

THE PRICING AND DETERMINANTS OF THE DISCRETIONARY  
COMPONENT OF EMPLOYEE STOCK OPTION VALUE

by

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ABSTRACT

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In this study, I first re-examine the pricing effect of employee stock option (ESO) value. I find a negative association between ESO value and share price, supporting the view that investors view ESO value as an expense of the firm. Further, I find a negative relation between the nondiscretionary component of ESO value (i.e., the expected ESO value) and stock price; this finding indicates that markets view the full ESO value as well as the nondiscretionary component of ESO value as an expense of the firm. Additionally, I find the discretionary component of ESO value (i.e., the

unexpected ESO value) is also negatively associated with stock price; this finding suggests that markets price the discretionary component of ESO value as well.

Further, I find a positive association between stock price and understatement of ESO value. This result, under the efficient markets hypothesis, indicates that the discretionary component of ESO value for understating firms is likely driven by information incentive. I do not find significant result for overstating firms; this finding is inconsistent with the position that firms over-reporting their ESO values are likely to communicate their private information to outside investors.

Moreover, I find a significant negative association between the understatement of ESO value and the proxy for change in firms' future operating risk, after controlling for firms' opportunities and incentives to under-value their option value as well as other firm characteristics. This result supports the information communication perspective that managers communicate their private information about firms' future operating risk by exercising their managerial discretion in ESO value estimates. More importantly, after controlling for these factors, the negative association between understatement of ESO value and firms' future operating risk provides a theoretical interpretation as to the pricing effect of the discretionary component of ESO value for understating firms, in an efficient market.

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# CHAPTER 1

## INTRODUCTION

### 1.1 Overview of the Study

The immense growth in top executive compensation in the U.S. during the last two decades results mainly from the stock option awards. Yermack (1995) reports that stock option awards account for 20% of CEO income in 1984, 35% in 1990, and 30% in 1991<sup>1</sup>. Pearl Meyer & Partners (2001) shows that, on average, stock options account for 60% of CEO compensation for the largest 200 U.S. corporations in 2000. In addition, Balsam and Ryan (2005) report the average of stock options as a percentage of total CEO compensation and other top officers for large U.S. publicly held corporations from 1993 to 2002, is 53%<sup>2</sup>. Because of the enormous increase in stock options granted to firms' top executives, how to measure the value of ESOs as well as how to report the granting of these options in financial statements has become a subject of considerable interest.

In the past, Generally Accepted Accounting Principles (GAAP) requires that employee stock option (ESO) cost be measured by the excess of the market price of the underlying stock over the exercise price of the option at the grant date. This approach is

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<sup>1</sup> The sample includes 792 U.S. public corporations between 1984 and 1991. Stock option value is valued by Black-Scholes-Merton (1973) methodology at the date of grant.

<sup>2</sup> Balsam and Ryan (1995) use 59,698 observations from Standard & Poor's ExecuComp, which includes the firms in the S&P 500, Mid-Cap, and Small-Cap indexes, for their analysis.

referred to as the *intrinsic value based method*. Since most companies set the exercise price of an option equal to the market price of the underlying stock at the option's grant date, virtually no ESO compensation cost is recognized under the *intrinsic value based method*. In October 1995, the Financial Accounting Standards Board (FASB) issued Statement of Financial Accounting Standard (SFAS) No. 123, which encouraged, but did not require firms to adopt the *fair value based method* of accounting for an ESO. Under the *fair value based method*, the value of options is measured at the grant date using an option-pricing model. Once determined at the grant date, the employee stock option value (hereafter termed ESO value) is then amortized and recognized as expense to the firm over the vesting period.

Accounting for stock-based compensation, especially ESOs, has long been a controversial financial reporting issue, causing intense debate among investors, auditors, managers, government regulators, and standard setters. The major controversy is centered around the question of whether the value of an ESO is an expense of the firm.

The FASB believes that the value of an ESO is an expense of the firm that should be recognized in its net income (FASB 1995). The FASB position is based upon the idea that issuing an ESO dilutes the value of existing stockholder claims on the firm by transferring those claims from existing shareholders to employees (Skinner 1996). In addition, employees provide services to the firm, thus the value of the transferred ownership claims represents a cost of generating earnings (Aboody et al. 2004).

Opponents to the recognition of ESO expense argue that issuing ESOs more closely aligns employee interests with those of stockholders and helps reduce employee turnover, implying that ESO value is positively related to stock price (Skinner 1996). Opponents also claim that ESOs are transactions among shareholders and thus are not an expense of the firm. Additionally, ESO value cannot be measured reliably because existing option value estimation technology is not suitable for employee options. Further, estimation of option value requires the exercise of substantial management discretion (Aboody et al. 2004).

Motivated by the controversy surrounding the issue of accounting for ESOs as well as the effects that the issuance of stock options has on firm value, numerous studies addressed the ESO valuation issue by testing the pricing effect of the ESO value. Aboody (1996), Aboody et al. (2004), and Balsam, Bartov, and Yin (2005) find a negative relation between stock price and ESO value, and thus suggest that ESO value is value relevant and that investors view ESO value as an expense of the firm<sup>3</sup>. Additionally, based upon his finding, Aboody (1996) also suggests that the dilution effect from ESOs dominates the incentive effect.

On the other hand, Rees and Stott (2001) and Bell et al. (2002) find a positive relation between disclosed ESO expense and share price, and suggest that the incentive benefit derived from the ESO plan outweighs the cost associated with the plan. Overall,

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<sup>3</sup> These studies are all related to the value relevance issue of ESOs, the chief difference lies in the definition of ESO value. Aboody (1996) focuses on the pricing effect of the estimated value of outstanding employee stock options. Aboody et al. (2004) investigate the relation between share prices and disclosed but not recognized stock option expense under SFAS 123. Balsam et al. (2005) compare the differential pricing effect between the disclosed versus the recognized option expense.

prior evidence regarding whether ESO value is perceived by the investors as an expense is mixed. Thus, the first purpose of my dissertation is to re-examine the pricing effect of ESO value.

