Do Firms Understate Stock Option-Based Compensation Expense Disclosed under SFAS 123?

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Abstract. Focusing on the four key option pricing model inputs – expected option life, expected stock price volatility, expected dividend yield, and the risk-free interest rate for the expected life of the option – this study finds that firms understate option value estimates and, thus, stock-based compensation expense disclosed under SFAS 123. As predicted based on incentives and opportunities for management to understate SFAS 123 expense, the understatement of option value estimates is increasing in proxies for the magnitude of the expense, is greater for firms with weaker corporate governance, and, to a lesser extent, is increasing in the excessiveness of executive pay. The findings are strongest for the expected option life and expected stock price volatility input assumptions, consistent with firms' greater latitude in determining these inputs. We find weaker evidence of understatement associated with the expected dividend yield assumption, and none for the interest rate assumption, consistent with these inputs being less amenable to discretion. Taken together, our findings raise some concern that the exercise of management discretion adversely affects the overall reliability of SFAS 123 expense.

Keyword: stock option-based compensation, SFAS 123, financial reporting discretion

JEL Classifications: M41, M52, G13, J33

Do Firms Understate Stock Option-Based Compensation Expense Disclosed under SFAS 123?

The objective of this study is to determine whether firms understate stock-based compensation expense that is disclosed but not recognized under Statement of Financial Accounting Standards (SFAS) No. 123 (Financial Accounting Standards Board (FASB), 1995, hereafter SFAS 123 expense). SFAS 123 expense relates to employee compensation in the form of stock options. It is based on estimates of the grant-date values of options granted to employees, which depend on expectations about the future. Although SFAS 123 provides guidance relating to factors firms should consider in making these estimates, substantial opportunity for managerial discretion remains. We focus on the key inputs to option value estimates – assumptions of expected option life from grant to exercise and expected stock price volatility, expected dividend yield, and the risk-free interest rate for the expected life of the option. SFAS 123 requires disclosure of these assumptions, which permits us to investigate whether managerial discretion reflected in the assumptions varies predictably with incentives and opportunity for firms to understate SFAS 123 expense.

We identify two incentives for firms to understate SFAS 123 expense and, thus, option value estimates. The first relates to increasing investors' perceptions of the firm's profitability. Prior research and anecdotal evidence are consistent with users of financial statements viewing SFAS 123 expense as an expense of the firm. If, consistent with this view, managers believe that understating SFAS 123 expense will cause investors to perceive profitability to be higher than they otherwise would, firms have incentives to understate it. The second relates to decreasing any perceived excessiveness of compensation paid to the firm's executives. The executive compensation literature documents that managers often attempt to minimize perceptions that

their compensation, particularly that related to stock options, is excessive. Thus, we predict that the understatement of firms' disclosed option value estimates increases with the magnitude of stock option-based compensation expense and the perceived excessiveness of executive pay. We also consider management's opportunity to understate SFAS 123 expense by considering the strength of the firm's corporate governance structure. We predict that firms with weaker corporate governance have more understatement of disclosed option value estimates.

Our first set of tests focuses on determining whether proxies for firms' incentives and opportunity to understate SFAS 123 expense can explain firms' disclosed option value estimates, after controlling for an estimate of option values that we calculate using option pricing model inputs we determine following the guidelines in SFAS 123. Differences between firms' disclosed option value estimates and our calculated option values arise only from differences between firms' disclosed input assumptions, which are potentially subject to discretion, and the input assumptions we determine, which are not. Detecting a significant negative relation between disclosed option values and our experimental variables indicates that the understatement of option value estimates and, thus, SFAS 123 expense is larger for firms with greater incentives and opportunity to do so.

Our proxy for the magnitude of stock option-based compensation expense is the number of options granted during the year multiplied by our calculated option value, deflated by number of shares outstanding. Our proxy for excessive executive pay is, following prior research, the residual from a regression of Chief Executive Officer (CEO) annual compensation on proxies for firm size, performance, growth, risk, and industry membership. Our proxy for corporate governance is based on the governance score compiled by the Investor Responsibility Research Center.

To implement our tests, we hand collect disclosures relating to stock option-based compensation for firms in the Standard and Poors (S&P) 500, S&P 400 mid-capitalization, and S&P 600 small-capitalization indices. We collect option pricing model inputs used by the firm in estimating the value of its granted options, the resulting option value estimates, and other items related to the firm's employee stock options. Our sample comprises 3,368 firm-year observations from 1996 to 2001 with all of the data we require for our tests.

We find that firms' disclosed option value estimates significantly understate the option values that we calculate. As predicted, we also find that the understatement increases with our proxies for the magnitude of stock option-based compensation expense and weaker corporate governance. These findings indicate that the extent to which firms understate option value estimates through their combined discretion in assumed expected option life, expected stock price volatility, expected dividend yield, and the risk-free interest rate is larger for firms that have greater incentives and opportunity to do so.

Our second set of tests focuses on determining which of the four option pricing model inputs are associated with firms' understatement of option value estimates. For each input, we calculate option value estimates using the assumption we determine for that input and the firms' disclosed assumptions for the other three inputs. Thus, differences between disclosed option values and our calculated option values arise only from differences between the particular disclosed input assumption, which is potentially subject to discretion, and the input assumption we determine, which is not.

For expected option life, we find a significant association between the understatement of option value estimates and the magnitude of stock option-based compensation expense, perceived excessiveness of executive pay, and weaker corporate governance. For expected stock

price volatility, we find a significant association for the magnitude of stock option-based compensation expense and weaker corporate governance. For expected dividend yield, we find a significant association only for corporate governance; for the interest rate assumption, we find no association between the understatement of option value estimates and our experimental variables.

The stronger findings for expected option life and expected volatility are consistent with firms' having latitude in determining these input assumptions. The weaker findings for expected dividend yield and the interest rate assumption are not unexpected given that the ability of firms to manage these two input assumptions is limited by the existence of publicly available benchmarks for determining them. Benchmarks for expected option life and expected stock price volatility are less well established, making understating these input assumptions a potentially more fruitful way of understating SFAS 123 expense.

Results from additional analyses reveal corroborating inferences. First, we find identical inferences when we focus on whether our experimental variables explain the difference between the disclosed option value and the option value we calculate. Second, we find identical inferences when we focus on the input assumptions themselves, rather than the resulting estimated option value. Third, we find identical inferences when we use the number of options granted as an alternative proxy for stock option-based compensation expense.

The paper proceeds as follows. The next section summarizes the financial reporting for employee stock option-based compensation, and Section 2 discusses firms' incentives and opportunity to understate SFAS 123 expense. Section 3 outlines the research design and Section 4 describes the data and descriptive statistics. Section 5 presents our findings and Section 6 concludes.

1. Financial Reporting for Stock Option-Based Compensation

Accounting for stock option-based compensation is specified in Accounting Principles Board Opinion (APB) No. 25 (APB, 1973) and SFAS 123. Under APB 25, stock option-based compensation expense is based on the difference at the measurement date between the stock price and option exercise price. Because for most fixed option grants the exercise price equals the stock price at the date of grant, the expense under APB 25 typically equals zero. Under SFAS 123, the expense is calculated based on the option's fair value at grant date, and is not adjusted for subsequent changes in value. SFAS 123 expense is grant-date option value multiplied by the number of granted options, amortized over the vesting period. To capture the fact that some employees terminate employment before the end of the vesting period, firms can either recognize forfeitures as they occur, or use the number of options expected to vest.

SFAS 123 permits firms to apply the measurement provisions in APB 25 or SFAS 123; almost all firms apply APB 25.[1] If a firm measures the expense under APB 25, SFAS 123 requires disclosure of pro forma net income, which is what net income would have been had SFAS 123 expense been recognized. Other required disclosures include the number of options granted, vesting period, estimated value of options granted, and the inputs the firm used to estimate option values, i.e., option exercise price, expected option life, expected stock price volatility, expected dividend yield, and the risk-free interest rate for the expected option life.[2]

[1] Since the summer of 2002, many firms have announced their intention to recognize SFAS 123 expense in determining net income. For analyses of factors associated with these firms' decision to recognize SFAS 123 expense and the market reaction, see Aboody, Barth, and Kasznik (2004b). Our sample period predates these recognition announcements.

[2] Although SFAS 123 expense depends on other assumptions, we focus on those related to disclosed option value estimates because there likely is less opportunity for management discretion relating to the others. In particular, the number of options granted, vesting period, and exercise price are contractual and, thus, observable at grant date, as is the grant date stock price. Also, granting fewer options, lengthening the vesting period, and increasing the exercise price have economic consequences for the firm beyond managing accounting amounts.

In estimating grant date option values, SFAS 123 requires use of the expected life of the option, rather than its contractual term, because employee stock options are nontransferable and, thus, employees systematically exercise them early (Huddart and Lang, 1996). SFAS 123 states that in estimating expected option life, a firm should consider the option vesting period, the average length of time similar grants have been outstanding, and expected stock price volatility. In estimating expected stock price volatility, a firm should consider historical volatility for the most recent period that is commensurate with expected option life. In estimating expected dividends, a firm should consider historical dividends, and its expectations about changes in dividends over the expected option life. The risk-free interest rate is to be the implied yield currently available on zero-coupon U.S. government issues with a remaining term equal to the expected option life.

