.434****	**0.321***	0.003	0.028
Delta - at least 4 above Xth	**0.614***	**0.469****	**0.557*****	**0.366***	0.220	0.189	0.243
Vega - at least 4 above Xth	**1.042****	**0.588*****	**0.452***	**0.468****	**0.352***	**0.314***	0.149
Delta - at least 5 above Xth	**0.891****	**0.531***	**0.545****	**0.502****	**0.525****	**0.356***	**0.429****
Vega - at least 5 above Xth	**1.092*****	**0.704*****	**0.548****	**0.484****	**0.407***	**0.389***	0.294
Firm-Level Controls	Yes						
Firm-Year Observations	32,630						

Appendix A
Summary of Replicated Studies

Study	Primary Equity Incentives Proxy	Accounting Irregularity Proxy	Sample	Sample Period	Unit of Analysis	Research Design	Observed Association
Erickson, Hanlon, and Maydew (2006)	Delta	AAERs	50 firm years plus matches	1996-2003	Sum of top 5 paid executives	Matched pair - size, industry, year. Logistic regression	None
Armstrong, Jagolinzer, and Larcker (2010)	Delta	AAERs, restatements, class action lawsuits	Between 157 and 464 firm years plus matches depending on irregularity proxy	2001-2005	CEO	Matched pair - size, industry, year; propensity score. Conditional logistic regression	None or negative
Feng, Ge, Luo, and Shevlin (2011)	Delta scaled by the sum of delta, cash, and bonus	AAERs	116 firm years plus matches	1993-2005	CEO and CFO	Matched pair - size, industry, year. Conditional logistic regression	Positive CEO, no association CFO
Armstrong, Larcker, Ormazabal, and Taylor (2013)	Delta and vega	AAERs, restatements, discretionary accruals	20,445 firm years in non-matched samples; 568 or 361 firm years in matched samples plus matches	1992-2009	Average of top 5 paid executives	Matched pair - size, industry, year; propensity score. OLS and probit regression; test of differences in means and medians	Positive for vega, no association for delta when vega included in the model
Johnson, Ryan, and Tian (2009)	Delta, component deltas	AAERs	53 firm years plus matches	1992-2005	Average of top 5 paid executives and CEO only	Matched pair - size, industry, year. Conditional logistic regression	Positive only for incentives related to unrestricted stock

Appendix B
Variable Definitions and Data Sources

Variable	Definition	Data Source
Named	Indicator variable equal to 1 for executives implicated in reporting fraud, and 0 otherwise.	AAERs
Fraud	Indicator variable equal to 1 for executives at fraud firms (at the beginning of the year reporting fraud begins), and 0 otherwise.	
Fraud Firm	Indicator variable equal to 1 for fraud firms at the beginning of the year reporting fraud begins, and 0 otherwise.	
Post	Indicator variable equal to 1 for frauds that began after August 29, 2002, and 0 otherwise.	
Delta	Change in value of an executive's common stock and option portfolio for a one percent change in common share price (expressed in hundreds of thousands).	DEF 14A filings/ Execucomp / CRSP
Vega	Change in value of an executive's option portfolio for a one percent change in common share price volatility (expressed in thousands).	
CEO	Indicator variable equal to 1 for CEOs, and 0 otherwise.	
CFO	Indicator variable equal to 1 for CFOs, and 0 otherwise.	
Standardized Delta	Highest executive-level standardized delta in the firm where executive-level standardized delta is the executive's delta less the mean of the year, industry, within-firm rank delta all scaled by the standard deviation of the year, industry, within-firm rank delta.	
Standardized Vega	Highest executive-level standardized vega in the firm where executive-level standardized vega is the executive's vega less the mean of the year, industry, within-firm rank vega all scaled by the standard deviation of the year, industry, within-firm rank vega.	
Delta N-X	Indicator variable equal to 1 if the firm has at least N executives with a year, industry, within-firm delta-ranked delta above the Xth percentile, and 0 otherwise.	
Vega N-X	Indicator variable equal to 1 if the firm has at least N executives with a year, industry, within-firm vega-ranked vega above the Xth percentile, and 0 otherwise.	
Market Cap	Natural logarithm of the firm's market capitalization.	Compustat
MTB	Ratio of the firm's market value of equity to book value of equity.	
Leverage	Total book value of debt scaled by total book value of equity.	
ROA	Net income scaled by total assets.	
Capital	Net property, plant, and equipment scaled by total assets.	
Receivables	Accounts receivable scaled by total assets.	
Intangible	Research and development expense plus advertising expense all scaled by sales.	
Growth	Sales in year t less sales in year t - 1 all scaled by sales in year t - 1.	
Financing	Sum of equity and debt issued in the current period scaled by total assets.	
Acquisition	Indicator variable equal to 1 if current period acquisitions are more than 20% of sales, and 0 otherwise.	
Constraint	Financial constraint proxy developed in Kaplan and Zingales (1997).	
Return	Buy and hold return for the previous 12 months.	CRSP
Firm Age	Number of years the firm has been listed on CRSP.	
Female	Indicator variable equal to 1 for female executives, and 0 otherwise.	DEF 14A filings/ Boardex
MBA	Indicator variable equal to 1 for executives with an MBA degree, and 0 otherwise.	
CPA	Indicator variable equal to 1 for executives with a CPA license, and 0 otherwise.	
Auditor	Indicator variable equal to 1 for executives with professional audit experience, and 0 otherwise.	
Education	Discrete variable equal to 3 for executives who have a PhD, 2.5 for executives with multiple Master's degrees, 2 for executives with one Master's degree, 1 for executives with a Bachelor's degree, and 0 for executives without a college degree.	
Founder	Indicator variable equal to 1 for executives who founded or are members of the family that founded the company, and 0 otherwise.	
Age	The age of the executive.	