Statement of Financial Accounting Standards (SFAS) No. 123 provides firms with general guidance for the use of historical data<sup>4</sup>, industry average<sup>5</sup> and other currently available information necessary to make their expectation about the option-pricing model input assumptions. However, managers still have much latitude in their judgment on these input choices. The discretionary component of ESO value or the unexpected ESO value<sup>6</sup>, which cannot be explained by the firm's historical experience or the contemporaneous industry average, is most likely attributable to this managerial discretion. From information communication perspective (Watts and Zimmerman 1986; Healy et al. 1993; Subramanyam 1996; Ahmed et al. 2000; Sankar et al. 2001), the flexibility afforded by SFAS 123 may provide managers an opportunity to communicate their private information, e.g. firms' future operating, financial risk, or the like, to outside investors by exercising their discretion in option input choices and thus ESO

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<sup>4</sup> SFAS 123R ¶A21 suggests, "Historical experience is generally the starting point for developing expectations about the future. Expectations based on historical experience should be modified to reflect ways in which currently available information indicates that the future is reasonably expected to differ from the past".

<sup>5</sup> Under certain circumstances, historical information (e.g., the stock price volatility) may not be available. For example, a newly publicly traded firm may have little historical information on the volatility of its own shares, and SFAS 123R ¶A22 indicates that the entity might "base expectations about future volatility on the average volatility of otherwise similar public entities. For purpose of identifying otherwise similar entities, an entity would likely consider characteristics such as industry, stage of life cycle, size, and financial leverage".

<sup>6</sup> Hodder et al. (2006) defined the Black-Scholes value using the expected input assumptions as the expected ESO value or the nondiscretionary component of ESO value. In contrast to the expected ESO value, the unexpected ESO value or the discretionary component of ESO value represents the extent to which the reported ESO value deviates from its expected one. Hodder et al. label this difference as the "discretionary component of ESO value". Since I adopt the Hodder et al. expectation model in determining the expected input assumptions, I also use these terminologies interchangeably in this study.

value estimates. In such cases, since the discretionary component of ESO value accommodates additional information about firms' future risk, an efficient market, by its mechanism, supposedly incorporates the risk-related information into its valuation assessment. Alternatively, managers could also have incentives to opportunistically exercise their discretion in ESO value estimates, i.e. managerial opportunism perspective (Healy 1985; DeAngelo et al. 1994; Burgstahler et al. 1997; Burgstahler et al. 2006; Teoh, Welch, and Wong 1998a, b; Guidry et al. 1999). In such situations, investors may interpret the discretionary component of ESO value as being merely manipulated with little implication about firm's future cash flows.

To examine the sources of the pricing effect of ESO value, my dissertation further tests whether discretionary, nondiscretionary, or both portions of ESO values in combination account for the pricing effect of ESO value. Partition of ESO value into discretionary and nondiscretionary portions allows me to examine whether managerial discretion reflected in the input assumptions underlying the option value calculation can affect the investors' valuation assessment.

Unlike the discretionary component of ESO value, the nondiscretionary component of ESO value is solely determined by historical data and industry average and thus is independent of the managerial discretion issue. Moreover, this component represents the expected value of an ESO. Therefore, I posit a negative relation between share price and the nondiscretionary component of ESO value.

Further, recent studies document evidence supporting the position that firms tend to opportunistically undervalue their ESOs (Yermack 1998; Bartov et al. 2004;

Aboody et al. 2006; Johnston 2006; Hodder et al. 2006). For example, managers may shorten the expected lives of stock options to reduce the apparent value of managerial compensation (Yermack 1998), or opportunistically use their discretion to lower the expected volatility when firm's option holdings are relatively large (Bartov et al. 2004, Hodder et al. 2006). Firms manipulate ESO expense downward in order to mitigate the negative effect on their share price (Johnston 2006). Additionally, increasing investor perceptions of the firm's profitability and decreasing perceived excessiveness of executive pay could also be incentives for managers to understate option value by way of exercising their discretion in determining expected option volatility, expected dividend yield, and expected option life (Aboody et al. 2006). These empirical evidences support the position that underestimation of ESO value is likely attributable to opportunistic incentives. To test this position, I posit that for understating firms, if managerial opportunism is the motivation, there is no relation between stock price and the discretionary component of ESO values.

On the other hand, managers could also reflect their assessment of change in firms' future economic condition, e.g., operating or financing risk or the like, in ESO value estimates by exercising their discretion over option-pricing model inputs, resulting in a lower ESO value than expected and thereby signaling a lower future operating or financing risk to outside investors. To test this conjecture, I make a conditional hypothesis, namely if information communication is the motivation, I predict to observe a positive relation between share prices and the discretionary component variable for understating firms.

Moreover, Aboody et al. (2006) argue that exercising discretion in estimating option values cannot be used to shift income across periods, because grant-date option value estimates cannot be subsequently adjusted for any managerial discretion exercised in the estimation procedure. Therefore, management incentives identified in prior research to decrease earnings do not apply to SFAS 123 expense. Contrary to Aboody et al. (2006) position, Hodder et al. (2006) find nearly half of their sample firms appear to use discretion to increase the estimated ESO value. Their further investigation suggests that firms overstating their ESO value are likely to communicate their private information to outside investors, primarily about firms' future operating risk. To test Hodder et al. position, I posit a negative relation between share price and the discretionary component of ESO value for overstating firms, if information communication is the motivation.

Alternatively, there could be opportunistic incentives to overstate option value in certain exceptional circumstances, for example, potential political costs (Watts and Zimmerman 1986). The political costs hypothesis suggests that the use of reported profit by politicians and regulators provides corporate managers with an incentive to adopt accounting procedures that reduce reported earnings. Lower reported profits reduce the likelihood of adverse government actions against the firm, and increase the likelihood of government subsidies to the firm, if the politicians, regulators, and those opposing the actions that benefit the firm do not adjust the reported profits to undo management's earnings reducing accounting choices. As long as it is costly for outsiders to undo the accounting choices, management has an incentive to choose

accounting procedures that report lower earnings in the current year (Zimmerman 1983; Watts and Zimmerman 1986; Jensen and Meckling 1978). Accordingly, I posit no relation between stock price and the discretionary component of ESO value for overstating firms, if opportunism is the motivation.

The above hypotheses are based upon two maintained assumptions: the markets are efficient and the Hodder et al. (2006) expectation model correctly decomposes the full ESO value into discretionary and nondiscretionary components.

In option valuation theory, the option value is a positive function of the underlying share price, which results in a positive relation between ESO value (discretionary and nondiscretionary components) and stock price. This positive mechanical relation between stock price and ESO value causes the ordinary least square (OLS) coefficient on the ESO variable to be biased and inconsistent. To mitigate this simultaneity bias, I use the instrumental variable approach to construct the discretionary and nondiscretionary components of ESO value variables. The instruments include net income, book value of equity, expected earnings growth rate, and option-pricing model inputs. The option-pricing model inputs used as instruments are expected option life, expected stock return volatility, the expected risk-free interest rate and expected dividend yield.