Because option value estimates depend on expectations about the future, SFAS 123 creates an opportunity for the exercise of management discretion. SFAS 123 states that expectations are to be based on past experience, modified to reflect ways in which currently available information indicates the future is reasonably expected to differ from the past. Despite guidance in SFAS 123 relating to factors firms should consider in making these assumptions, significant room for discretion remains. In particular, estimated option values depend on assumptions of expected option life from grant to exercise, future stock price volatility, and future dividends, and the risk-free interest rate. Moreover, there is no *ex post* verification of the grant-date option values used in the calculation of SFAS 123 expense. That is, unlike for other accruals, there is no mechanism in the accounting system that subsequently reveals whether the

option value estimates are reasonable or adjusts them for errors in their estimation. This susceptibility to discretion has raised concerns that SFAS 123 expense is not reliably estimable.[3]

The accounting treatment of stock option-based compensation has been one of the most controversial in the FASB's history and received further attention following the recent wave of accounting scandals and the collapse of the stock-compensation-intensive technology sector. In 2004, the FASB revisited SFAS 123 and amended it to require recognition of stock-based compensation expense (FASB, 2004). In the same year, the International Accounting Standards Board issued a similar standard (IASB, 2004). Despite the considerable attention to stock option-based compensation in recent years, there is little evidence on how management discretion affects the reliability of the expense disclosed under SFAS 123.[4]

2. Incentives and Opportunity to Understate SFAS 123 Expense

Our main research question is whether firms understate SFAS 123 expense by understating option value estimates. We identify two incentives for firms to do so. The first relates to increasing investors' perceptions of the firm's profitability. Even though SFAS 123 expense is not recognized, prior research finds evidence consistent with financial statement users viewing SFAS 123 expense as an expense of the firm. Because SFAS 123 expense relates to employee compensation, firms' operating income can be overstated if the expense is not

[3] Reliability is one of the primary factors standard-setters consider in assessing accounting amounts (FASB, 1980). Reliability of accounting amounts has several dimensions (FASB, 1980). One is verifiability, i.e., the extent to which different measurers would arrive at the same amount, and another is neutrality, i.e., the amount is an unbiased measure of the object of measurement. These are the dimensions we focus on. That is, we take the measurement guidance in SFAS 123 as given and investigate how firms implement that guidance. Thus, the understatement to which we refer is relative to unbiased implementation of SFAS 123. A third dimension of reliability is representational faithfulness, i.e., the extent to which the amount represents what it purports to represent. Focusing on this dimension of reliability would require determining the best estimate of employee stock option values, which is beyond the scope of our inquiry.

[4] Aboody, Barth, and Kasznik (ABK, 2004a) provides evidence on the reliability of SFAS 123 expense using a capital markets-based research design. It concludes that SFAS 123 expense is reliable enough to be reflected in

included.[5] In particular, Aboody (1996) finds a significant negative relation between share price and researcher-estimated values of outstanding employee stock options, and Aboody, Barth, and Kasznik (2004a) finds a significant negative relation between share prices and SFAS 123 expense. To the extent managers believe that understating SFAS 123 expense increases their firms' perceived profitability, they have incentives to do so.[6] Such incentives could be related to equity valuation effects associated with SFAS 123 expense or to implicit contracts based on pro forma net income.[7] Thus, we predict that the understatement of firms' disclosed option value estimates increases with the magnitude of stock option-based compensation expense.

Our directional prediction differs from many other earnings management studies that predict some firms have incentives to decrease earnings and, therefore, to increase expenses. These studies typically focus on accounting-based contractual provisions that provide incentives to decrease earnings in particular circumstances. However, underlying these earnings-decreasing predictions typically is the accruals-reversal feature of accounting. With accruals-reversal, exercising discretion to decrease earnings in one period results in increased earnings in a subsequent period. For example, managers with nonlinear cash bonus plans may have incentives to maximize their compensation by selecting earnings-decreasing discretionary accruals in the current period, knowing that such discretionary accruals will reverse in subsequent periods, thereby increasing earnings in those periods (e.g., Healy, 1985).

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investors' valuation assessments. ABK jointly tests reliability and relevance. The design does not permit determining the extent of reliability or identifying more or less reliable inputs.

[5] Consistent with this view, Standard and Poors (S&P) includes unrecognized expense from stock option grants in the calculation of "Core Earnings" in an attempt to provide a standard, comparable income number that most closely reflects the earnings from the firm's ongoing operations (BusinessWeek, May 27, 2002, pp. 34-37).

[6] This belief of managers is summarized in the following quote:

> "If stock options aren't a form of compensation, what are they? And if compensation isn't an expense then what is it? And if expenses shouldn't go into the calculation of earnings, where in the world should they go?" (Warren Buffet, CEO of Berkshire Hathaway, Inc., 1994).

[7] Although we are unaware of use of pro forma net income disclosed under SFAS 123 in explicit accounting-based contracts, the extent to which pro forma net income affects implicit contracts is an open question.

The accruals-reversal feature of accounting is not present in the case of SFAS 123 expense. Unlike for other accruals, grant-date option value estimates are not subsequently adjusted for any discretion exercised in their estimation; once grant-date option values are determined, they are not changed in subsequent periods. Thus, exercising discretion in estimating option value estimates cannot be used to shift income across periods.[8] As a consequence, management incentives identified in prior research to decrease earnings do not apply to SFAS 123 expense. For example, without the prospects of a subsequent earnings reversal, the incentives for managers to understate earnings in response to nonlinear bonus plans are essentially nullified.

The second incentive for firms to understate SFAS 123 expense relates to decreasing perceived excessiveness of executive pay. The executive compensation literature finds that although managers make financial reporting and disclosure decisions that increase their compensation (e.g., Healy, 1985; Aboody and Kasznik, 2000), they also attempt to minimize investors' perception of its magnitude.[9] Murphy (1999) surveys the executive compensation literature and notes that higher perceived pay levels impose costs on executives by inviting scrutiny and criticism from the media, labor unions, institutional investors, and shareholder groups. Some of these costs are non-pecuniary and some are pecuniary, e.g., an increased

[8] The only exception is the treatment of expected forfeitures. SFAS 123 expense is adjusted during the vesting period for differences between expected and actual forfeitures. Thus, exercising discretion relating to expected forfeitures can alter the timing of SFAS 123 expense across periods within the vesting period. We do not consider discretion with respect to expected forfeitures because neither they nor whether the firm incorporates them are publicly disclosed and, therefore, available to us.

[9] Lewellen, Park, and Ro (1995), Murphy (1996), Yermack (1998), and Baker (1999) find evidence consistent with firms understating in their proxy statements estimated values of options granted to the firm's CEO, particularly when the CEO receives more compensation than predicted by compensation models.

likelihood of employment termination or reduced pay in future periods. These costs likely are greater for executives whose compensation is perceived as excessive.[10]

Executives whose compensation could be perceived as excessive likely are more concerned about attracting media and investor attention if their firms disclose high levels of SFAS 123 expense. Relatedly, Dechow, Hutton, and Sloan (1996) finds a significant relation between the use of stock options in top executive compensation and the likelihood the firm submitted a comment letter opposing the FASB's proposal to recognize SFAS 123 expense. This proxy is the primary variable explaining firms' positions on the proposal. Thus, we expect that the extent to which firms understate SFAS 123 expense increases in the perceived excessiveness of executive pay.

We will not find evidence that firms understate SFAS 123 expense if managers do not believe that understating the expense will either increase perceived firm profitability or decrease the perceived excessiveness of executive pay. Managers might believe that investors and other users of the financial statements do not view SFAS 123 expense as an expense of the firm, or ignore it. Managers also might believe that financial statement users see through the effects of exercised discretion.[11] Finally, as with all financial statement amounts, SFAS 123 expense is subject to audit, regulatory enforcement, and scrutiny by investor groups, resulting in costs associated with managing it. Although it is difficult to quantify these costs, we presume firms do

[10] There are numerous examples of excessive executive compensation attracting media attention and investor action. For example, Computer Associates International Inc. awarded more than $1 billion in stock to three top executives, of which $655 million was to Chairman and CEO Charles B. Wang, ranking him one of the highest-paid executives in 1999. As described in BusinessWeek (April 17, 2000), "the award prompted a dozen lawsuits and a barrage of criticism. Graef S. Crystal, the prominent executive-pay gadfly, lambasted the award as 'unconscionable' and described Wang as easily the most overpaid CEO in the history of the U.S."

[11] There is a large literature documenting that managers exercise financial reporting discretion and that equity values reflect some effects of such discretion (for a review of this literature, see Fields, Lys, and Vincent, 2001). Also, managers talk and act as if they believe financial statement users do not undo fully the effects of accounting discretion. Regardless of whether managers succeed in managing investors' perceptions, extant studies (e.g., Sloan, 1996; Burgstahler and Dichev, 1997; Xie, 2001; Barth and Hutton, 2004) assume they attempt to do so.

not have unlimited opportunity to manage option value estimates. Therefore, we will not find evidence that firms understate the SFAS 123 expense if the cost of doing so exceeds any potential benefits.

To capture some of the cross-sectional variation in firms' opportunity to manage financial statement amounts, we consider the relation between the understatement of option value estimates and the firm's corporate governance. We expect that firms with weaker corporate governance have more opportunity to understate option values. This prediction is consistent with Dechow, Sloan, and Sweeney (1996), which finds that firms are more likely to manipulate earnings, as evidenced by SEC accounting enforcement actions, if they have weak corporate governance. It also is consistent with Klein (2002), which shows that boards of directors that are structured to be more independent of the CEO are more effective in monitoring financial accounting decisions.

3. Research Design

Our first set of tests focuses on determining whether our proxies for firms' incentives and opportunity to understate SFAS 123 expense explain firms' disclosed option value estimates, after controlling for calculated option values that are not subject to discretion. In particular, we base our inferences on the following equation:

$$OPTVAL_{it} = \sum_{N=1}^{33} \alpha_{0N} INDUSTRY_{Nit} + \sum_{Y=1996}^{2001} \alpha_{0Y} YR_{Yit} + \alpha_1 OPTVAL\_CALC_{it} \\ \beta_1 COMPX_{it} + \beta_2 RESCOMP_{it} + \beta_3 GOV_{it} + \mathrm{K} * CONTROLS_{it} + \varepsilon_{1it}. \quad (1)$$

OPTVAL is the estimated value of each option granted by the firm, as disclosed under SFAS 123. *OPTVAL_CALC* is an option value estimate we calculate using the Black-Scholes (1973) option pricing formula based on option pricing model inputs that we determine, as

described below. Because *OPTVAL* is based on firms' expectations of option life, future stock price volatility, and future dividend yield, and the risk-free interest rate over the expected option life, it reflects any discretion firms exercise in determining these inputs. In contrast, *OPTVAL_CALC* is not affected by discretion. Thus, estimating (1) permits us to test whether the effects of discretion in firms' inputs are associated with incentives and opportunity to understate SFAS 123 expense, as reflected in our experimental variables described below, *COMPX*, *RESCOMP*, and *GOV*. *CONTROLS* is a vector of control variables, which also are described below. $INDUSTRY_N$ (YR_Y) is an indicator variable that equals one if the firm is in industry *N* (the observation is from year *Y*), and zero otherwise. Subscripts *i* and *t* denote firms and years.[12]

Our proxy for the magnitude of stock option-based compensation expense is *COMPX*, the number of options granted during the year multiplied by *OPTVAL_CALC* and deflated by shares outstanding at the end of the year. We do not use SFAS 123 expense itself as the proxy because it is a function of the disclosed option value estimates, which are the focus of our tests. Our proxy for excessive executive pay is *RESCOMP*. Following Murphy (1996), Yermack (1998), and Baker (1999), *RESCOMP* is the residual from a regression of total annual CEO compensation on proxies for firm size, performance, growth, risk, and industry membership, as described in the Appendix. Our proxy for corporate governance is based on the governance score compiled by the Investor Responsibility Research Center (IRRC). The IRRC score is based on 23 corporate governance provisions that measure shareholders' rights (see Gompers, Metrick, and Ishii, 2003). *GOV* is an indicator variable that equals one if the firm's IRRC

[12] We estimate all equations using a robust regression technique, pooling data across years. The procedure begins by calculating Cook's D statistic and excluding observations with D > 1. Then, the regression is re-estimated, weights for each observation are calculated based on absolute residuals – Huber weights and biweights – and the estimation is repeated iteratively using the weighted observations until convergence in the maximum change in weights is achieved (Berk, 1990). Our significance tests are based on standard errors calculated using the pseudo

governance score is above the sample median, i.e., with weaker corporate governance, and zero otherwise.[13] We predict that the coefficients on *COMPX*, *RESCOMP*, and *GOV* are negative.