Who Did It Matters: Executive Equity Compensation and Financial Reporting Risk

Internet Appendix

This Appendix reports additional information and the results of various additional analyses and robustness tests conducted in support of the main analyses in the paper. The list of tables in this Appendix is presented below.

Table of Contents:

Appendix Table 1
Correlations of Equity Incentives by Executive Role in Fraud Firms

This table provides correlation coefficients between proxies for equity incentives across executive role in fraud firms at the beginning of the period the fraud began. Non-CEO/CFOs include all non-CEO/CFO top 5 paid executives. Variables are defined in Appendix Table 12. * denotes statistical significance at or beyond the 0.10 level.

	CEO Delta	CEO Vega	CFO Delta	CFO Vega	Non-CEO/CFO Delta	Non-CEO/CFO Vega
	(1)	(2)	(3)	(4)	(5)	(6)
CEO Delta	1					
CEO Vega	0.70*	1				
CFO Delta	0.56*	0.59*	1			
CFO Vega	0.54*	0.79*	0.87*	1		
Non-CEO/CFO Delta	0.44*	0.33*	0.31*	0.31*	1	
Non-CEO/CFO Vega	0.47*	0.69*	0.19*	0.49*	0.54*	1

Appendix Table 2
Summary of Prior Literature Analyzing Compensation Incentives and Financial Reporting Risk

Study	Primary Equity Incentives Proxy	Accounting Irregularity Proxy	Sample	Sample Period	Unit of Analysis	Research Design	Observed Association
Baber, Kang, Liang, and Zhu (2007)	Compensation mix, exercisable options scaled by shares outstanding	Restatements	193 firm years plus matches	1997-2002	CEO	Matched pair - year, industry, exchange, assets. Logistic regression	None
Bergstressor and Philippon (2006)	Incentive ratio (delta scaled by compensation)	Discretionary accruals	4,761 firm years	1994-2000	CEO	OLS regression	Positive
Burns and Kedia (2006)	Delta, component deltas	Restatements, restatement magnitude	266 firm years plus all other Execucomp firm years	1995-2002	CEO	Pooled logistic regression, pooled OLS regression	Positive only for incentives related to stock options
Cheng and Farber (2008)	Value of option grants scaled by total compensation	Restatements	289 firm years plus matches	1997-2001	CEO	OLS regression	Positive
Cheng and Warfield (2005)	Equity holdings in shares scaled by shares outstanding	Meet/just beat forecast, abnormal accruals	All firms with available data during sample period	1993-2000	CEO	Logistic regression	Positive for unexercisable options and stock holdings
Cornett, Marcus, and Tehranian (2008)	Equity compensation scaled by total compensation	Discretionary accruals	All firms in the S&P 100 Index over the sample period	1994-2003	CEO	OLS regression	Positive, mitigated by institutional ownership, board independence, and institutional investor representation on the board

Appendix Table 2 - Continued

Study	Primary Equity Incentives Proxy	Accounting Irregularity Proxy	Sample	Sample Period	Unit of Analysis	Research Design	Observed Association
Denis, Hanouna, and Sarin (2006)	Option intensity	Litigation	358 firm years plus matches	1993-2002	CEO	Matched pair - size, industry, year. Logistic regression	Positive
Efendi, Srivastava, and Swanson (2007)	Component value, option intrinsic value, option delta	Restatements, severe restatements	95 firm years plus matches	2001-2002	CEO	Matched pair - size, industry, year. Logistic regression, ordered logistic regression	Positive for option intrinsic value and option delta
Harris and Bromiley (2007)	Option and bonus value scaled by total compensation value	Restatements	434 firm years plus matches	1997-2002	CEO	Matched pair - size, industry, year. Conditional logistic regression	Positive for option value scaled by total compensation value
Hopkins, Maydew, and Venkatachalam (2015)	Total compensation	Discretionary accruals, restatements	All Execucomp firms over the sample period with available data	2001-2011	General Counsel	OLS regression, logistic regression	Positive for within-GAAP earnings management, negative for restatements
Jiang, Petroni, and Wang (2010)	Delta	Discretionary accruals, meet/just beat forecast	All Execucomp firms over the sample period with both CEO and CFO data	1993-2006	CEO and CFO	OLS regression	No association CEO, positive CFO, no results in the post-SOX period
Larcker, Richardson, and Tuna (2007)	Compensation mix	Restatements, abnormal accruals	1,484 firm years, 118 firm years plus all firms over the sample period with available data	2002-2003	CEO	OLS regression, pooled logistic regression	Positive, none

Appendix Table 3
Fraud Firm Details and Documentation

aaiPharma Inc.