I find a negative relation between stock price and the ESO value variable, which is consistent with my first hypothesis. This finding provides additional evidence supporting the position that markets view the value of an ESO as an expense of the firm. Moreover, as predicted, I find a negative relation between the nondiscretionary

component of ESO value and share price, which is accordant with my second hypothesis. This finding indicates that markets view the full ESO value as well as predicted ESO value as an expense of the firm, in a similar fashion.

To exclude the possible interpretation that the result could be influenced by intertemporally correlated omitted variables, I use “change-form” regression to examine the value relevance of ESO value, as suggested by Skinner (1996). The major difference between value relevance studies which examine price levels and those which examine price changes, or returns, is that the former focus upon determining what is reflected in firm value and the latter examine what is reflected in changes in value over a specific period of time (Barth et al. 2001). Thus, “change-form” regression could determine whether a change in the discretionary component of ESO value is reflected in the firm’s annual return on a timely basis.

I find a negative relation between stock returns and change in the ESO value. This finding suggests that change in the ESO value is reflected in stock returns on a timely basis. It is unlikely that this result is driven by correlated omitted variable across years. However, I cannot exclude the possibility that the result could be driven by measurement errors in the discretionary component of ESO value proxy.

In addition, I find a positive relation between share price and the discretionary component of ESO value for understating firms. Under the efficient markets hypothesis, this finding suggests that discretionary component of ESO values for understating firms is likely driven by information communication motive. That is, managers communicate their assessment of change in firms’ future risk by exercising their discretion in option

value estimates, resulting in a lower option value and thereby signaling a lower level of future risk assessment.

Alternatively, I do not find significant association between share price and the discretionary component of ESO value for overstating firms. This result suggests that the discretionary component of ESO value for overstating firms is unlikely driven by information motive, this result is inconsistent with the posit that firms overstating their options are likely to communicate their private information to outside investors (Aboody et al. 2006, Hodder et al. 2006).

An alternative interpretation of this result is that it may be naive to assume the markets can, on average, correctly price discretionary component of ESO value; rather the markets might simply mechanically response to the discretionary component of ESO value for understating firms. Additional evidence is needed to determine whether the mechanistic relation interpretation is more consistent with my finding. Accordingly, I conduct a second set of analysis examining the relation between firms' future risk and the discretionary component of ESO value.

I use two alternative proxies for change in firms' future operating risk. One is measured on the accounting accrual basis and the other is on the cash basis. I find a significant negative association between the understatement of ESO value and the proxy for operating risk, which is computed as one-year-ahead percentage change in the standard deviation of operating cash flow. This result suggests that the greater extent of underestimation of ESO value is associated with lower levels of firms' future operating risk. This result supports the information communication hypothesis that managers

communicate their private information about firms' future operating risk by exercising their managerial discretion in ESO value estimates. More importantly, this statistical association provides a theoretical interpretation as to the pricing effect of the discretionary component of ESO value for understating firms, in an efficient market.

On the other hand, I do not find similar result if operating risk is measured by accounting accrual number, i.e., operating income. One plausible interpretation of the result is that accounting earnings is a noisy proxy for operating risk.

### 1.2 Motivations of the Study

First, Statement of Financial Accounting Standards (SFAS) No. 123 provides firms with general guidance for the use of historical data, industry average, and other currently available information necessary to make their expectation about the option-pricing model input assumptions. However, managers still have much room in their judgment on these input choices. The management of ESO value has been addressed in recent studies by examining the issue of managerial discretion over option-pricing model inputs. These studies find that ESO value estimates are a fertile area for manipulation (Yermack 1998; Bartov et al 2004; Aboody et al. 2006; Johnston 2006; Hodder et al. 2006). The discretionary component of ESO value, which cannot be explained by the contemporaneous industry average or the firm's historical experience, is most likely attributable to this managerial discretion. Partition of ESO value into discretionary and nondiscretionary portions allows me to examine whether managerial discretion reflected in the option-pricing model inputs underlying the option value calculation can affect the investors' valuation assessment.

Second, Hodder et al. (2006) and Aboody et al. (2006) suggest that the discretionary component of ESO value for understating firms is mainly driven by opportunistic incentives. Alternatively, the discretionary component of ESO value for overstating firms is most likely attributable to information communication incentives. The interpretation of their findings motivates me to assess whether the competing perspectives, that is information communication perspective and managerial opportunism perspective, can explain the pricing effect of the discretionary component of ESO value. In addition, ESO value estimation is sensitive to these input assumptions. The average magnitude<sup>7</sup> of ESO value and its sensitivity to these input assumptions make it economically significant as a subject for my study.

### 1.3 Contributions of the Study

First, Aboody (1996) documented evidence indicating the full ESO value is value relevant. My dissertation extends Aboody's study by further examining the effect of managerial discretion exercised in option-pricing model input assumptions on the pricing effect of ESO value. To my knowledge, the current study is the first to investigate the pricing effect of the discretionary and nondiscretionary components of ESO values by examining whether the market incorporates the managerial discretion as reflected in the input assumption choices into its valuation assessment. Thus, evidence provided by this study could improve our understanding of the way in which capital markets process ESO information. Moreover, this study fills in the deficiency in the Aboody (1996) valuation model by taking into consideration a relevant but omitted

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<sup>7</sup> From the income statement perspective, Merrill Lynch estimates that if all S&P500 firms were to expense options [in 2002], reported profits would fall about 10% (Fortune 2002).

variable problem<sup>8</sup>, and using more recent sample years as well as instruments that are more delicate in the instrumental variable construction<sup>9</sup>.

Second, compared to Aboody et al. (2004), I use a more recent and longer sample period to address a related issue, the pricing effect of ESO value, but different dimensions. Aboody et al. focus on the value relevance of disclosed but not recognized ESO expense, while this study mainly investigates whether discretionary, nondiscretionary, or both components can explain the value relevance of the full ESO value.