We estimate *OPTVAL_CALC* using proxies for the four key option pricing model inputs, following the guidelines outlined in SFAS 123. In particular, in place of the firm's disclosed expected volatility assumption, *VOL*, which is an input for the disclosed option value estimate, *OPTVAL*, we use historical volatility estimated over a period equal to expected option life, *VOL_HIST*. SFAS 123 states that when determining expected volatility, a firm should consider historical volatility for the most recent period that is commensurate with expected option life. Similarly, in place of the firm's disclosed expected dividend assumption, *DIV*, we use dividend yield measured over the prior year, *DIV_HIST*; SFAS 123 states that in estimating future dividends, firms should consider its dividend yield history. In place of the firm's interest rate assumption, *INT*, we use the grant-year average yield on zero coupon U.S. Treasury Bills with a term equal to expected option life, *INT_HIST*, as suggested by SFAS 123.

In place of the firm's expected option life assumption, *LIFE*, we use *LIFE_PRED*, the predicted value from a regression of *LIFE* on four instrumental variables. The first is the option vesting period. SFAS 123 states that expected option life should depend on the vesting period. The next two are the number of options cancelled during the year deflated by the sum of options outstanding at the end of the year and options cancelled during the year, and the number of options exercised during the year deflated by the sum of options outstanding at the end of the year and options exercised during the year. SFAS 123 states that a firm should consider the

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values approach described in Street, Carroll, and Ruppert (1988), after adjusting them to be heteroskedasticity-consistent (White, 1980). Our inferences are unaffected by using ordinary least squares estimation.

[13] We use an indicator variable for *GOV* because we have no reason to believe that all of the governance provisions comprising it affect governance equally. For example, we have no reason to believe that the effect on governance of the firm having 5 provisions rather than 2 is the same as having 23 provisions rather than 20. Nonetheless,

average length of time similar grants have been outstanding in the past.[14] The fourth is the percent of options granted to the top five executives. We expect that such options have longer expected lives than do options granted to other employees.[15]

We use an instrumental variables approach for *LIFE* because there is no single proxy that captures expected option life well. The advantage of using an instrumental variables approach is that multiple dimensions of expectations can be taken into account. The disadvantage is that mean differences between the disclosed amounts and amounts not subject to discretion are not preserved. As evidenced by the correlation coefficients reported in table 2, for the other three inputs, *VOL*, *DIV*, and *INT*, highly correlated single-variable proxies are available. Thus, we use them rather than using an instrumental variables approach.

Our second set of tests focuses on determining which of the option pricing model inputs are associated with firms' incentives and opportunity to understate SFAS 123 expense. We base our inferences on estimating four versions of (1), one for each of the inputs, *LIFE*, *VOL*, *DIV*, and *INT*. In particular, for each input, we calculate $OPTVAL\_CALC^{INPUT}$ using the assumption we determine for the input in question and the disclosed assumptions for the other three inputs. For example, for *LIFE*, we calculate $OPTVAL\_CALC^{LIFE}$ using *LIFE_PRED*, *VOL*, *DIV*, and *INT*. For *VOL*, we calculate $OPTVAL\_CALC^{VOL}$ using *VOL_HIST*, *LIFE*, *DIV*, and *INT*. Thus, differences between *OPTVAL* and $OPTVAL\_CALC^{INPUT}$ reflect only differences between the

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untabulated findings reveal that none of our inferences is affected by defining *GOV* as the number of governance provisions.

[14] We presume that option cancellations reflect option forfeitures prior to vesting. Although such forfeitures do not directly affect expected option life, they suggest the level of employee turnover. Cancellations also could reflect expiration of out-of-the-money vested options. Thus, in a sensitivity analysis we include the ratio of current share price to the average exercise price of cancelled options as an explanatory variable and interacted with option cancellations. Untabulated findings reveal that the negative relation we document between *LIFE* and option cancellations is not attributable to out-of-the-money options.

[15] Untabulated findings reveal that all four variables are significantly associated with *LIFE*, with signs consistent with expectations. The t-statistics are 7.39 for vesting period, –11.17 for the fraction of cancelled options, –10.94

particular disclosed input assumption, which is potentially subject to discretion, and the input assumption we determine, which is not.

In particular, we estimate the following equations:

$$OPTVAL_{it} = \sum_{N=1}^{33} \alpha_{0N} INDUSTRY_{Nit} + \sum_{Y=1996}^{2001} \alpha_{0Y} YR_{Yit} + \alpha_1 OPTVAL\_CALC^{LIFE}{}_{it} + \beta_1 COMPX_{it} + \beta_2 RESCOMP_{it} + \beta_3 GOV_{it} + \mathrm{K} * CONTROLS^{LIFE}{}_{it} + \varepsilon_{2ait}. \quad (2a)$$

$$OPTVAL_{it} = \sum_{N=1}^{33} \alpha_{0N} INDUSTRY_{Nit} + \sum_{Y=1996}^{2001} \alpha_{0Y} YR_{Yit} + \alpha_1 OPTVAL\_CALC^{VOL}{}_{it} + \beta_1 COMPX_{it} + \beta_2 RESCOMP_{it} + \beta_3 GOV_{it} + \mathrm{K} * CONTROLS^{VOL}{}_{it} + \varepsilon_{2bit}. \quad (2b)$$

$$OPTVAL_{it} = \sum_{N=1}^{33} \alpha_{0N} INDUSTRY_{Nit} + \sum_{Y=1996}^{2001} \alpha_{0Y} YR_{Yit} + \alpha_1 OPTVAL\_CALC^{DIV}{}_{it} + \beta_1 COMPX_{it} + \beta_2 RESCOMP_{it} + \beta_3 GOV_{it} + \mathrm{K} * CONTROLS^{DIV}{}_{it} + \varepsilon_{2cit}. \quad (2c)$$

$$OPTVAL_{it} = \sum_{N=1}^{33} \alpha_{0N} INDUSTRY_{Nit} + \sum_{Y=1996}^{2001} \alpha_{0Y} YR_{Yit} + \alpha_1 OPTVAL\_CALC^{INT}{}_{it} + \beta_1 COMPX_{it} + \beta_2 RESCOMP_{it} + \beta_3 GOV_{it} + \mathrm{K} * CONTROLS^{INT}{}_{it} + \varepsilon_{2dit}. \quad (2d)$$

Equations (1) and (2a) through (2d) each includes a vector of control variables, *CONTROLS* and $CONTROLS^{INPUT}$, which comprises variables that are intended to mitigate measurement error in our calculated option value associated with using proxies for expected option life, expected volatility, expected dividend yield, and the risk-free interest rate. The controls also are intended to control for firm characteristics that could explain differences in option values unrelated to our predictions. Because equations (1) and (2a) through (2d) test for

for the fraction of exercised options, and 2.14 for the percent of options granted to the top five executives. The estimation equation also controls for industry and year effects. The adjusted R^2 is 15.6%.

the effects of discretion in different inputs, the control variables differ across equations. We do not predict the sign of the relation between *OPTVAL* and the control variables.

CONTROLS, $CONTROLS^{LIFE}$, $CONTROLS^{VOL}$, and $CONTROLS^{DIV}$ each includes the natural logarithm of market value of equity, *SIZE*, because larger firms likely are more well-established and so are likely to have longer expected option lives, lower volatility, and higher dividend yields. Each also includes the book-to-market ratio, *BM*, and sales growth over the prior year, *GROWTH*, because firms with more growth, i.e., lower *BM* and higher *GROWTH*, might have less stable workforces and, thus, shorter option lives, and likely have higher volatility and lower dividend yields. Each also includes the number of options outstanding at the beginning of the year as a percentage of shares outstanding at the end of the year, *OPT_OUT*, as a control for unspecified factors related to firms' propensity to issue stock options to employees. For example, firms with higher stock price volatility tend to rely more extensively on stock options for compensation.[16] Each also includes stock price volatility over the prior year, $1YR\_VOL^{PRE}$ as a proxy for the firm's volatility. We do this because SFAS 123 and Huddart and Lang (1996) suggest that firms with more volatile stock prices likely have shorter option lives.[17] Also, firms might consider volatility from recent periods to be more indicative of future volatility than that from earlier periods. Finally, it is likely that firms with lower volatility pay higher dividends. $CONTROLS^{INT}$ does not include variables capturing firm characteristics

[16] *OPT_OUT* is not an incentive variable because although SFAS 123 expense includes option value estimates associated with option grants in prior years, SFAS 123 requires the expense to be based on grant-date option values. The expense is not adjusted for subsequent changes in option values. Thus, any discretion exercised by firms in determining the inputs in any particular year affect only the estimated values of options granted during that year. Estimated values of options granted in prior years do not change. Untabulated findings reveal that our inferences are identical when we omit *OPT_OUT* from equations (1) and (2a) through (2d).

[17] Huddart and Lang (1996) and Core and Guay (2001) find that recent stock performance is significantly related to employees' early option exercises. The focus of these studies is on explaining *ex post* exercise patterns. In contrast, we seek to explain firms' *ex ante* assumptions relating to expected option lives.

because, unlike the other three inputs, *INT* relates to market interest rates, not firm-specific characteristics.