AAER 2824: https://www.sec.gov/litigation/litreleases/2008/lr20566.htm

AAER 2270: https://www.sec.gov/litigation/litreleases/lr19290.htm

Litigation Release 19290: https://www.sec.gov/litigation/complaints/comp19290.pdf

DEF 14A: https://www.sec.gov/Archives/edgar/data/1013243/000095014403004846/g81566ddef14a.htm

The fraud was perpetrated by David M. Hurley, who at the time of the fraud was an Executive Vice President at aaiPharma and President of the company's pharmaceutical division (he was briefly promoted to COO in 2004 before resigning approximately one month later). During the third and fourth fiscal quarters in 2003, Hurley arranged four fraudulent sales transactions to help the company meet its revenue targets. Hurley made these sales on consignment but instructed employees to prepare invoices stating that the sales were final and that payment was due within 60 days. As a result of these fraudulent transactions, aaiPharma overstated its third and fourth quarter revenues by approximately $28.3 million, which was more than 10 percent of the firm's total revenue for the year.

I collected compensation information for the top paid aaiPharma executives from the firm's DEF 14A for fiscal year 2002 filed on 4/11/2003. This filing contains the accumulated equity paid to and held by executives closest to the beginning of the fraud period in the firm's third quarter of 2003.

Aerosonic Corporation

AAER 3013: https://www.sec.gov/litigation/admin/2009/34-60329.pdf

AAER 2392: https://www.sec.gov/litigation/admin/34-53404.pdf

AAER 2375: https://www.sec.gov/litigation/litreleases/lr19567.htm

AAER 2126: https://www.sec.gov/litigation/litreleases/lr18935.htm

Litigation Release 18935: https://www.sec.gov/litigation/complaints/comp18935.pdf

DEF 14A: https://www.sec.gov/Archives/edgar/data/109471/000104291099000703/0001042910-99-000703.txt

The fraud was perpetrated by CEO John M. Nabors and CFO Eric J. McCracken. Starting in January 1999, Nabors and McCracken recorded fictitious and premature revenue, overstated inventory, and did not create reserves for obsolete inventory. Over the near 4-year fraud period, the SEC alleges that earnings were overstated in periodic filings by at least 35% and as much as 825%. The SEC also alleges that during the fraud period McCracken sold stock at inflated prices. The AAERs note that over the entire period, Aerosonic's revenue and inventory were overstated by approximately $11.6 million.

The Litigation Release notes that "In an attempt to avoid detection of their schemes, Nabors and McCracken tightly controlled Aerosonic's financial information and exercised virtually unfettered control over Aerosonic's financial records. Defendants avoided serious scrutiny within the Company through their calculated selection of mostly unqualified personnel which they controlled and directed." The fraud went undetected for so long at least in part because of negligent conduct by the firm's auditor. AAERs were also issued related to improper professional conduct by the audit engagement partner, Andrew J. McAdams, who supervised the Aerosonic audit. It appears McAdams was

aware of the reporting risk, particularly pertaining to inventory, and even raised these concerns with the CEO, but chose to issue unqualified audit opinions during the fraud period.

I collected compensation information for the top paid Aerosonic executives from the firm's DEF 14A for fiscal year 1998 filed on 5/28/1999. This filing contains the accumulated equity paid to and held by executives closest to the beginning of the fraud period in the firm's first quarter of 1999.

Brooke Corporation

AAER 3317: https://www.sec.gov/litigation/admin/2011/34-65260.pdf

AAER 3316: https://www.sec.gov/litigation/admin/2011/34-65254.pdf

AAER 3304: https://www.sec.gov/litigation/litreleases/2011/lr22046.htm

AAER 3276: https://www.sec.gov/litigation/litreleases/2011/lr21957.htm

Litigation Release 21957: https://www.sec.gov/litigation/complaints/2011/comp21957.pdf

DEF 14A: https://www.sec.gov/Archives/edgar/data/834408/000119312507068641/ddef14a.htm

The AAERs implicate many executives in this fraud, including: Robert D. Orr, CEO, Leland G. Orr, CFO, Michael S. Lowry, CEO of a Brooke subsidiary, Michael S. Hess, CEO of a Brooke subsidiary, Kyle L. Garst, CEO of a Brooke subsidiary, and Travis W. Vrbas, CFO.

The fraud began during fiscal year 2007 in filings for the fiscal year end and continued through the first two quarters of 2008. The fraud involved overstating the number of Brooke Capital franchisees by including failed and abandoned locations and by overstating the financial health of the franchisees. The fraud also involved pledging the same loans as collateral to multiple lenders, falsifying loan performance reports, understating loan loss reserves, failing to write down residual interests in credit facility assets, and numerous other misstatements over the fraud period.

In this case, the only top 5 paid executive not implicated in the fraud was James H. Ingraham, the company's General Counsel and Secretary. Michael S. Lowry and Travis W. Vrbas are not included in my sample because they were not top 5 paid executives and compensation data are not available for them.

I collected compensation information for the top paid Brooke executives from the firm's DEF 14A for fiscal year 2006 filed on 3/29/2007. This filing contains the accumulated equity paid to and held by executives closest to the beginning of the fraud period in the firm's fiscal year 2007.