Third, the findings have implications for accounting standard-setters. To the extent that managers believe exercising managerial discretion over the option-pricing model inputs as reflected in the discretionary component of ESO value, can influence investor perception of a firm's profitability and, therefore a firm's stock price, they probably will exercise their discretion in ESO value estimates in an opportunistic fashion. For understating firms, though I find information communication incentive could motivate managers to exercise their managerial discretion to under-report their ESO values, and thereby signaling a lower level of firms' future operating risk to outside investors, I also find that opportunistic incentive may motivate managers to under-value their ESOs as well. The purpose of this study is to examine how the

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<sup>8</sup> Aboody (1996) ignores future growth in earnings and book values. Thus, the firm's future growth prospects become a potentially important omitted variable. The question then becomes one of assessing whether future earnings growth is a *correlated* omitted variable. (Skinner, 1996)

<sup>9</sup> Aboody (1996) uses the number of options per share that expires in one to ten years, and book value of equity as well as accounting earnings as the instruments to construct the instrumental variable. In this study, in addition to book value of equity, earnings, and the expected earnings growth rate, I use four option-pricing model inputs as instruments to construct my instrumental variable, which are the main determinants of option value and thus are correlated with the option value,.

markets process the information underlying the value of an ESO. Therefore, I leave to standard setters the determination whether it is desirable to allow managers to exercise their discretion, afforded by SFAS No. 123, in option-pricing model input choice, and therefore ESO value estimates.

#### 1.4 Organization of the Study

The remainder of this dissertation is organized follows. CHAPTER 2 reviews related prior studies. CHAPTER 3 describes the research design and CHAPTER 4 presents the data and descriptive statistics. CHAPTER 5 discusses empirical results. CHAPTER 6 offers additional analyses. CHAPTER 7 concludes.

## CHAPTER 2

### LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

#### 2.1 Institutional Background of ESO Accounting

Accounting for ESOs is specified in Accounting Principles Board (APB) Opinion No. 25 (APB 1973), SFAS No. 123 (FASB 1995) and SFAS No. 123R (FASB 2004). Under APB No. 25, stock-based compensation expense is the excess of stock price over option exercise price on the measurement date; this is so called “intrinsic value based method”. The measurement date is the date at which the exercise price and the number of options are known. For firms with fixed stock option plans, the option grant date is the measurement date. Because most firms set the exercise price of the option equal to the stock price at the grant date, no compensation expense is recognized under APB No. 25.

SFAS123 defines a *fair value based method* of accounting for ESOs and encourages all firms to adopt this method for all of their ESO plans. The FASB also allows firms to continue to measure compensation cost using the *intrinsic value based method* of accounting as prescribed by APB Opinion No. 25. Under the *fair value based method*, ESO expense is based on estimated option fair values at the grant date. Option fair values are calculated using an option-pricing model that takes into account the exercise price, the expected option life, the current price of the underlying stock, the

expected volatility of the price of the underlying stock, expected dividends yield, and the risk-free interest rate for the expected term of the option. Once measured at the grant date, the option value is then amortized and recognized as compensation expense over the vesting period of the option grant. Firms that elect to continue to account for ESOs using Opinion No. 25 must make *pro forma* disclosure of net income, as if the *fair value based method* of accounting had been applied. The *pro forma* amounts will reflect the difference between compensation cost, if any, reported in net income and the related cost measured by the *fair value based method* that would have been recognized in the income statement if the *fair value based method* had been used. Other required disclosures include the number of options granted and exercised, the estimated value of options granted, the vesting period, and the option-pricing model inputs to the option fair value calculation. Option-pricing model inputs include the option exercise price, the option's expected life, the stock's dividend yield, the risk-free interest rate, and a measure of the stock price's volatility.

In fact, only a few firms elected to adopt the fair value based accounting for ESO expense prior to 2002. However, more and more firms adopted or announced their intention to adopt the fair value method after the summer of 2002. The major reason for this change was that these companies wanted to show the investing community that they believe in fair and transparent financial reporting. These decisions were influenced, in part, by many financial reporting scandals of the late 1990's and early 2000's.

Initially when SFAS123 was issued in 1995, the FASB required firms to use the *prospective* application for their options expense. Prospective application of the option

expense rules require that only option granted in the current period are recognized as expense. All previously granted options are ignored. However, the prospective method introduced a *ramp-up* effect, which caused a gradual increase in recognized ESO expense during the first few years after adoption. As more and more firms chose to adopt the *fair value based method* to expense option values, the FASB issued SFAS148 (2002) in response to concerns about this ramp-up effect and the lack of consistency and comparability it caused in reported results. SFAS148 amended the method specified in SFAS 123 by permitting two additional transition methods, i.e. *modified prospective method* and *retroactive restatement method*.

Under the modified prospective method, option expense is recognized from the beginning of the fiscal year of adoption as if the fair value method had been used to account for all employee awards granted, modified, or settled in fiscal years beginning after December 15, 1994. Consequently, this method results in an immediate and more complete transitional report than did the original prospective method. Furthermore, firms under this approach were able to avoid the ramp-up effect by requiring *full* expense recognition starting from the beginning of the adoption year. The retroactive restatement method asked for restatements of all periods to reflect option expense under the fair value method for all employee awards granted, modified, or settled in fiscal year beginning after December 15, 1994. For options expense related to currently granted options, firms recognized the expense in the income statement under the above three transition methods. However, expense amounts related to unvested options granted in prior years, firms continue to disclose this information in footnotes under prospective

method, but recognized it in the income statement under the other two methods. Therefore, the prospective method causes ESO expense to be partially recognized and partially disclosed for the same fiscal year.

Accounting for stock-based compensation has long been a debatable financial reporting issue, leading to intense debate among investors, managers, standards setters, and regulators. The main issue aims at whether the value of ESOs is an expense of the firm, or whether or how investors incorporate the value of a firm's ESO into its share price. Next, I present prior studies related to the issue of value relevance of ESO values.

## 2.2 Value Relevance of Employee Stock Option Value

To examine whether and how investors incorporate the value of a firm's ESOs into its stock price, Aboody (1996) uses the Ohlson (1995) valuation model that relates the firm's stock price to its accounting earnings, its book value and its ESO value per share. His sample includes 478 firms from 1983 to 1990. In this study, the ordinary least square (OLS) coefficient on ESO value is biased and inconsistent, since ESO value is correlated with the error term, i.e. stock price is a component of the option-pricing model that calculates the ESO value. To fix this simultaneity issue<sup>10</sup>, Aboody (1996) applies the instrumental variable approach in his study. After controlling for the simultaneity issue, Aboody (1996) finds a significant *negative* relation between the estimated value of outstanding employee stock options and stock price. Aboody's

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<sup>10</sup> The instrumental variable approach is implemented by two-stage least squares (2SLS) procedures. In the first stage, the option value is regressed on all predetermined variables and instruments. Predetermined variables include earnings and book value of equity. Instruments are the number of outstanding options that expires in one to ten years, deflated by the number of outstanding shares. In the second-stage regression, the ESO value is replaced by the predicted value from the first-stage regression. Since there is no correlation between the instruments and the error term, the bias in the coefficient on the ESO is eliminated and the instrumental approach yields a constant estimator for ESO value.

finding suggests that ESO value is incorporated by investors into their assessment of the firm's value. Additionally, this result also suggests that the dilution effect dominates the incentive effect<sup>11</sup>. Further investigations also suggest that the correlation between option value and stock price is stronger for the option's intrinsic value than for the option's time value. The above statement holds for options that are later in the vesting period as opposed to those earlier in the vesting period, and for the options of larger firms as opposed to those of small firms.