$CONTROLS^{VOL}$, $CONTROLS^{DIV}$, and $CONTROLS^{INT}$ each includes *LIFE* because expected volatility, expected dividend yield, and the risk-free interest rate depend on the firm's assumption about expected option life – each is to reflect expectations over a future period equal to expected option life. Generally, the longer expected option life, the firm is likely to be less volatile and pay more dividends. The risk-free interest rate depends on expected option life because of term structure effects. *CONTROLS* includes an expected option life variable for the same reasons. However, it includes *LIFE_PRED* rather than *LIFE* because equation (1) is designed to test for discretion in all input assumptions, including *LIFE*. Thus, controlling for *LIFE* in equation (1) would confound our tests. Equations (2b), (2c), and (2d) are designed to test for discretion in expected volatility, expected dividend yield, and the risk-free rate, respectively, not expected option life. We do not include a control for expected life in equation (2a) because expected option life is the variable of interest in that equation.

CONTROLS and $CONTROLS^{VOL}$ each also includes stock price volatility over the subsequent year, $1YR\_VOL^{POST}$. We do so to mitigate measurement error in *OPTVAL_CALC* and $OPTVAL\_CALC^{VOL}$ associated with using *VOL_HIST* as a proxy for expected volatility. Equations (1) and (2b) are designed to test for discretion in the expected volatility assumption and realized future volatility is a proxy for expected volatility.[18] We do not include

[18] Untabulated findings reveal that all three volatility measures are incrementally significantly positively related to *VOL*. In particular, the coefficients (t-statistics) from a regression of *VOL* on *VOL_HIST*, $1YR\_VOL^{PRE}$, and $1YR\_VOL^{POST}$ are 0.67, 0.14, and 0.08 (50.32, 12.01, and 9.68). Ideally, we would include realized future volatility for a subsequent period equal to expected option life. However, because our sample period ends in 2001, we are unable to do so. Expected future volatility can also be approximated using estimates of implied volatilities inferred from the prices of traded call options (see Bartov, Mohanram, and Nissim, 2004). However, publicly traded options generally have much shorter horizons than employee stock options, and are not available for many of our sample firms.

$1YR\_VOL^{POST}$ in equations (2a) and (2c) because $OPTVAL\_CALC^{LIFE}$ and $OPTVAL\_CALC^{DIV}$ do not depend on *VOL_HIST*. $CONTROLS^{VOL}$ also includes *DIV_HIST* because firms with lower dividends tend to have higher volatility. This is the same reason we include $1YR\_VOL^{PRE}$ in $CONTROLS^{DIV}$.[19]

4. Data and Descriptive Statistics

4.1. Data

Our sample comprises firms in the S&P 500, S&P 400 mid-capitalization, and S&P 600 small-capitalization indices with stock option-based compensation plans. We include firms from these three indices because we seek to test our predictions on a broad sample of firms – these indices represent over 50% of the total market capitalization of the US equity markets and comprise large, medium, and small firms.[20] Also, firms in these indices are those included in the Execucomp database, from which we obtain our executive compensation data. We identify a firm as having a stock option-based compensation plan if the firm has a nonzero number of shares reserved for stock option plans (Compustat data item # 215), or if Execucomp identifies the firm as having options outstanding to at least one of its top five executives. Of the 1,175 firms that meet these criteria, 980 have financial statements available on EDGAR and disclose SFAS 123 expense. The final sample comprises 3,368 firm-year observations relating to 887 firms with all data required for our tests.

[19] Untabulated findings reveal that our inferences relating to *COMPX*, *RESCOMP*, and *GOV* from equations (1) and (2a) through (2d) are identical when we exclude the control variables. Untabulated findings also reveal that our inferences from equations (1), (2a), (2c), and (2d) are identical when we include all of the control variables. We do not include *LIFE_PRED* or *LIFE* in equation (2a) and *DIV_HIST* in equation (2c) because *LIFE* and *DIV* are the variables of interest in these equations. The tabulated specification of equation (2b) includes all control variables.

[20] Firms in the S&P 500 index are noticeably larger than those in the other two indices. However, our inferences are unaffected if we estimate our equations separately for firms in the S&P 500 index and in the other two indices.

We hand collect data relating to stock option-based compensation in fiscal years 1996 through 2001 from firms' financial statement footnotes. We collect the fair value of granted options, option vesting period, and inputs for the option pricing model. Many firms disclose ranges of these inputs across multiple grants within the year; we use the mid-point of the range. We also collect the number and exercise prices of options granted, exercised, and cancelled. We obtain other financial statement data from Compustat and stock price data from CRSP.

4.2. Descriptive Statistics

Table 1 presents the industry composition of the sample. It reveals that sample firms represent many industries. Although the distribution differs somewhat from the Compustat population, no single industry represents 10% or more of the sample. The industry breakdown in table 1 is the basis on which we determine *INDUSTRY*.

Table 2 presents descriptive statistics, in panel A, relating to the variables that we use in our tests, and correlation coefficients, in panel B, for some of our key variables. Regarding information disclosed under SFAS 123, table 2, panel A, reveals that the mean (median) disclosed value of options granted, *OPTVAL*, is $10.36 ($9.68) per option, which compares with an untabulated exercise price of $29.65 ($26.32). The mean (median) option value estimate calculated based on option pricing model inputs that we determine, *OPTVAL_CALC*, is $11.07 ($9.83) per option. Untabulated statistics reveal that for 58% of our observations *OPTVAL* is less than *OPTVAL_CALC*. The untabulated mean (median) difference between *OPTVAL* and *OPTVAL_CALC* reveals that, on average, firms understate option value estimates under SFAS 123 by approximately 5.5% (7.6%), which is significantly different from zero.[21] The focus of

[21] The term significant denotes statistical significance at less than the 5% level, using a one-sided test for signed predictions and a two-sided test otherwise.

our tests is determining whether the extent of understatement is associated with the incentives and opportunity to manage the estimates.

The mean (median) *LIFE* is 5.55 (5.09) years, which is considerably less than the typical ten-year contractual life, consistent with employees exercising options early. By construction because of the instrumental variables approach, *LIFE_PRED* has the same mean (median) as *LIFE*. The mean (median) *VOL* is 37.00% (33.00%), which is similar to the 36.93% (33.20%) of *VOL_HIST*, and the mean (median) *DIV* is 1.27% (0.90%), which is similar to the 1.25% (0.91%) of *DIV_HIST*; the *p*-values for the differences in means (medians) are 0.63 (0.29) for volatility and 0.19 (0.99) for dividends. These statistics do not indicate that managers understate expected volatility or overstate expected dividend yield relative to historical levels. The mean (median) *INT* is 5.68% (5.79%), which is somewhat lower than the 5.71% (5.86%) of *INT_HIST*; the *p*-values for the differences are 0.01 (0.72).

Regarding the other factors, the shorter-horizon volatility measures, $1YR\_VOL^{PRE}$, which has a mean (median) of 44.25% (39.43%), and $1YR\_VOL^{POST}$, which has a mean (median) of 47.55% (41.90%), are higher than longer-horizon volatility, *VOL_HIST*. The mean (median) *SIZE* is 7.72 (7.68). The mean (median) *BM* is 0.47 (0.37) and *GROWTH* is 12.70% (8.27%), indicating sample firms have relatively high growth. The mean (median) *OPT_OUT* indicates that firms' outstanding options average 7.34% (5.78%) of total shares outstanding.

Regarding our proxies for the magnitude of stock option-based compensation expense, excessive executive pay, and corporate governance, the mean (median) value of all options granted during the year per share, *COMPX*, is 0.28 (0.17). Because it is a regression residual, mean *RESCOMP* is 0.00 by construction. The mean (median) of *GOVSCORE*, the IRRC

corporate governance measure, is 8.89 (9.00), indicating that, on average, firms have nine of the 23 provisions comprising the measure.

Regarding correlations between the variables, table 2, panel B, reveals that, as expected, many variables are significantly correlated with each other. The highest correlations are among variables representing similar constructs; the Pearson (Spearman) correlation between *VOL* and *VOL_HIST* is 0.85 (0.87), *DIV* and *DIV_HIST* is 0.80 (0.93), and *INT* and *INT_HIST* is 0.70 (0.68).[22] The Pearson (Spearman) correlation between *LIFE* and *LIFE_PRED* is somewhat lower, 0.33 (0.35), which is not unexpected given that we use an instrumental variables approach to construct *LIFE_PRED*.

5. Findings

5.1. Using the Black-Scholes Formula to Calculate Option Values

Our tests rely on attributing differences between *OPTVAL* and *OPTVAL_CALC* to differences in the inputs to the option pricing model. In particular, we seek to test whether the firm's input assumptions reflect the predicted exercise of discretion, by constructing our own input assumptions that do not reflect discretion. *OPTVAL* is disclosed by the firm; we calculate *OPTVAL_CALC* using the Black-Scholes option pricing formula. However, SFAS 123 does not require use of a particular option pricing model and many firms do not disclose which model they use. Thus, differences between *OPTVAL* and *OPTVAL_CALC* could be attributable to our use of the Black-Scholes formula, not differences in input assumptions. Also, firms with multiple option grants within a year disclose only ranges of option values and input assumptions

[22] The limited discretion in SFAS 123 relating to the interest rate assumption might lead one to expect a higher correlation between *INT* and *INT_HIST*. However, firms base *INT* on the interest rate prevailing at grant date. Because we do not have access to grant dates, we base *INT_HIST* on average rates over the grant year. This difference introduces noise in *INT_HIST*. For example, the means of the risk-free rate for each year in our sample

across these grants. In these cases, we define *LIFE*, *VOL*, *DIV*, and *INT* as the mid-points of the range. Doing so could result in differences between *OPTVAL* and *OPTVAL_CALC* that are unrelated to discretion. Moreover, in these cases, *OPTVAL* is the average option value for the firm in a particular year. Given that option values are nonlinear in the inputs, even if the mid-points of the ranges of assumptions reasonably reflect the inputs, the resulting option value might not equal *OPTVAL*.

Thus, before estimating (1) and (2a) through (2d) to test our predictions, we assess the extent of these potential estimation problems. Specifically, we use the Black-Scholes formula and *LIFE*, *VOL*, *DIV*, and *INT* as inputs to calculate option value. We then compare this calculated option value to *OPTVAL*. Untabulated summary statistics from a regression of *OPTVAL* on this option value reveal that its estimated coefficient is 1.002 (indistinguishable from one with *p*-value of 0.71), and an adjusted R^2 of 99.7%. These statistics provide strong evidence that our use of the Black-Scholes formula and mid-points of ranges of input assumptions are unlikely to affect our inferences.