Vitesse Semiconductor Corporation

AAER 3591: https://www.sec.gov/litigation/admin/2014/34-73421.pdf

AAER 3495: https://www.sec.gov/litigation/litreleases/2013/lr22825.htm

AAER 3263: https://www.sec.gov/litigation/admin/2011/34-64272.pdf

AAER 3262: https://www.sec.gov/divisions/enforce/friactions/friactions2011.shtml

AAER 3217: https://www.sec.gov/litigation/litreleases/2010/lr21769.htm

Litigation Release 21769: https://www.sec.gov/litigation/complaints/2010/comp21769.pdf

DEF 14A: https://www.sec.gov/Archives/edgar/data/880446/0000898430-96-005841.txt

filed 12/20/1996; contains compensation data for fiscal years 1995 and 1994

The fraud was perpetrated by CEO Louis R. Tomasetta, CFO Eugene F. Hovanec, Controller Yatin D. Mody, and Director of Finance Nicole R. Kaplan. The initial fraud began in 1995 and involved the CEO and CFO who initiated a large options backdating scheme to benefit themselves and other employees. Tomasetta and Hovanec backdated or repriced 40 option grants to employees and officers, representing over 60% of the total options that Vitesse awarded during the period. As a result, Vitesse failed to record compensation expense of $184 million during fiscal years 1995-2005 and in some years overstated pretax income (or understated loss) by up to 45%. The AAERs also note that beginning in September 2001, Tomasetta and Hovanec engaged in revenue recognition fraud via channel stuffing that involved two additional employees – Mody and Kaplan. This fraud continued through April 2006.

I treat fiscal year 1995 as the first year of the fraud, as this was the first year the financial statements were materially misstated as a result of the failure to properly recognize the backdated options. I collected compensation data from the DEF 14A filed on 12/20/1996, which contains compensation data for the previous two years. Although the AAERs do not note at what time during 1995 the first options were backdated, I collected data for the fiscal year ended 1994, which is before the backdating began. Because I treat 1995 as the first fraud year, I do not treat Mody or Kaplan as implicated in the fraud (Mody first appeared as a top 5 paid executive in the DEF 14A filed in 2004, several years after his involvement in the fraud began and Kaplan did not join the firm until 1998 and was never a top 5 paid executive).

Appendix Table 4
Variable Computations

Option Delta	$\frac{\partial V}{\partial S} * \frac{S}{100} = \frac{e^{-dT} N(Z) * S}{100}$
Vega	$\frac{\partial V}{\partial \sigma} * 0.01 = e^{-dT} N'(Z) S T^{\frac{1}{2}} * 0.01$
Gamma	$\frac{\partial^2 V}{\partial S^2} = \frac{e^{-dT} N(Z)}{S\sigma\sqrt{T}}$
V	$Se^{-dT} N(Z) - Xe^{-rT} N(Z - \sigma T^{\frac{1}{2}})$
Z	$\left[\ln\left(\frac{S}{X}\right) + T\left(r - d + \frac{\sigma^2}{2}\right)\right] / \sigma T^{1/2}$
N	Cumulative probability function for the normal distribution
N'	Normal density function
S	Price of the underlying stock
X	Exercise price of the option
σ	Expected stock return volatility over the life of the option
r	Natural logarithm of the risk-free rate
T	Time to maturity of the option in years
d	Natural logarithm of the expected dividend yield over the life of the option
Standardized Delta (Vega)	$\max_{j \in [n]} \left(\frac{Delta(Vega)_{i,\,j} - mean\ Delta(Vega)_{year,\,ind,\,rank}}{\sigma Delta(Vega)_{year,ind,rank}} \right)$
i	Executive
j	Firm
year	Year
ind	Industry measured by 2-digit SIC code
rank	Within-firm equity incentive rank
Constraint	$-\frac{1.002CF_{i,t}}{A_{i,t-1}} - \frac{39.368D_{i,t}}{A_{i,t-1}} - \frac{1.315C_{i,t}}{A_{i,t-1}} + 3.139B_{i,t} + 0.283Q_{i,t}$
CF	Cash flows
D	Cash dividends
C	Cash balance
B	Book leverage = book debt divided by the sum of book debt and book equity
Q	Tobin's Q = market value of equity plus total assets minus book value of equity all scaled by total assets
A	Total assets

Appendix Table 5
Equity Incentives and Reporting Fraud: Within-Fraud Firm Analysis - Additional Proxies

This table provides results for estimates of logistic regressions of equation (1) analyzing the association between equity incentives and perpetrating financial reporting fraud. The dependent variable, *Named*, is an indicator variable equal to 1 for executives implicated in reporting fraud, and 0 otherwise. All other variables are defined in Appendix Table 12. ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.10 levels, respectively. Standard errors are bootstrapped.