The FASB argues that stock-based compensation is an expense of the firm and should be recognized in net income (FASB1995). It also argues that issuing ESOs dilutes the value of existing stockholder claims on the firm by transferring claims on equity from existing shareholders to employees (Skinner 1996). Additionally, employees provide services to the firm, thus the value of the transferred ownership claims represents a cost of generating earnings (Aboody et al. 2004).

Opponents to recognizing option expenses argue that issuing ESOs more strongly aligns employees' interests with those of stockholders, and helps reduce employee turnover. This argument implies that ESO value should be positively related to stock price (Skinner, 1996). Opponents also claim that an ESO is a transaction among shareholders and thus is not an expense of the firm. Moreover, they suggest that ESO value cannot be measured reliably because existing option value estimation methods are

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<sup>11</sup> Compensating employees with ESOs rather than cash compensation might be attractive to firms, because ESOs provide long-term incentives and could reduce agency problems. Therefore, ESO value affects stock prices in two opposing ways: it dilutes the value of the firm's outstanding stock, i.e., the dilution effect, and yet provides incentives to employees to act in the best interests of the firm and therefore increase the firm's stock price, i.e., the incentive effect.

not suitable for employee options. Besides, current method of estimating option value requires the exercise of substantial management discretion (Aboody et al. 2004).

Instead of examining the relation between the stock price and option value, Rees and Stott (2001) examine the value relevance of disclosed ESO expenses using the fair value method, and they find that the disclosed ESO expense in 1996 is positively associated with annual stock returns. This result suggests that the incentive benefit derived from the ESO plan outweighs the cost associated with the plan. They also find that smaller firms have higher growth potential benefit from an ESO plan compared to larger, more mature firms. Because firms that are in the growth stage of their life cycle are likely to have a high demand for cash, granting ESOs will allow the firms to limit cash payment and still attract highly-talented employees. Additionally, the fact that employees have accepted the contract and have participated in an ESO plan might send a positive signal to the market about the future growth prospects of the firm. However, a problem with their study is that they only use one-year's data from only 756 firms. Also, their result is subject to the simultaneity concern.

Bell et al. (2002) examine a related research question. They consider whether investors view profitable software firms' ESO expenses similarly as for other expenses by examining the relation between disclosed but not recognized expense under SFAS No. 123 and the firms' stock price. Their sample includes 85 profitable computer software firms from 1996 to 1998. They find a positive relation between share price and ESO expense, without considering the simultaneity issue. Based on this result, they conclude that the market appears to value these firms' ESO expense not as an expense

but as an intangible asset. After controlling for this simultaneity relation by using a two-stage instrumental variable approach, they find an insignificantly negative association between share price and the ESO expense variable. This finding is consistent with the statement that the disclosed but not recognized ESO expense under SFAS No.123 lacks relevance and reliability.

More recently, to address this controversial issue, Aboody et al. (2004) use the Ohlson (1995) valuation model to investigate the relation between share price and stock option expense that is disclosed but not recognized under SFAS123 after controlling for income, equity book value, and expected earnings growth. They collect ESO expense from firms' footnote disclosures from 1995 to 1998, resulting in a final sample of 2,274 firm-year observations.

Controlling for the mechanical relation between stock price and ESO value by instrumental variable approach, they find a significant negative association between the disclosed option expense and share price. They conclude that investors view the disclosed ESO expense under SFAS123 as an expense of the firm that is measured with sufficient reliability to be reflected in shareholders' valuation assessments. To investigate whether SFAS123 expense reflects on a timely basis changes in investor-perceived cost associated with ESO compensation, they regress stock return on net income, change in net income, change in earning growth, and change in their instrumental variable for ESO compensation. They find a significant negative relation between returns and the ESO compensation variable, and this result suggests that an increase in SFAS123 expense is associated with decrease in share price. Bell et al

(2002) suggest that the difference between theirs and Aboody et al. (2001) research findings is most likely attributed to sample difference. To investigate this conjecture, Aboody et al. (2004) find an insignificant relation between share price and ESO expense variable for computer software firms, consistent with Bell et al. (2002). More importantly, they find Bell et al.'s inferences are not generalizable to broader samples of firms, including profitable firms in a variety of industries and firms in knowledge-based industries beyond computer software.

In December 2002, FASB issued SFAS No. 148, Accounting for Stock-Based Compensation-Transition and Disclosure, which amended the transition method specified in SFAS123 and also increased the frequency with which firms disclosed their *pro forma* numbers. In addition to the annual disclosures, SFAS148 requires new quarterly disclosures for all firms with stock-based compensation starting in the quarter of 2003. To investigate the value relevance of recently promulgated SFAS148 quarterly disclosures and whether the valuation effects of disclosed and recognized option expense are equal, Balsam et al. (2005) use 142 distinct firms or 363 firm-quarter observations that recently begin recognizing option expense voluntarily and thus reported both disclosed and recognized option expense. They regress an abnormal return variable, size-adjusted buy-and-hold stock returns for the fiscal quarter over a 90-day window ending the last day of the fiscal quarter, on seasonal change in the per-share unrecognized option expense and seasonal change in the per-share recognized option expense, controlling for change in earnings per share, firm size, and change in expected earnings growth. They find that disclosed and recognized quarterly option

expenses are value relevant and more importantly, disclosed and recognized option expenses are reflected in stock returns as expenses and in a similar fashion. This result suggests that market value recognized/disclosed ESO expense as expenses, regardless of their reporting regime, i.e. recognition versus disclosure.

Taken together, prior evidence on the value relevance of ESO value is mixed. In this study, I re-examine this issue and provide additional evidence regarding the value relevance of ESO value. In particular, I extend prior studies by examining the pricing effect of the discretionary and nondiscretionary components of ESO value. In the following section, I discuss the two competing theories that motivate the hypotheses tested in this dissertation: information communication and managerial opportunism.