5.2. Primary Findings

Table 3 presents our findings relating to estimating (1), which tests for discretion associated with the combined effect of all four inputs, as reflected in disclosed option value estimates, *OPTVAL*. It reveals, as expected, that the option value calculated using our proxies for the four key inputs, *OPTVAL_CALC*, is highly significant in explaining *OPTVAL* (t = 115.96).

Consistent with predictions, table 3 also reveals that our proxies for the magnitude of stock option-based compensation expense, excessive executive pay, and corporate governance

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period, assuming a five-year expected life, range from 4.55% to 6.22%. The standard deviations range from 0.37%

are negatively associated with *OPTVAL*. Although the coefficient *RESCOMP* is not significantly different from zero (t = –1.43), the coefficients on *COMPX* and *GOV* are significantly negative (t = –6.74 and –4.13). These findings indicate that the extent to which firms make input assumptions that result in lower option value estimates is larger for firms with greater incentives and opportunity to do so.

Table 4 presents regression summary statistics from estimating (2a) through (2d), which focus on the effects of each input assumption considered separately. Table 4, panel A, relates to (2a), which focuses on the effects of *LIFE*. Consistent with table 3, it reveals that $OPTVAL\_CALC^{LIFE}$ is highly significant in explaining *OPTVAL* (t = 168.61). Recall that the only difference between $OPTVAL\_CALC^{LIFE}$ and *OPTVAL* is that we use *LIFE_PRED* to calculate $OPTVAL\_CALC^{LIFE}$, whereas firms use *LIFE* to calculate *OPTVAL*.

Consistent with predictions, table 4, panel A, reveals that our proxies for the magnitude of stock option-based compensation expense, excessive executive pay, and corporate governance all are significantly negatively associated with *OPTVAL*, after controlling for $OPTVAL\_CALC^{LIFE}$ and the other control variables. The t-statistics associated with the coefficients on *COMPX*, *RESCOMP*, and *GOV* are –7.36, –2.36, and –2.63. These findings indicate that, as predicted, firms assume an expected option life that results in lower option value estimates when they have greater incentives and opportunity to do so. Table 4, panel B, presents summary statistics from (2b), which focuses on the effects of *VOL*. It reveals that $OPTVAL\_CALC^{VOL}$ is highly significant in explaining *OPTVAL* (t = 175.12). Panel B also reveals that, as predicted, firms' assumptions of expected stock price volatility are significantly

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to 0.54%, which indicate substantial within-year variation in interest rates.

associated with *COMPX* (t = –3.56) and *GOV* (t = –2.70). However, it reveals no significant relation with *RESCOMP* (t = 0.33).

Table 4, panel C, presents summary statistics from (2c), which focuses on *DIV*. Consistent with the findings relating to *LIFE* and *VOL*, $OPTVAL\_CALC^{DIV}$ is highly significant in explaining *OPTVAL* (t = 364.96). Also, firms' assumptions of expected dividend yield are significantly negatively associated with *GOV* (t = –1.83), consistent with firms exercising discretion in determining *DIV* to understate option value estimates when corporate governance is weaker. However, panel C reveals no significant relation with *COMPX* or *RESCOMP* (t = –0.18 and –0.99). Finally, table 4, panel D, presents summary statistics from (2d), which focuses on *INT*. In contrast to the findings for *LIFE*, *VOL*, and *DIV*, but not unexpectedly, panel D reveals no evidence that firms use the interest rate assumption to understate option value estimates. In particular, it reveals that the coefficients on *COMPX*, *RESCOMP*, and *GOV* are all insignificantly different from zero (t = 0.67, 0.21, and –1.21).

5.3. Additional Analyses

5.3.1. [OPTVAL – OPTVAL_CALC] as the Dependent Variable

Equations (1) and (2a) through (2d) include variations of *OPTVAL_CALC* as a control variable. This permits us to interpret the coefficients on our experimental variables, i.e., *COMPX*, *RESCOMP*, and *GOV*, as relating to differences between *OPTVAL* and *OPTVAL_CALC* resulting from differences in input assumptions. An alternative specification is to use *[OPTVAL – OPTVAL_CALC]* as the dependent variable. This specification restricts the coefficient on *OPVAL_CALC* to equal one; in the primary specification its coefficient is unrestricted. In this alternative specification, our proxy for stock option-based compensation expense, $COMPX^{\dagger}$, is the number of options granted during the year multiplied by their average

exercise price and deflated by shares outstanding at the end of the year, rather than *COMPX*. We do not use *COMPX* because it depends on *OPTVAL_CALC*, which is part of the dependent variable in this specification. Exercise price is highly positively correlated with option value, but is not mechanically related.

Table 5, panel A, presents summary statistics associated with total option value, analogous to table 3. It reveals inferences similar to those in table 3, except that the coefficient on *RESCOMP* is significantly negative in the table 5 specification. In particular, $COMPX^{\dagger}$, *RESCOMP*, and *GOV* are significantly negatively related to differences between *OPTVAL* and *OPTVAL_CALC* (t = –12.06, –1.77, and –4.01).

Table 5, panel B, presents summary statistics associated with each of the inputs separately, analogous to table 4, panels A though D. All inferences in table 5, panel B, are the same as in table 4, except that $COMPX^{\dagger}$ and *GOV* are significantly negatively related to *DIV* in the table 5 specification. Specifically, relating to *LIFE*, table 5, panel B, reveals that $COMPX^{\dagger}$, *RESCOMP*, and *GOV* are all significantly negatively related to differences between *OPTVAL* and $OPTVAL\_CALC^{LIFE}$ (t = –8.10, –2.69, and –2.48). Relating to *VOL*, table 5, panel B, reveals that $COMPX^{\dagger}$ and *GOV* are significantly negatively related to differences between *OPTVAL* and $OPTVAL\_CALC^{VOL}$ (t = –5.57 and –2.75) and *RESCOMP* is not (t = 0.21). Relating to *DIV*, $COMPX^{\dagger}$ and *GOV* are significantly negatively related to differences between *OPTVAL* and $OPTVAL\_CALC^{DIV}$ (t = –2.15 and –1.78) and *RESCOMP* is not (t = –0.83). Relating to *INT*, $COMPX^{\dagger}$, *RESCOMP*, and *GOV* are not significantly related to differences between *OPTVAL* and $OPTVAL\_CALC^{INT}$ (t = –0.91, 0.01, and –1.36).

5.3.2. Inputs as the Dependent Variables

Our primary tests focus on the effects on option value of discretion in the option pricing model input assumptions. We do this because our predictions relate to incentives to manage option value and stock option-based compensation expense, which depends on option value. Because of this, we test our predictions on the combined effect of discretion in all of the inputs. Also, the effect on option value of discretion in each input assumption is nonlinear, in ways that differ across the inputs. Yet, it is the inputs that are the subject of managerial discretion. Thus, we also estimate equations (2a) through (2d) using the inputs, i.e., *LIFE*, *VOL*, *DIV*, and *INT*, as the dependent variables.

Table 6 presents the findings. It reveals inferences that are similar to those in table 4. Specifically, table 6 reveals that *COMPX* and *GOV* are significantly negatively related to *LIFE* (t = –7.26 and –2.73). However, in contrast to table 4, panel A, *RESCOMP* is negatively related to *LIFE*, but not significantly so (t = –1.57).[23] Table 6 also reveals that, consistent with table 4, *COMPX* and *GOV* are significantly negatively related to *VOL* (t = –3.27 and –5.42) and *RESCOMP* is not (t = –1.32). Again consistent with table 4, only *GOV* is significantly negatively related to *DIV* (t = –2.17), and none of the three experimental variables is significantly related to *INT* (t = –0.98, –0.96, and 0.97).[24]

5.3.3. Number of Options Granted

The number of options granted, *OPT_GRANT*, is an alternative proxy for stock option-based compensation expense that does not depend on option values. We do not use

[23] In table 6, we restrict the sample to be the same as in tables 3 and 4. However, those tables require availability of *OPTVAL*, which is not required in table 6. When we estimate the table 6 specifications using all available data (number of observations = 3,724), the untabulated findings are identical to those in table 4, including the significant negative relation between *LIFE* and *RESCOMP* (t = –2.41).

[24] Because assuming a higher dividend yield decreases option value, in the table 6 estimation of the *DIV* regression we multiply the experimental variables, *COMPX*, *RESCOMP*, and *GOV*, by minus one.

OPT_GRANT in our primary tests because it is possible that *OPT_GRANT* and *OPTVAL* are negatively correlated not because of the factors we posit, but because firms tend to grant fewer options when option values are higher (Core and Guay, 2001). Although (1) and (2a) through (2d) include *OPTVAL_CALC* as an explanatory variable, which permits interpreting the coefficient on *OPT_GRANT* as the association between *OPTVAL* and *OPT_GRANT* after controlling for the unmanaged value of options granted, it is possible that some mechanical correlation remains. However, untabulated findings reveal that our inferences are unaffected if we use *OPT_GRANT* in place of *COMPX* in our estimating equations. In particular, the coefficients on *OPT_GRANT* are significantly negative in (1), (2a), and (2b) (t = –3.42, –3.88, and –1.64), and not significantly different from zero in (2d) (t = –1.33). In contrast to table 4, but consistent with predictions, the coefficient is significantly negative in (2c) (t = –2.00).

6. Summary and Concluding Remarks

Focusing on the four key option pricing model inputs – expected option life, expected stock price volatility, expected dividend yield, and the risk-free interest rate for the expected life of the option – this study finds that firms understate estimates of option values and, thus, SFAS 123 expense. Our findings indicate that firms with higher stock option-based compensation expense, firms that have CEOs with perceived excessive pay, and firms with weaker corporate governance assume expected option life, expected stock price volatility, and expected dividend yield that result in significantly lower option value estimates. These three assumptions all depend on firm-specific characteristics, making them candidates for exercise of discretion. We find no evidence that firms use the risk-free interest rate assumption to understate option value estimates, consistent with this assumption depending primarily on market interest rates. The understatement of option value estimates we document is unlikely to be attributable to firms

adjusting option value estimates to better reflect their assessment of the value of the options. Rather, it suggests managerial opportunism.