	Incentive Ratio	Gamma	Bonus	All
	(1)	(2)	(3)	(4)
Incentive Ratio	0.641**			0.097
	(2.38)			(0.31)
Gamma		0.009***		0.007***
		(5.05)		(3.82)
Bonus			0.030**	0.020
			(2.35)	(1.21)
Delta				0.025**
				(2.47)
Vega				0.004***
				(2.94)
CEO	1.018***	0.860***	0.983***	0.654***
	(8.31)	(6.84)	(7.93)	(4.81)
CFO	1.656***	1.641***	1.601***	1.727***
	(8.85)	(8.78)	(8.76)	(8.86)
Firm Fixed Effects	Yes	Yes	Yes	Yes
Firms	404	404	404	404
Executives	1,805	1,805	1,805	1,805
Pseudo R-Squared	0.10	0.12	0.10	0.14

Appendix Table 6
Equity Incentives and Reporting Fraud: Within-Fraud Firm Analysis - Components of Delta

This table provides results for estimates of logistic regressions of equation (1) analyzing the association between equity incentives and perpetrating financial reporting fraud for the individual components of *Delta*. The dependent variable, *Named*, is an indicator variable equal to 1 for executives implicated in reporting fraud, and 0 otherwise. All other variables are defined in Appendix Table 12. ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.10 levels, respectively. Standard errors are bootstrapped.

	All Executives			
	(1)	(2)	(3)	(4)
Delta Share	0.026***			0.025**
	(2.75)			(2.37)
Delta U Option		0.202***		0.508***
		(3.81)		(3.44)
Delta E Option			0.086**	-0.036
			(2.02)	(-0.66)
CEO	0.970***	0.958***	0.991***	0.906***
	(8.00)	(7.97)	(8.12)	(7.28)
CFO	1.598***	1.596***	1.572***	1.626***
	(8.80)	(8.72)	(8.69)	(8.83)
Firm Fixed Effects	Yes	Yes	Yes	Yes
Firms	404	404	404	404
Executives	1,805	1,805	1,805	1,805
Pseudo R-Squared	0.10	0.10	0.09	0.11

Appendix Table 7
Equity Incentives and Reporting Fraud: Within-Fraud Firm Analysis - Components of Vega

This table provides results for estimates of logistic regressions of equation (1) analyzing the association between equity incentives and perpetrating financial reporting fraud for the individual components of *Vega*. The dependent variable, *Named*, is an indicator variable equal to 1 for executives implicated in reporting fraud, and 0 otherwise. All other variables are defined in Appendix Table 12. ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.10 levels, respectively. Standard errors are bootstrapped.

	All Executives		
	(1)	(2)	(3)
Vega U Option	0.006***		0.006***
	(4.85)		(4.13)
Vega E Option		0.005***	0.001
		(2.99)	(0.74)
CEO	0.963***	0.963***	0.906***
	(7.96)	(7.96)	(7.37)
CFO	1.575***	1.575***	1.619***
	(8.72)	(8.72)	(8.82)
Firm Fixed Effects	Yes	Yes	Yes
Firms	404	404	404
Executives	1,805	1,805	1,805
Pseudo R-Squared	0.11	0.09	0.09

Appendix Table 8
Equity Incentives and Reporting Fraud: Matched Sample Analysis - CEOs Only

This table provides results for estimates of logistic regressions of equation (2) analyzing the association between equity incentives and perpetrating financial reporting fraud for a size, industry, and year matched sample of fraud and non-fraud firms. The first column includes CEOs implicated in the fraud and CEOs at matched non-fraud firms; the second column includes CEOs at fraud firms who were not implicated in the fraud and CEOs at matched non-fraud firms. The dependent variable, *Fraud*, is an indicator variable equal to 1 for executives at fraud firms, and 0 otherwise. All other variables are defined in Appendix Table 12. ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.10 levels, respectively.

	CEO Named	CEO Not Named
	(1)	(2)
Delta	0.055***	-0.008
	(2.79)	(-0.46)
Vega	0.005***	0.002
	(2.87)	(1.38)
Market Cap	-0.695***	-0.119
	(-5.28)	(-1.20)
MTB	-0.027	-0.054*
	(-0.60)	(-1.71)
Leverage	0.434***	0.264***
	(2.79)	(2.65)
ROA	-0.616	-1.539***
	(-0.79)	(-2.66)
Capital	-1.401	-0.483
	(-1.47)	(-0.72)
Receivables	1.665*	2.078***
	(1.74)	(2.68)
Intangible	-0.949	-0.725*
	(-0.78)	(-1.94)
Growth	1.107**	0.615**
	(2.50)	(2.51)
Financing	0.913***	0.171
	(2.87)	(0.93)
Acquisition	-0.103	-0.429
	(-0.16)	(-0.78)
Constraint	0.174	0.152**
	(1.28)	(2.25)
Return	0.340*	-0.029
	(1.68)	(-0.16)
Firm Age	-0.064***	-0.006
	(-3.71)	(-0.52)
Intercept	4.138**	-0.381
	(2.41)	(-.037)
Industry Fixed Effects	Yes	Yes
CEOs	394	322
Pseudo R-Squared	0.34	0.14

Appendix Table 9
Variable Definitions and Data Sources for Variables Used in Replications