### 2.3 Information Communication Perspective vs. Managerial Opportunism Perspective

Prior literature suggests two perspectives for the exercise of managerial discretion over accounting earnings. That is, the private information communication perspective (Watts and Zimmerman 1986; Healy et al. 1993; Subramanyam 1996; Ahmed et al. 2000; Sankar et al. 2001), and the managerial opportunism perspective (Healy 1985; DeAngelo et al. 1994; Burgstahler et al. 1997; Burgstahler et al. 2006; Teoh, Welch, and Wong 1998a, b; Guidry et al. 1999).

From the information communication perspective, managers employ discretionary accruals in order to include as much of the impact of current economic events or private information into current reported earnings as possible. Similar to this view, Healy et al. (1993) suggest that managers have superior information compared to that of outside investors as to their firm's current and future performance. Management

forecasts affect stock prices, as so managers' decisions to change their firms' financial policies. Because accrual accounting not only requires managers to record past events, but to make forecasts of future effects of these events, financial statement have the potential to convey managers' superior information. As a result, manager disclosure strategies provide a potentially important means to impart their knowledge to outside investors, even when capital markets are considered to be efficient.

Consistent with this perspective, Subramanyam (1996) finds that the discretionary accruals are on average priced by the markets and are positively associated with future operating cash flows, net income, and changes in future dividends, and thus suggests that the flexibility afforded by GAAP allows managers to improve the value relevance of earnings by communicating private information about the firms' future profitability that is not captured in the nondiscretionary component of accruals.

Moreover, Sankar et al. (2001) provide evidence that also supports the importance of allowing reporting discretion for improved information communication through earnings' reports; specifically, they find that there is always an informational advantage to allowing reporting discretion when the manager is endowed with private information beyond current earnings in a multi-period framework.

These studies suggest that improved information communication appears to be a legitimate reason to allow for flexibility in accounting standards (Subramanyam 1996).

On the other hand, the managerial opportunism perspective suggests that the widespread use of accounting information by investors and financial analysts in order to

help value stocks can create an incentive for managers to attempt to influence short-term stock price performance by manipulating earnings (Dye 1988; Trueman and Titman 1988). Prior studies examined whether managers overstate earnings in periods prior to equity offers. Findings in those studies suggest that firms report income-increasing unexpected accruals prior to seasoned equity offers and initial public offers (Teoh, Welch, and Wong 1998a and 1998b). Other earnings management studies have shown that earnings are also managed in order to avoid earnings decreases and losses (Burgstahler et al. 1997), or to meet the expectations of financial analysts (Burgstahler et al. 2006).

Furthermore, accounting data are also used to help monitor and regulate the contracts between a firm and its stakeholders. For example, management compensation contracts are used to align the interests of management and the firm's stockholders. Lending contracts are written to limit management actions that benefit the firm's stockholders at the expense of its creditors. These contractual constraints could induce managers to use the flexibility afforded by GAAP to manage income opportunistically, thereby creating distortions in the reported earnings (Watts and Zimmerman 1986; Subramanyam 1996).

DeAngelo et al. (1994) provide little evidence of earnings management among firms that are close to violate lending covenants. Guidry et al. (1999) find that managers for large multinational firms are likely to defer income when the earnings target in their incentive bonus seem would not be met or when the managers are already entitled to the

maximum bonuses permitted under the plan. Healy (1985) reports similar results in a single company context.

While the above discussion deals with why managers exercise discretion over earnings numbers, these views can also be applied to the context of why managers exercise discretion over option-pricing model inputs. SFAS 123 provides general guidance for managers to use historical data, industrial average, and other currently available information to make their expectations about the model inputs; however, SFAS 123 guidelines leave significant latitude for managers to exercise their discretion in option-pricing model input choices. If markets view ESO value as an expense of the firm, the decreased ESO expense can improve investor perceptions about firm's profitability. This effect is essentially the same as that of exercising managerial discretion to increase accounting accruals thereby improving the firm's perceived profitability.

The management of ESO value has been addressed in recent studies by examining the issue of managerial discretion over option-pricing model inputs. These studies indicate that managers appear to select inputs to systematically overstate or understate the value of their ESOs. I present this line of literature next.

#### 2.4 Managerial Discretion over Option-Pricing Model Inputs

Yermack (1998) analyzes company disclosures of CEO stock option values in compliance with the Securities and Exchange Commission (SEC) regulations<sup>12</sup> for reporting executive compensation information to stockholders, using sample data for

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<sup>12</sup> The regulations require disclosure of executive compensation information in proxy statements mailed to stockholders in advance of firms' annual meetings.

*Fortune 500* companies, from 1992 to 1994. He finds that companies appear to exploit the flexibility of the SEC's disclosure requirements to reduce the apparent value of managerial compensation. Those *Fortune 500* companies that elect to disclose CEO stock options values under-report the values by an average of 8.9% compared to benchmark values derived from methods widely used by financial economists<sup>13</sup>. Yermack (1998) also find that companies shorten the expected stock option lives and unilaterally apply discounts to Black-Scholes-Merton (hereafter, BSM) formula. Moreover, he finds an association between the amount by which companies undervalue their CEO stock option awards and the degree to which CEO receive excessive pay.

SFAS 123 (1995) provides firms with general guidance for managers to use historical experience, industrial average, and other currently available information to make their expectation about the option-pricing model inputs, but managers still have much discretion in their managerial judgment on model assumption choices.

What are the motivations to manage the impact of the option on *pro forma* income? Balsam et al. (2003) suggest firms with high levels of CEO pay or stock option grants relative to performance have greater incentives to understate the *pro forma* stock option expense to mitigate the potential criticisms<sup>14</sup>. The other is about potential

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<sup>13</sup> Yermack (1998) calculate a parallel set of benchmark Black-Scholes-Merton estimates using assumptions for inputs to the formula. The risk-free interest rate is the continuously compounded annual yield prevailing on the date of the stock option award for the zero-coupon US Treasury bond with duration equal to expected option life. The dividend yield is estimated as four times the quarterly dividend declared nearest to the date of the stock option award, divided by the company's stock price on the award date, with this quotient compounded continuously. Stock volatility is estimated as the square root of the annualized sample variance of continuously compounded daily returns to holders of the company's common stock, using data from the 120 trading days immediately prior to the award date.