These findings have implications for our understanding of the financial reporting for stock option-based compensation expense. In particular, our findings are consistent with firms managing a disclosed earnings amount; prior literature focuses on recognized earnings. This suggests managers believe that even though SFAS 123 expense is disclosed but not recognized, it is relevant to financial statement users. More importantly, our findings suggest that some concerns about the overall reliability of SFAS 123 expense are not unwarranted. We leave it to standard setters to determine whether the effects of discretion on reliability are sufficient to cause them concern and, if so, how such effects can be mitigated.

Our study is silent on the potential implications of changing the accounting treatment of SFAS 123 expense from footnote disclosure to expense recognition. Although expense recognition would likely provide managers with greater incentives to understate the expense, it would also likely increase costs related to audit, regulatory enforcement, and scrutiny by investor groups associated with doing so.

Appendix: **Estimation of Excessive CEO Compensation**

Testing the prediction that perceived excessive executive pay motivates firms to understate SFAS 123 expense requires a measure of excessive pay. Our benchmark is the predicted value from a regression of annual CEO compensation on variables identified in prior research as explaining CEO compensation, particularly firm size, performance, growth, risk, and industry membership. We interpret the regression residual, *RESCOMP*, as perceived excessive compensation, and use it as a proxy for the excessiveness of executive pay.

Consistent with Smith and Watts (1992) and Core, Holthausen, and Larcker (1999), among others, we expect that larger firms with growth opportunities and complex operations demand higher-quality managers, leading to higher CEO compensation. Consistent with Core, Holthausen, and Larcker (1999) we use sales, *SALES*, as a proxy for size and complexity, book-to-market ratio, *BM*, and one-year sales growth, *GROWTH*, as proxies for growth opportunities and investment opportunity set. We also include two measures of firm performance, return on assets, *ROA*, and annual stock return, *RET*. We control for stock price volatility, $1YR\_VOL^{PRE}$, because prior studies find a positive relation between volatility and CEO compensation (see, e.g., Cyert, Kang, Kumar, and Shah, 1997). We also control for industry and year effects. The estimation equation is:

$$Log(CEO\_COMP)_{it} = \sum_{N=1}^{33} \theta_{0I} INDUSTRY_{Nit} + \sum_{Y=1996}^{2001} \alpha_{0Y} YR_{Yit} + \theta_1 Log(SALES)_{it} + \theta_2 BM_{it} + \theta_3 GROWTH_{it} + \theta_4 ROA_{it} + \theta_5 RET_{it} + \theta_6 1YR\_VOL^{PRE}{}_{it} + \varepsilon_{A1it} \quad \text{(A1)}$$

CEO_COMP is total annual CEO compensation, measured as the sum of cash salary, bonus payments, restricted stock awards, and stock option grants, as estimated and reported by Execucomp.[25] All other variables are as defined in the text, and *Log* denotes logarithm.[26]

To estimate (A1), we use robust regression and pool all firm-year observations with available data. Untabulated summary statistics reveal that all of the coefficients are consistent with predictions and prior research. In particular, the coefficients on *Log*(*SALES*), *GROWTH*, *ROA*, *RET*, and $1YR\_VOL^{PRE}$ are significantly positive (t = 68.45, 7.14, 2.39, 2.42, and 12.54), and that on *BM* is significantly negative (t = –19.05). Many industry intercepts are significantly different from zero and from each other, indicating significant across-industry variation in CEO compensation. The regression explains 61% of the variation in CEO compensation. This explanatory power is the same as that of the analogous equation in Baker (1999) and considerably more than the 16% for the three-factor model in Yermack (1998).

[25] Execucomp estimates the value of options granted to top executives by assuming, for all stock options, an expected life of 70% of contractual life, stock price volatility estimated over the past five years, dividend yield estimated over the past three years, and risk-free interest rate measured over the past seven years.

[26] We do not include some proxies for human capital and agency conflicts that Baker (1999) and Core, Holthausen, and Larcker (1999) use because of lack of data availability and our much larger sample. Our inferences are insensitive to including two of these proxies for which data are available, i.e., CEO tenure with the firm and CEO stock ownership. We use the logarithm of *CEO_COMP* and *SALES* because doing so is common practice in the compensation literature. Our findings are robust to using the variables without the logarithmic transformation.

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Table 1. Industry classification for sample of 887 firms from the Standard and Poors (S&P) 500, S&P 400 mid-capitalization, and S&P 600 small-capitalization indices.

	Frequency in Sample		Frequency in Compustat	
Industry	N	% (1)	% (2)	Ratio of (1) to (2)
Agriculture, Mining	41	4.62	4.06	1.1
Construction	9	1.02	1.15	0.9
Food, Tobacco	27	3.04	2.13	1.4
Textile, Apparel	17	1.92	1.30	1.5
Lumber, Furniture	14	1.58	0.90	1.8
Paper	23	2.59	0.90	2.9
Printing	30	3.38	1.24	2.7
Chemicals	78	8.79	5.39	1.6
Rubber, Plastics	19	2.14	1.52	1.4
Leather, Glass	9	1.02	0.80	1.3
Metal Industries	38	4.28	2.48	1.7
Machinery	59	6.65	5.40	1.2
Electrical Equipment	58	6.54	6.61	1.0
Transportation Equipment	32	3.61	1.68	2.1
Instruments	42	4.73	5.02	0.9
Misc. Manufacturing	9	1.02	1.02	1.0
Transportation Services	22	2.48	2.22	1.1
Communications	14	1.58	4.10	0.4
Utilities	33	3.72	2.88	1.3
Durables - Wholesale	20	2.25	2.32	1.0
Nondurables - Wholesale	16	1.80	1.46	1.2
Retail	24	2.70	1.35	2.0
Apparel Stores	17	1.92	1.05	1.8
Eating and Drinking	17	1.92	1.49	1.3
Misc. Retail	16	1.80	1.80	1.0
Banks	60	6.76	11.54	0.6
Insurance Services	39	4.40	3.16	1.4
Lodging	9	1.02	0.70	1.5
Business Services	51	5.75	13.05	0.4
Entertainment	10	1.13	1.81	0.6
Health Services	15	1.69	1.66	1.0
Other Services	9	1.02	1.89	0.5
Others	10	1.13	5.92	0.2
Total	887	100.00	100.00	

Table 2. Descriptive statistics and correlation coefficients for sample of 3,368 firm-year observations over the 1996 through 2001 period, relating to 887 firms from the Standard and Poors (S&P) 500, S&P 400 mid-capitalization, and S&P 600 small-capitalization indices.

Panel A: Descriptive statistics

Variable	Mean	Median	Std. Dev.
OPTVAL	10.36	9.68	6.26
OPTVAL_CALC	11.07	9.83	6.08
LIFE (years)	5.55	5.09	1.70
VOL (%)	37.00	33.00	17.37
DIV (%)	1.27	0.90	1.52
INT (%)	5.68	5.79	0.69
LIFE_PRED (years)	5.55	5.09	0.58
VOL_HIST (%)	36.93	33.20	16.31
DIV_ HIST (%)	1.25	0.91	1.45
INT_ HIST (%)	5.71	5.86	0.59
$1YR\_VOL^{PRE}$ (%)	44.25	39.43	20.38
$1YR\_VOL^{POST}$ (%)	47.55	41.90	22.38
SIZE	7.72	7.68	1.76
BM	0.47	0.37	0.43
GROWTH (%)	12.70	8.27	29.48
OPT_OUT (%)	7.34	5.78	7.00
COMPX	0.28	0.17	0.38
RESCOMP	0.00	0.01	0.80
GOVSCORE	8.89	9.00	2.28

Table 2. Continued.

Panel B: Correlation coefficients

	OPTVAL	*LIFE*	*VOL*	*DIV*	*INT*	*LIFE_PRED*	*VOL_HIST*	*DIV_HIST*	*INT_HIST*	*COMPX*	*RESCOMP*	*GOV*
OPTVAL		**0.10**	–0.01	**–0.08**	**–0.05**	**0.09**	**–0.04**	**–0.17**	**–0.06**	**0.38**	**0.08**	–0.01
LIFE	**0.06**		**–0.23**	**0.17**	**0.13**	**0.33**	**–0.27**	**0.16**	**0.17**	**–0.19**	**–0.06**	0.03
VOL	–0.01	**–0.22**		**–0.48**	**–0.17**	**–0.34**	**0.85**	**–0.47**	**–0.19**	**0.25**	0.03	**–0.13**
DIV	**–0.12**	**0.18**	**–0.66**		0.03	**0.29**	**–0.50**	**0.80**	**0.05**	**–0.26**	**–0.09**	**0.11**
INT	**–0.04**	**0.12**	**0.14**	**0.04**		**0.07**	**–0.17**	0.03	**0.70**	**–0.05**	–0.02	**0.04**
LIFE_PRED	**0.10**	**0.35**	**–0.35**	**0.27**	**0.07**		**–0.33**	**0.31**	**0.09**	**–0.30**	0.01	**0.13**
VOL_HIST	**–0.06**	**–0.25**	**0.87**	**–0.67**	**–0.15**	**–0.36**		**–0.49**	**–0.21**	**0.32**	**0.05**	**–0.09**
DIV_HIST	**–0.12**	**0.17**	**–0.64**	**0.93**	**0.05**	**0.28**	**–0.65**		**0.05**	**–0.29**	**–0.07**	**0.10**
INT_HIST	**–0.07**	**0.22**	**–0.19**	**0.06**	**0.68**	**0.07**	**–0.20**	**0.06**		**–0.04**	–0.02	0.01
COMPX	**0.41**	**–0.23**	**0.33**	**–0.38**	**–0.07**	**–0.38**	**0.35**	**–0.42**	**–0.09**		**0.24**	–0.02
RESCOMP	**0.11**	**–0.05**	**0.06**	**–0.09**	–0.02	0.01	**0.06**	**–0.08**	–0.02	**0.32**		0.00
GOV	–0.01	0.02	**–0.13**	**0.19**	**0.04**	**0.12**	**–0.10**	**0.17**	0.02	–0.02	0.01	

OPTVAL is the average estimated value of options granted during the year. *LIFE* is expected option life. *VOL* is expected stock price volatility. *DIV* is expected dividend yield. *INT* is the risk-free interest rate for the expected life of the option. *OPTVAL*, *LIFE*, *VOL*, *DIV*, and *INT* are disclosed under SFAS 123.