Variable	Definition	Data Source
	Erickson, Hanlon, and Maydew (2006)	
Sensitivity	Change in value of the top five managers' stock, restricted stock, and stock option portfolio in response to a 1% change in stock price following Core and Guay (2002).	DEF 14A Filings
CEO Chair	Indicator variable that is set to one if the Chairman of the Board is also the CEO.	DEF 14A Filings
Number of Meetings	Number of board meetings held during the fiscal year.	Execucomp
Financing	Ex ante measure of a firm's desire for external financing. It is an indicator variable coded 1 if the firm's variable freecash is less than -0.5 and 0 otherwise where freecash is defined as: (cash from operations in year t - average capital expenditures from years t-3 to t-1)/ current assets in year t-1.	Compustat
Leverage	Total debt scaled by total assets.	Compustat
MV Equity	Market value of equity of the firm.	Compustat
Altman's Z	Proxy for risk of financial distress calculated based on Altman (1968) as updated by Begley, Ming, and Watts (1996).	Compustat
Book to Market	Book value of shareholder's equity divided by the market value of equity.	Compustat
Earnings to Price	Net income per share divided by end-of-year stock price.	Compustat
Return on Assets	Net income divided by year-end assets.	Compustat
Sales Growth	Percentage change in sales (Compustat data #12) from the prior year to the current year (for the fraud firms from two years prior to the fraud to the year prior to the fraud).	Compustat
Age of Firm	Length of time in years the firm has been publicly traded.	
M&A in First Year of Fraud	Indicator variable set equal to 1 if the firm had an acquisition that contributed to sales in the prior year (acquisition in the first year of fraud for fraud firms), and 0 otherwise. (Variable is set equal to 1 if data #249 > 0, otherwise variable is set equal to 0).	Compustat
Stock Volatility	Standard deviation of returns calculated over 60 months.	CRSP
CEO Tenure	Number of years the CEO has been the CEO of the company.	Execucomp

Appendix Table 9 - Continued

Variable	Definition	Data Source
	Armstrong, Jagolinzer, and Larcker (2010)	
EqIncQuint	Quintile ranking of the CEO's portfolio delta for which quintiles are computed annually from the cross-sectional distribution of portfolio deltas. Portfolio delta is calculated as the change in the risk-neutral dollar value of the CEO's equity portfolio for a 1% change in the firm's stock price.	Equilar
Leverage	Ratio of total debt to market value of assets.	Compustat
Market Cap	Natural logarithm of the market value of the firm's equity.	Compustat
Mkt to Book	Market value of equity divided by the book value of equity.	Compustat
Idiosync Risk	Natural logarithm of the standard deviation of residuals from a firm specific regression of monthly returns on the monthly return to the CRSP value weighted portfolio index using the previous 36 months (and requiring at least 12 months) of observations (Core and Guay [1999]).	CRSP
Tenure	Natural logarithm of the CEO's tenure with the firm in years + 1.	MSCI
Outside Ld Dir	Indicator variable that equals 1 if the firm has appointed a lead independent director, and 0 otherwise.	MSCI
CEO Apptd Outs Dirs	Fraction of outside directors appointed by the CEO; calculated as the number of outside directors whose tenure is less than the CEO's tenure, scaled by the total number of directors.	MSCI
Staggered Bd	Indicator variable that equals 1 if the corporate directors have staggered terms, and 0 otherwise.	MSCI
Pct Old Outs Dirs	Number of outside directors who are at least 69 years old scaled by the total number of directors.	MSCI
Pct Busy Outs Dirs	Number of outside directors who serve simultaneously on at least two boards scaled by the total number of directors.	MSCI
Pct Founding Dirs	Number of directors who are founders of the firm scaled by the total number of directors.	MSCI
Pct Fin Exps Aud	Number of directors with financial expertise who serve on the audit committee scaled by the total number of directors.	MSCI
Outside Chmn	Indicator variable that equals 1 if the chairman of the board of directors is an outsider, and 0 otherwise.	DEF 14A Filings
Outside Dir Holds	Number of shares held by outside directors scaled by the total number of shares outstanding.	DEF 14A Filings
Numbers Dirs	Natural logarithm of the number of directors on the board.	DEF 14A Filings
Dir Comp Mix	Ratio of total dollar equity compensation to total equity plus cash compensation for nonexecutive directors.	DEF 14A Filings
Number Inst Owns	Natural logarithm of the number of institutional owners of the firm's shares.	Thomson Reuters
Num Blockhldrs	Natural logarithm of the number of institutional owners that own at least 5% of the firm's outstanding shares.	Thomson Reuters
Activists	Natural logarithm of the number of institutional owners denoted as activists.	Thomson Reuters