<sup>14</sup> Executive pay is regularly criticized by the press, employees, and shareholders as excessive and unrelated to firm performance. A high level of CEO pay relative to firm performance and large stock

adverse economic consequences to the firm, that is, SFAS123 expense may lead to a lower stock price and higher costs of capital, and thus small firms, high-tech, high-growth, and newly public firms may be more concerned about these economic consequences than others. To test this conjecture, Balsam et al. (2003) use a sample of 137 firms from the 1997 version of S&P Execucomp database to examine whether *pro forma* footnote disclosures under SFAS123 are managed in the initial year, 1996. However, they find little evidence that firms manage the estimated option value. One interpretation for this result is that firms may avoid manipulating grant values because the inputs to the model are disclosed and may be scrutinized by users of financial statements. On the other hand, Balsam et al. do find that firm-specific incentives affect how that value is allocated. More specifically, they find firms that provide high levels of CEO pay or stock option compensation relative to performance allocate a small proportion of the option value to the 1996 *pro forma* expense, apparently to reduce criticism of that pay. In addition, small firms and newly public firms also do so, apparently to increase perceptions of their profitability. These results suggest that firms manipulate *pro forma* option expense when their estimate choices cannot be observed.

Bartov et al. (2004) examine to what extent firms follow the guidance in SFAS123 and use forward-looking information in addition to the readily available historical volatility in estimating expected volatility. To address their research question, they use a sample of 547 distinct firms or 1,991 firm-year observations with compensation data available on Execucomp from 1996 to 2001 and a regression of

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option grants to employee relative to firm performance are likely to generate criticism from these related parties (Balsam et al. 2003).

disclosed stock price volatility on historical volatility and implied volatility, derived by equating the BSM formula with the prices of traded options. If firms incorporate both historical and forward-looking information in estimating the expected volatility, they predict both coefficient estimates should be significantly greater than zero. In addition, the relative magnitude of the coefficient estimates indicates the extent to which firms adjust historical volatility to reflect forward-looking information as deriving the expected volatility parameter. The result suggests that firms rely on both historical and forward-looking information in determining the expected volatility. To determine whether firms incorporate forward-looking information opportunistically to decrease expected volatility and thus the option expense, they add an indicator variable, equal to one when implied volatility is greater than historical volatility, to the regression model. They obtain an interesting finding that when implied volatility is less than historical volatility, firms rely heavily on forward-looking information, but when implied volatility is greater than historical volatility, firms rely heavily on historical information, and that is, firms' reliance on forward-looking information is limited to situations when this reliance results in lower estimated volatility and thus smaller option expense. They interpret this finding as managers opportunistically using the discretion in estimating expected volatility afforded by SFAS123. They also find that managers estimate volatility in such opportunistic fashion primarily when their option holdings or the firm's options granting intensity are relatively large.

Aboody et al. (2006), using a broader set of samples, address a similar research question as Balsam et al. (2003) that whether firms understate SFAS123 expenses by

understating option value estimates. They suggest the reasons SFAS123 expense is susceptible to managerial discretion through the estimation of grant-date option values are that option value estimates depend on expectations about the future, creating a chance for the exercise of management discretion, and that no *ex post* verification of the grant-date values are used to calculate the expense. They hypothesize two managers' incentives to understate their SFAS123 expense, increasing investors' perceptions of the firm's profitability and decreasing perceived excessiveness of executive pay and predict the understatement of firms' disclosed option value increases with the magnitude of stock option-based compensation expense and the perceived excessiveness of executive pay. Aboody et al. also consider management's opportunity to understate SFAS 123 expense by taking into account the strength of the firm's corporate governance structure. To test their hypotheses, they use 3,368 firm-year observations from 1996 to 2001, from S&P500, S&P400 mid-cap and S&P600 small-cap indices with stock-based compensation plans. As predicted based upon opportunities and incentives to underreport SFAS 123 expense, the underestimation of option values is increasing in the magnitude of the expense, is greater for firms with weaker corporate governance, and to a lesser extent, is increasing in the excess of executive pay. The findings are strongest for the expected option life and expected stock price volatility, consistent with firms' greater latitude in determining these inputs.

Johnston (2006) uses a sample of 43 firms that voluntarily recognize stock option expense and a sample of 43 control firms that do not to examine whether firms that voluntarily recognize stock option expense manage that expense downward more

than firms that do not recognize the expense by adjusting option-pricing model inputs. This is the first study to examine if the recognition decision provides greater incentives for firms to manipulate the stock option expense. His hypothesis is based upon the reasoning that previous research documents a negative relation between stock option expense and stock price (Aboody et al. 2004), and thus from the equity valuation perspective, a firm may want to manipulate its stock-based compensation downward to reduce the negative effect on its share price. The empirical result supports this hypothesis. Specifically, recognizing firms assume a lower level of volatility than disclosing firms, a finding consistent with the results of Bartov et al. (2004) and Hodder et al. (2006).

To examine whether managers exercise systematic discretion over option-pricing model inputs to estimate ESO value and whether opportunistic and informational incentives are related to managers' discretion over ESO inputs, Hodder et al. (2006) use 1,748 firm-year observations from 1995 to 1998 in their study. They first regress reported input on historical input<sup>15</sup> and industry benchmark<sup>16</sup> and then obtain the fitted model input.

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<sup>15</sup> The historical volatility is the standard deviation of the natural logarithm of monthly CRSP price relatives ( $P_t/P_{t-1}$ ) over each firm's reported expected option life beginning six months before the fiscal year-end. Historical dividend yield is calculated by dividing the prior year's dividends by the fiscal year-end closing price. Historical option life is the prior year's reported option life. Historical risk-free interest rate is the weighted -average constant maturity rates for a term equal to the firm's expected option life on Treasury bill from the Federal Reserve Bank data archives.

<sup>16</sup> They estimate industry benchmark for each model input using reported model inputs for all firms in the S&P 1500 from year 1995 to 1998. They then use the Fama and French (1997) industries and require each firm to include a minimum of six firms to ensure meaningful comparison. Industry benchmark is the contemporaneous mean of each reported inputs, calculates over all other firms in the industry.

To quantify the magnitude of discretion over ESO value, Hodder et al. (2006) calculate the BSM value using the reported model inputs and the fiscal year-end price for stock and strike prices and then calculate the BSM value using the predicted model inputs and the fiscal year-end price for stock and strike prices. The difference between the above two option values, i.e. the discretionary component of ESO value, captures the aggregate effect of discretion over all four model inputs, representing the dollar effect per option arising from the differences between the reported and predicted inputs. They find the mean of the discretionary component of option values is  $-\$0.16$ , suggesting that managerial discretion results in statistically significant under-reporting of ESO values averaging  $\$0.16$  per option. In other words, firms appear to systematically select inputs that jointly decrease fair value. On the other hand, contrary to conventional wisdom, Hodder et al. (2006) find a greater proportion, i.e. 53% of firms exercise value-increasing discretion, relative to over-reporting firms. These proportions are statistically different and suggest that the effects of discretion are not random. Taken together, they conclude that discretion has a significant economic impact on reported values.