OPTVAL_CALC is the Black and Scholes (1973) value of options granted during the year, calculated using *VOL_HIST*, *DIV_HIST*, *INT_HIST*, and *LIFE_PRED*, in lieu of the SFAS 123 disclosed input assumptions, *VOL*, *DIV*, *INT*, and *LIFE*. *VOL_HIST* is the historical stock price volatility calculated over the most recent period similar to expected option life. *DIV_HIST* is the historical dividend yield for the most recent year. *INT_HIST* is the grant-year average yield on zero coupon U.S. Treasury Bills with a term equal to expected option life. *LIFE_PRED* is the predicted value from a regression of *LIFE* on four instrumental variables, (i) the option vesting period, (ii) the number of options cancelled during the year deflated by the sum of options outstanding at the end of the year and options cancelled during the year, (iii) the number of options exercised during the year deflated by the sum of options outstanding at the end of the year and options exercised during the year, and (iv) the percent of options granted to the top five executives, and on industry and year indicator variables. The option value is calculated based on the SFAS 123 disclosed average exercise price.

$1YR\_VOL^{PRE}$ ($1YR\_VOL^{POST}$) is stock price volatility over the prior (subsequent) year. *SIZE* is the logarithm of market value of equity at fiscal year end. *BM* is the book value of equity divided by market value of equity at fiscal year end. *GROWTH* is the one-year

percentage increase in sales revenue. *OPT_OUT* is the number of options outstanding at the beginning of the year deflated by number of shares outstanding.

COMPX is the number of options granted during the year multiplied by *OPTVAL_CALC*, deflated by number of shares outstanding. *RESCOMP* is the residual from a regression of total annual CEO compensation on proxies for firm size, performance, growth, risk, and industry membership. *GOV* is an indicator variable taking the value of one for firms with "Governance Score" (*GOVSCORE*) above the sample median (i.e., firms with weaker governance), and zero otherwise. The "Governance Score" is a measure compiled by the Investor Responsibility Research Center (IRRC), based on 23 corporate governance provisions that measure shareholders' rights.

Pearson (Spearman) correlation coefficients are shown in the upper (lower) triangle. Correlation coefficients significantly different from zero at *p*-values less than 5% are in boldface type.

Table 3. Summary statistics from a regression of option value estimates used in the calculation of SFAS 123 expense on proxies for firms' incentives and opportunity to understate SFAS 123 expense and control variables.

Variable	Predicted sign	Coefficient	t-statistic
OPTVAL_CALC	+	0.90	115.96
COMPX	–	–0.01	–6.74
RESCOMP	–	–0.05	–1.43
GOV	–	–0.28	–4.13
SIZE	?	0.08	3.56
BM	?	–0.16	–2.20
GROWTH	?	0.37	3.30
OPT_OUT	?	1.07	2.11
$1YR\_VOL^{PRE}$	?	–0.01	–3.47
$1YR\_VOL^{POST}$	?	0.01	0.87
LIFE_PRED	?	0.03	0.29
Adj R^2		0.90	
N		3,368	

The dependent variable is *OPTVAL*, the average estimated value of options granted during the year, disclosed under SFAS 123.

OPTVAL_CALC is the Black and Scholes (1973) value of options granted during the year, calculated using *VOL_HIST*, *DIV_HIST*, *INT_HIST*, and *LIFE_PRED*, in lieu of the SFAS 123 disclosed input assumptions, *VOL*, *DIV*, *INT*, and *LIFE*. *VOL_HIST* is the historical stock price volatility calculated over the most recent period similar to expected option life. *DIV_HIST* is the historical dividend yield for the most recent year. *INT_HIST* is the grant-year average yield on zero coupon U.S. Treasury Bills with a term equal to expected option life. *LIFE_PRED* is the predicted value from a regression of *LIFE* on four instrumental variables, (i) the option vesting period, (ii) the number of options cancelled during the year deflated by the sum of options outstanding at the end of the year and options cancelled during the year, (iii) the number of options exercised during the year deflated by the sum of options outstanding at the end of the year and options exercised during the year, and (iv) the percent of options granted to the top five executives, and on industry and indicator variables. The option value is calculated based on the SFAS 123 disclosed average exercise price.

COMPX is the number of options granted during the year multiplied by *OPTVAL_CALC*, deflated by number of shares outstanding. *RESCOMP* is the residual from a regression of total annual CEO compensation on proxies for firm size, performance, growth, risk, and industry membership. *GOV* is an indicator variable taking the value of one for firms with "Governance Score" above the sample median (i.e., firms with weaker governance), and zero otherwise. The

"Governance Score" is a measure compiled by the Investor Responsibility Research Center (IRRC) based on 23 corporate governance provisions that measure shareholders' rights.

SIZE is the logarithm of market value of equity at fiscal year end. *BM* is the book value of equity divided by market value of equity at fiscal year end. *GROWTH* is the one-year percentage increase in sales revenue. *OPT_OUT* is the number of options outstanding at the beginning of the year deflated by number of shares outstanding. $1YR\_VOL^{PRE}$ ($1YR\_VOL^{POST}$) is stock price volatility over the prior (subsequent) year.

Coefficients are estimated using a robust regression technique. The intercept varies across the 33 industries listed in Table 1 and the six sample years; estimated intercepts are untabulated. All tabulated t-statistics are based on White (1980) heteroskedasticity-consistent standard errors.

Table 4. Summary statistics from a regression of option value estimates used in the calculation of SFAS 123 expense on proxies for firms' incentives and opportunity to understate SFAS 123 expense and control variables.

Panel A: Discretion in expected option life, *LIFE*

Variable	Predicted sign	Coefficient	t-statistic
$OPTVAL\_CALC^{LIFE}$	+	0.99	168.61
COMPX	–	–0.01	–7.36
RESCOMP	–	–0.06	–2.36
GOV	–	–0.13	–2.63
SIZE	?	0.03	1.90
BM	?	–0.02	–0.36
GROWTH	?	0.05	0.61
OPT_OUT	?	0.85	2.62
$1YR\_VOL^{PRE}$	?	–0.01	–3.03
Adj R^2		0.95	
N		3,368	

Panel B: Discretion in expected stock price volatility, *VOL*

Variable	Predicted sign	Coefficient	t-statistic
$OPTVAL\_CALC^{VOL}$	+	0.94	175.12
COMPX	–	–0.01	–3.56
RESCOMP	–	0.01	0.33
GOV	–	–0.12	–2.70
SIZE	?	0.08	4.85
BM	?	–0.02	–0.29
GROWTH	?	0.27	3.60
OPT_OUT	?	0.46	1.30
$1YR\_VOL^{PRE}$	?	–0.01	–3.65
$1YR\_VOL^{POST}$	?	0.01	2.78
LIFE	?	–0.01	–0.46
DIV_HIST	?	–0.05	–3.22
Adj R^2		0.96	
N		3,368	

Table 4. Continued.

Panel C: Discretion in expected dividend yield, *DIV*

Variable	Predicted sign	Coefficient	t-statistic
$OPTVAL\_CALC^{DIV}$	+	0.99	364.96
COMPX	–	–0.01	–0.18
RESCOMP	–	–0.01	–0.99
GOV	–	–0.05	–1.83
SIZE	?	0.01	1.48
BM	?	0.08	2.63
GROWTH	?	0.05	1.17
OPT_OUT	?	0.25	1.73
$1YR\_VOL^{PRE}$	?	0.01	0.79
LIFE	?	–0.04	–4.83
$Adj\ R^2$		0.99	
N		3,368	

Panel D: Discretion in risk-free interest rate, *INT*

Variable	Predicted sign	Coefficient	t-statistic
$OPTVAL\_CALC^{INT}$	+	0.99	466.51
COMPX	–	0.01	0.67
RESCOMP	–	0.01	0.21
GOV	–	–0.03	–1.21
LIFE	?	–0.02	–3.09
$Adj\ R^2$		0.99	
N		3,368	

The dependent variable in all regressions is *OPTVAL*, the average estimated value of options granted during the year, disclosed under SFAS 123.

$OPTVAL\_CALC^{LIFE}$ is the Black and Scholes (1973) value of options granted during the year, calculated using SFAS 123 disclosed input assumptions for expected stock price volatility, *VOL*, expected dividend yield, *DIV*, the risk-free interest rate for the expected life of the option, *INT*, and using predicted option life, *LIFE_PRED*, in lieu of the SFAS 123 disclosed expected option life, *LIFE*. *LIFE_PRED* is the predicted value from a regression of *LIFE* on four instrumental variables, (i) the option vesting period, (ii) the number of options cancelled during the year

deflated by the sum of options outstanding at the end of the year and options cancelled during the year, (iii) the number of options exercised during the year deflated by the sum of options outstanding at the end of the year and options exercised during the year, and (iv) the percent of options granted to the top five executives, and on industry and year indicator variables. The option value is calculated based on the disclosed average exercise price.

$OPTVAL\_CALC^{VOL}$ is the Black and Scholes (1973) value of options granted during the year, calculated using SFAS 123 disclosed input assumptions for *LIFE*, *DIV*, and *INT*, and using *VOL_HIST*, the historical stock price volatility calculated over the most recent period similar to expected option life. The option value is calculated using the disclosed average exercise price.

$OPTVAL\_CALC^{DIV}$ is the Black and Scholes (1973) value of options granted during the year, calculated using SFAS 123 disclosed input assumptions for *LIFE*, *VOL*, and *INT*, and using *DIV_HIST*, the historical dividend yield for the most recent year. The option value is calculated based on the disclosed average exercise price.

$OPTVAL\_CALC^{INT}$ is the Black and Scholes (1973) value of options granted during the year, calculated using SFAS 123 disclosed input assumptions for *LIFE*, *VOL*, and *DIV*, and using *INT_HIST*, the grant-year average yield on zero coupon U.S. Treasury Bills with a term equal to expected option life. The option value is calculated based on the disclosed average exercise price.

COMPX is the number of options granted during the year multiplied by *OPTVAL_CALC*, deflated by number of shares outstanding. *RESCOMP* is the residual from a regression of total annual CEO compensation on proxies for firm size, performance, growth, risk, and industry membership. *GOV* is an indicator variable taking the value of one for firms with "Governance Score" above the sample median (i.e., firms with weaker governance), and zero otherwise. The "Governance Score" is a measure compiled by the Investor Responsibility Research Center (IRRC) based on 23 corporate governance provisions that measure shareholders' rights.