Appendix Table 9 - Continued

Variable	Definition	Data Source
	Feng, Ge, Luo, and Shevlin (2011)	
CFO Sensitivity	Onepct/(Onepct + Salary + Bonus) where Onepct is calculated as per Core and Guay (2002).	DEF 14A Filings
CEO Sensitivity	Onepct/(Onepct + Salary + Bonus) where Onepct is calculated as per Core and Guay (2002).	DEF 14A Filings
Change in Receivables	Annual change in Receivables divided by average total assets.	Compustat
Change in Inventory	Annual change in Inventory divided by average total assets.	Compustat
Change in Cash Sales	Annual percentage change in cash sales; cash sales is computed as (Sales – Change in receivables).	Compustat
Change in Earnings	Annual change in (Earnings/Average total assets).	Compustat
RSST Accruals	(Change WC + Change NCO + Change FIN)/Average total assets, where WC = (Current Assets – Cash and Short-term Investments) – (Current Liabilities – Debt in Current Liabilities); NCO = (Total Assets – Current Assets – Investments and Advances) – (Total Liabilities – Current Liabilities – Long-term Debt); FIN = (Short-term Investments + Long-term Investments) – (Long-term Debt + Debt in Current Liabilities + Preferred Stock).	Compustat
	Armstrong, Larcker, Ormazabal, and Taylor (2013)	
Cash Comp	Natural logarithm of one plus the average total cash compensation received by the top 5 executives during the year.	DEF 14A Filings
Delta	Natural logarithm of one plus the average sensitivity of the top 5 executives' equity portfolio to a 1% change in stock price.	DEF 14A Filings
Vega	Natural logarithm of one plus the average sensitivity of the top 5 executives' equity portfolio to a 0.01 change in stock volatility.	DEF 14A Filings
Size	Natural logarithm of market value.	Compustat
BM	Ratio of book value of equity to market value of equity.	Compustat
Leverage	Total liabilities divided by total assets.	Compustat
Firm Age	Number of years the firm appears on Compustat.	Compustat
Capital	Net plant, property, and equipment scaled by total assets.	Compustat
Intangibles	Ratio of research and development and advertising expense to sales.	Compustat
ROA	Net income scaled by total assets.	Compustat
Financing	Amount raised from stock and debt issuances during the year scaled by total assets.	Compustat
Inventory	Inventory scaled by total assets.	Compustat
Receivables	Accounts receivable scaled by total assets.	Compustat
Acquisition	Indicator variable for whether an acquisition accounts for 20% or more of total sales.	Compustat
Sales Growth	Change in sales scaled by prior period sales.	Compustat
Return	Buy and hold returns over the year.	CRSP

Appendix Table 9 - Continued

Variable	Definition	Data Source
	Johnson, Ryan, and Tian (2009)	
Incentives - Restricted Stock	Change in value of an executive's restricted stock portfolio for a 1% change in common share price.	DEF 14A Filings
Incentives - Unrestricted Stock	Change in value of an executive's unrestricted stock portfolio for a 1% change in common share price.	DEF 14A Filings
Incentives - Unvested Options	Change in value of an executive's unexercisable option portfolio for a 1% change in common share price.	DEF 14A Filings
Incentives - Vested Options	Change in value of an executive's exercisable option portfolio for a 1% change in common share price.	DEF 14A Filings
Log (Sales)	Natural logarithm of total revenue.	Compustat
Pre-Fraud Three-Year Sales Growth	Percentage in growth of total revenue during the three years preceding the fraud.	Compustat
Log (1 + Board Size)	Natural logarithm of 1 plus the number of members of the firm's board of directors.	ISS/Boardex/DEF 14A Filings
Percentage Board Insiders	Percentage of non-independent directors on the firm's board of directors.	ISS/Boardex/DEF 14A Filings
Log (1 + Board Meetings)	Natural logarithm of 1 plus the number of board meetings held during the year.	ISS/Boardex/DEF 14A Filings
CEO Chairman	Indicator variable that equals 1 if the CEO serves as the chairman of the board of directors, and 0 otherwise.	ISS/Boardex/DEF 14A Filings
Outside Blockholders	Percentage of the firm's equity held by outside blockholders.	Thomson Reuters
Log (1 + Audit Committee Size)	Natural logarithm of 1 plus the number of members of the firm's audit committee.	ISS/Boardex/DEF 14A Filings
Percentage Audit Committee Insiders	Percentage of non-independent directors on the firm's audit committee.	ISS/Boardex/DEF 14A Filings
Log (1 + Audit Committee Meetings)	Natural logarithm of 1 plus the number of audit committee meetings held during the year.	ISS/Boardex/DEF 14A Filings
Financing Need	Cash flows from operations minus the prior three-year average of capital expenditures all scaled by total assets.	Compustat
Leverage	Sum of short-term and long-term debt scaled by total assets.	Compustat
Log (1 + CEO Tenure)	Natural logarithm of 1 plus the number of years the CEO has served in the role.	Execucomp
Log (1 + Age)	Natural logarithm of 1 plus the CEO's age.	Execucomp
CEO Founder	Indicator variable that equals 1 if the CEO is the founder of the firm, and 0 otherwise.	Boardex/DEF 14A Filings
Number of Other Boards	Number of other boards the CEO concurrently serves on.	Boardex/DEF 14A Filings

Appendix Table 10
Summary Statistics - Percentage of Firm-Years with Executives with Relatively Strong Equity Incentives

This table provides summary statistics displaying the percentage of firm-years with at least N executives with equity incentives above the year, industry, within-firm equity incentive-ranked Xth percentile. *Delta N-X* is an indicator variable equal to 1 if the firm has at least N executives with a year, industry, within-firm delta-ranked delta above the Xth percentile, and 0 otherwise. *Vega N-X* is an indicator variable equal to 1 if the firm has at least N executives with a year, industry, within-firm vega-ranked vega above the Xth percentile, and 0 otherwise.

	Equity Incentive Xth Percentile Rank						
	95th	90th	85th	80th	75th	70th	65th
Percentage of firm-years with:	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Delta - at least 1 above Xth	11.26	20.61	28.57	36.08	42.79	48.75	54.74
Vega - at least 1 above Xth	9.18	17.14	24.26	31.29	37.97	44.23	50.07
Delta - at least 2 above Xth	6.13	12.69	19.26	25.43	31.61	37.50	43.26
Vega - at least 2 above Xth	6.05	12.50	18.59	24.61	30.48	36.45	42.23
Delta - at least 3 above Xth	3.81	8.82	14.07	19.50	25.03	30.48	35.92
Vega - at least 3 above Xth	4.40	9.86	15.23	20.59	26.07	31.32	36.77
Delta - at least 4 above Xth	2.08	5.77	9.95	14.50	19.08	23.91	28.95
Vega - at least 4 above Xth	3.11	7.42	12.13	16.95	21.77	26.55	31.64
Delta - at least 5 above Xth	0.85	2.98	5.60	8.87	12.41	16.22	20.24
Vega - at least 5 above Xth	1.80	4.78	8.37	12.30	16.28	20.15	24.39

Appendix Table 11
Summary Statistics - Percentage of Fraud Firm-Years in Firms with Executives with Relatively Strong Equity Incentives

This table provides summary statistics displaying the percentage of fraud firm-years in firms with at least N executives with equity incentives above the year, industry, within-firm equity incentive-ranked Xth percentile. *Delta N-X* is an indicator variable equal to 1 if the firm has at least N executives with a year, industry, within-firm delta-ranked delta above the Xth percentile, and 0 otherwise. *Vega N-X* is an indicator variable equal to 1 if the firm has at least N executives with a year, industry, within-firm vega-ranked vega above the Xth percentile, and 0 otherwise.

	Equity Incentive Xth Percentile Rank						
	95th	90th	85th	80th	75th	70th	65th
Percentage of fraud firm-years in firms with:	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Delta - at least 1 above Xth	1.08	1.05	1.00	0.97	0.93	0.91	0.90
Vega - at least 1 above Xth	1.19	1.10	0.94	0.91	0.92	0.94	0.95
Delta - at least 2 above Xth	1.18	1.07	1.04	0.97	0.99	0.94	0.94
Vega - at least 2 above Xth	1.22	1.15	1.03	0.94	0.96	0.95	0.91
Delta - at least 3 above Xth	1.53	1.30	1.14	1.05	0.97	1.04	0.96
Vega - at least 3 above Xth	1.49	1.20	1.06	1.05	1.03	0.93	0.92
Delta - at least 4 above Xth	1.85	1.46	1.35	1.05	1.05	1.03	1.01
Vega - at least 4 above Xth	1.91	1.40	1.18	1.15	1.04	1.04	0.92
Delta - at least 5 above Xth	3.08	1.82	1.45	1.25	1.18	1.10	1.14
Vega - at least 5 above Xth	2.57	1.68	1.34	1.22	1.10	1.08	0.92

Appendix Table 12
Variable Definitions and Data Sources

Variable	Definition	Data Source
Named	Indicator variable equal to 1 for executives implicated in reporting fraud, and 0 otherwise.	AAERs
Fraud	Indicator variable equal to 1 for executives at fraud firms (at the beginning of the year reporting fraud begins), and 0 otherwise.	
Delta	Change in value of an executive's common stock and option portfolio for a one percent change in common share price (expressed in hundreds of thousands).	DEF 14A filings/ Execucomp / CRSP
Vega	Change in value of an executive's option portfolio for a one percent change in common share price volatility (expressed in thousands).	
Incentive Ratio	Delta scaled by the sum of delta, cash salary, and cash bonus.	
Gamma	Change in rate of option sensitivity to a one percent change in common share price (expressed in thousands).	
Bonus	Cash bonus received in the current year (expressed in thousands).	
CEO	Indicator variable equal to 1 for CEOs, and 0 otherwise.	
CFO	Indicator variable equal to 1 for CFOs, and 0 otherwise.	
Delta Share	Change in value of an executive's common stock portfolio for a one percent change in common share price.	
Delta U Option	Change in value of an executive's unexercisable option portfolio for a one percent change in common share price.	
Delta E Option	Change in value of an executive's exercisable option portfolio for a one percent change in common share price.	
Vega U Option	Change in value of an executive's unexercisable option portfolio for a one percent change in common share price volatility.	
Vega E Option	Change in value of an executive's exercisable option portfolio for a one percent change in common share price volatility.	
Delta N-X	Indicator variable equal to 1 if the firm has at least N executives with a year, industry, within-firm delta-ranked delta above the Xth percentile, and 0 otherwise.	
Vega N-X	Indicator variable equal to 1 if the firm has at least N executives with a year, industry, within-firm vega-ranked vega above the Xth percentile, and 0 otherwise.	
Market Cap	Natural logarithm of the firm's market capitalization.	Compustat
MTB	Ratio of the firm's market value of equity to book value of equity.	
Leverage	Total book value of debt scaled by total book value of equity.	
ROA	Net income scaled by total assets.	
Capital	Net property, plant, and equipment scaled by total assets.	
Receivables	Accounts receivable scaled by total assets.	
Intangible	Research and development expense plus advertising expense all scaled by sales.	
Growth	Sales in year t less sales in year t - 1 all scaled by sales in year t - 1.	
Financing	Sum of equity and debt issued in the current period all scaled by total assets.	
Acquisition	Indicator variable equal to 1 if current period acquisitions are more than 20% of sales, and 0 otherwise.	
Constraint	Financial constraint proxy developed in Kaplan and Zingales (1997).	
Return	Buy and hold return for the previous 12 months.	CRSP
Firm Age	Number of years the firm has been listed on CRSP.	