SIZE is the logarithm of market value of equity at fiscal year end. *BM* is the book value of equity divided by market value of equity at fiscal year end. *GROWTH* is the one-year percentage increase in sales revenue. *OPT_OUT* is the number of options outstanding at the beginning of the year deflated by number of shares outstanding. $1YR\_VOL^{PRE}$ ($1YR\_VOL^{POST}$) is stock price volatility over the prior (subsequent) year.

Coefficients are estimated using a robust regression technique. The intercept varies across the 33 industries listed in Table 1 and the six sample years; estimated intercepts are untabulated. All tabulated t-statistics are based on White (1980) heteroskedasticity-consistent standard errors.

Table 5. Summary statistics from a regression of *[OPTVAL − OPTVAL_CALC]* on proxies for firms' incentives and opportunity to understate SFAS 123 expense and control variables

Panel A: Dependent variable is *[OPTVAL − OPTVAL_CALC]*

Variable	Predicted sign	Coefficient	t-statistic
COMPX[†]	–	–0.01	–12.06
RESCOMP	–	–0.06	–1.77
GOV	–	–0.27	–4.01
SIZE	?	–0.04	–1.71
BM	?	–0.04	–0.59
GROWTH	?	0.23	2.13
OPT_OUT	?	1.48	2.88
$1YR\_VOL^{PRE}$	?	–0.01	–5.39
$1YR\_VOL^{POST}$	?	0.01	1.77
LIFE_PRED	?	–0.33	–2.64
Adj R^2		0.10	
N		3,368	

Table 5. Continued.

Panel B: Dependent variable is *[OPTVAL – OPTVAL_CALC^{INPUT}]*

		INPUT							
		LIFE		*VOL*		*DIV*		*INT*	
Variable	Pred. sign	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
COMPX†	–	–0.01	–8.10	–0.01	–5.57	–0.01	–2.15	–0.01	–0.91
RESCOMP	–	–0.07	–2.69	0.01	0.21	–0.01	–0.83	0.01	0.01
GOV	–	–0.12	–2.48	–0.12	–2.75	–0.05	–1.78	–0.03	–1.36
SIZE	?	0.03	1.70	–0.01	–0.29	0.01	0.12		
BM	?	–0.01	–0.14	–0.01	–0.05	0.09	3.04		
GROWTH	?	0.02	0.21	0.18	2.47	0.03	0.69		
OPT_OUT	?	0.87	2.72	0.87	2.45	0.33	2.24		
1YR_VOL^{PRE}	?	–0.01	–4.84	–0.01	–3.37	0.01	0.62		
1YR_VOL^{POST}	?			0.01	3.53				
LIFE	?			–0.04	–3.28	–0.04	–5.84	–0.02	–3.63
DIV_HIST	?			0.01	0.75				
Adj R^2		0.06		0.07		0.06		0.04	
N		3,368		3,368		3,368		3,368	

The dependent variable in Panel A is [*OPTVAL – OPTVAL_CALC*]. *OPTVAL* is the average estimated value of options granted during the year, disclosed under SFAS 123. *OPTVAL_CALC* is the Black and Scholes (1973) value of options granted during the year, calculated using *VOL_HIST*, *DIV_HIST*, *INT_HIST*, and *LIFE_PRED*, in lieu of the SFAS 123 disclosed input assumptions, *VOL*, *DIV*, *INT*, and *LIFE*. *VOL_HIST* is the historical stock price volatility calculated over the most recent period similar to expected option life. *DIV_HIST* is the historical dividend yield for the most recent year. *INT_HIST* is the grant-year average yield on zero

coupon U.S. Treasury Bills with a term equal to expected option life. *LIFE_PRED* is the predicted value from a regression of *LIFE* on four instrumental variables, (i) the option vesting period, (ii) the number of options cancelled during the year deflated by the sum of options outstanding at the end of the year and options cancelled during the year, (iii) the number of options exercised during the year deflated by the sum of options outstanding at the end of the year and options exercised during the year, and (iv) the percent of options granted to the top five executives, and on industry and indicator variables. The option value is calculated based on the SFAS 123 disclosed average exercise price.

The dependent variable in Panel B is [$OPTVAL - OPTVAL\_CALC^{INPUT}$]. $OPTVAL\_CALC^{LIFE}$ is the Black and Scholes (1973) value of options granted during the year, calculated using *VOL*, *DIV*, *INT*, and *LIFE_PRED*. $OPTVAL\_CALC^{VOL}$ is the Black and Scholes (1973) value of options granted during the year, calculated using *LIFE*, *DIV*, *INT*, and *VOL_HIST*. $OPTVAL\_CALC^{DIV}$ is the Black and Scholes (1973) value of options granted during the year, calculated using *LIFE*, *VOL*, *INT*, and *DIV_HIST*. $OPTVAL\_CALC^{INT}$ is the Black and Scholes (1973) value of options granted during the year, calculated using *LIFE*, *VOL*, *DIV*, and *INT_HIST*. The option value is calculated using the disclosed average exercise price.

$COMPX^{\dagger}$ is the number of options granted during the year multiplied by their average exercise price, deflated by number of shares outstanding. *RESCOMP* is the residual from a regression of total annual CEO compensation on proxies for firm size, performance, growth, risk, and industry membership. *GOV* is an indicator variable taking the value of one for firms with "Governance Score" above the sample median (i.e., firms with weaker governance), and zero otherwise. The "Governance Score" is a measure compiled by the Investor Responsibility Research Center (IRRC) based on 23 corporate governance provisions that measure shareholders' rights.

SIZE is the logarithm of market value of equity at fiscal year end. *BM* is the book value of equity divided by market value of equity at fiscal year end. *GROWTH* is the one-year percentage increase in sales revenue. *OPT_OUT* is the number of options outstanding at the beginning of the year deflated by number of shares outstanding. $1YR\_VOL^{PRE}$ ($1YR\_VOL^{POST}$) is stock price volatility over the prior (subsequent) year.

Coefficients are estimated using a robust regression technique. The intercept varies across the 33 industries listed in Table 1 and the six sample years; estimated intercepts are untabulated. All tabulated t-statistics are based on White (1980) heteroskedasticity-consistent standard errors.

Table 6. Summary statistics from a regression of the SFAS 123 disclosed input assumptions used in the calculation of option value estimates on proxies for firms' incentives and opportunity to understate SFAS 123 expense and control variables

		INPUT							
		LIFE		*VOL*		*DIV*		*INT*	
Variable	Pred. sign	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
LIFE_PRED	+	0.92	13.80						
VOL_HIST	+			0.61	41.67				
DIV_HIST	+					1.00	385.09		
INT_HIST	+							0.72	21.12
COMPX	–	–0.01	–7.26	–0.41	–3.27	0.01	1.12	–0.01	–0.98
RESCOMP	–	–0.05	–1.57	–0.01	–1.32	–0.01	–0.19	–0.01	–0.96
GOV	–	–0.13	–2.73	–0.97	–5.42	–0.01	–2.17	0.02	0.97
SIZE	?	–0.02	–1.64	–0.77	–12.11	0.01	1.21		
BM	?	–0.10	–1.68	–2.14	–6.75	–0.01	–2.28		
GROWTH	?	0.02	0.23	0.38	1.13	–0.01	–0.62		
OPT_OUT	?	0.18	0.54	5.71	3.76	–0.01	–0.81		
$1YR\_VOL^{PRE}$	?	–0.01	–5.82	0.14	11.86	–0.01	–2.36		
$1YR\_VOL^{POST}$				0.07	8.81				
LIFE				0.02	0.48	0.01	2.21	0.01	1.24
DIV_HIST				–0.41	–6.19				
Adj R^2		0.18		0.89		0.99		0.61	
N		3.368		3.368		3.368		3.368	

LIFE is expected option life. *VOL* is expected stock price volatility. *DIV* is expected dividend yield. *INT* is the risk-free interest rate for the expected life of the option. *LIFE, VOL, DIV*, and *INT* are disclosed under SFAS 123.

LIFE_PRED is the predicted value from a regression of *LIFE* on four instrumental variables, (i) the option vesting period, (ii) the number of options cancelled during the year deflated by the sum of options outstanding at the end of the year and options cancelled during the year, (iii) the number of options exercised during the year deflated by the sum of options outstanding at the end of the year and options exercised during the year, and (iv) the percent of options granted to the top five executives, and on industry and year indicator variables. *VOL_HIST* is the historical stock price volatility calculated over the most recent period similar to expected option life. *DIV_HIST* is the historical dividend yield for the most recent year. *INT_HIST* is the grant-year average yield on zero coupon U.S. Treasury Bills with a term equal to expected option life.

COMPX is the number of options granted during the year multiplied by *OPTVAL_CALC*, deflated by number of shares outstanding. *OPTVAL_CALC* is the Black and Scholes (1973) value of options granted during the year, calculated using *LIFE_PRED*, *VOL_HIST*, *DIV_HIST*, and *INT_HIST*, in lieu of the SFAS 123 disclosed input assumptions, *LIFE*, *VOL*, *DIV*, and *INT*, and based on the SFAS 123 disclosed average exercise price. *RESCOMP* is the residual from a regression of total annual CEO compensation on proxies for firm size, performance, growth, risk, and industry membership. *GOV* is an indicator variable taking the value of one for firms with "Governance Score" above the sample median (i.e., firms with weaker governance), and zero otherwise. The "Governance Score" is a measure compiled by the Investor Responsibility Research Center (IRRC) based on 23 corporate governance provisions that measure shareholders' rights.

SIZE is the logarithm of market value of equity at fiscal year end. *BM* is the book value of equity divided by market value of equity at fiscal year end. *GROWTH* is the one-year percentage increase in sales revenue. *OPT_OUT* is the number of options outstanding at the beginning of the year deflated by number of shares outstanding. $1YR\_VOL^{PRE}$ ($1YR\_VOL^{POST}$) is stock price volatility over the prior (subsequent) year.

Coefficients are estimated using a robust regression technique. The intercept varies across the 33 industries listed in Table 1 and the six sample years; estimated intercepts are untabulated. All tabulated t-statistics are based on White (1980) heteroskedasticity-consistent standard errors.

Because assuming a higher dividend yield decreases option value, in the *DIV* regression we multiply the experimental variables, *COMPX*, *RESCOMP*, and *GOV*, by minus one.