To examine another research question, the relation between discretion and incentives, they regress their discretionary portion of ESO value on incentives to reduce reported compensation variables, earning management variables, and information variables. They only find the stock option plan size (i.e. one of the incentive variables to reduce reported compensation, which is measured by the number of options outstanding scaled by the number of common shares), is marginally significant in explaining

managerial discretion over the ESO value, indicating that firms with larger ESO plan undervalue their ESO value. None of their coefficients on the informational incentive variables are significant, suggesting that only opportunistic incentives influence firms' reported ESO values. Considering the possibility that prediction accuracy may be more cleanly distinguished between managerial opportunism and private information than is discretion, they further examine the relation between the accuracy of firms' reported ESO value and firms' use of discretion over their ESO estimates. Managers may exercise accuracy-improving discretion for at least two reasons. First, investors reward more accurate estimates with a lower cost of capital. Second, discretion should improve the accuracy of ESO estimates to the extent it is motivated by informational incentives, *ceteris paribus*. They partition the sample into firms that over-report and under-report ESO value and find that mean accuracy for under-reporters is significantly lower than mean accuracy for over-reporters. From the frequency table of the effect of discretion on accuracy, they also find most firms worsen accuracy when they under-report ESO value and firms that over-report values are more likely improve accuracy. This is an interesting finding because prior research concludes and business press repeatedly claim that managers use discretion to systematically understate ESO value and thereby decrease accuracy. Their finding suggests that accuracy is also related to the direction of deviation.

Hodder et al. (2006) further investigate the conjecture that if firms respond to opportunistic (informational) incentives, ESO values will be less (more) accurate. They argue that firms acting on opportunistic incentives will more likely under-report ESO

values. Because unlike other accounting choices where firms strategically increase expense or reverse it, a strategic increase in ESO expense does not reverse in subsequent periods. Thus, for firms that under-report ESO values, they expect opportunistic incentives to predominate and to be negatively related to the accuracy of the ESO value estimates. Conversely, for firms that over-report ESO values, they expect informational incentives to predominate and to be positively related to the accuracy of ESO value estimates. Consistent with their conjecture, they find firms that exercise discretion to report lower ESO value are acting on opportunistic incentives. These firms do not convey superior information about future operating, financing decision or dividend policy changes. The results provide evidence that over-reporters increase their ESO estimates at least to convey private information, primarily about future operating risk.

The above studies are silent on the effect of managerial discretion exercised in option-pricing model inputs on value relevance of ESO value. This study, to my knowledge, is the first to investigate the value relevance of the discretionary and nondiscretionary components of ESO value by examining the managerial discretion in the choice of option-pricing model input assumptions to see whether the market incorporates this discretionary portion into its valuation assessment.

Under the efficient markets hypothesis (EMH), if investors view the discretionary component of ESO value primarily as a manifestation of opportunistic behavior, investors are likely to interpret this component as being purely manipulated with no effect on future cash flows and thus no pricing effect is expected in such

situations. Alternatively, if the discretionary component of ESO value is driven by information incentive, the market presumably will incorporate this component into its valuation assessment. These two perspectives, information vs. opportunism, motivate my hypotheses about the relation between stock price and the discretionary component of ESO value, which will be discussed next.

### 2.5 Hypotheses

Because option value depends on expectation about the future and no *ex post* verification of the grant-date option value, the ESO expense disclosed under SFAS123 is subject to managerial discretion (Aboody et al. 2006). SFAS123 requires disclosure of the inputs assumptions managers use to estimate option value. This allows researchers to examine whether managerial discretion reflected in the option-pricing model inputs underlying the calculation of option value can influence investors' valuation assessment.

The first research question I examine is the pricing effect of ESO value. In addition to the debate over whether the value of an ESO should be considered an expense of the firm, there is another equally important issue regarding the economic dilutive effects of ESOs. To address this issue, Core et al. (2002) use a price-earnings model to develop a measure of earnings per share (EPS) that reflects the economic dilutive effects of ESOs. First, they assume that equity value is a function of current economic earnings, E. That is,

$$V_{\text{equity}} = V_{\text{equity}}(E) \quad (i)$$

This is just a transformation of the dividend-discount model of equity valuation (Gordon 1962; Fama and Miller 1972; Collins and Kothari 1989; Ohlson 1995). When a firm has outstanding options that can be converted into common stock, the value of equity is the sum of common stock value and option value:

$$\begin{aligned}V_{\text{equity}}(E) &= V_{\text{stock}}(E) + V_{\text{option}}(E) \\ &= P \cdot N_s + O \cdot N_o \\ &= P \cdot [N_s + N_o (O/P)] \quad (\text{ii})\end{aligned}$$

where:

$E$  = total earnings,

$V_{\text{equity}}$  = value of the firm's common stock,

$V_{\text{option}}$  = value of the firm's outstanding options,

$P$  = price per share of the firm's common stock,

$O$  = reported value per outstanding option,

$N_s$  = the weighted average number of common shares outstanding, and

$N_o$  = the number of options outstanding.

We may re-express Equation (ii) as the per-share value of the common stockholder's equity:

$$P = \frac{V_{\text{equity}}(E)}{N_s + N_o(O/P)} \quad (\text{iii})$$

Core et al. (2002) operationalize Equation (iii) to construct a diluted EPS measure that reflects common stockholders' per-share earnings using the following price-earning-multiple valuation model:

$$V_{\text{equity}} = k \cdot E \quad (\text{iv})$$

where  $k$  is the price-earnings multiple. Substituting Equation (iv) into Equation (iii) yields:

$$\begin{aligned} P &= \frac{kE}{N_s + N_o(O/P)} & (\text{v}) \\ &= \frac{kE}{N_s + (ON_o)/P} \\ &= \frac{k\left(\frac{E}{N_s}\right)}{1 + \left(\frac{ON_o}{N_s}\right)/p} \end{aligned}$$

Therefore,

$$P + \frac{ON_o}{N_s} = \frac{kE}{N_s}$$

$$P = \frac{kE}{N_s} - O\left(\frac{N_o}{N_s}\right) \quad (\text{vi})$$

Re-expressing (vi) by replacing O with (FIT + DISC) yields:

$$\begin{aligned} P &= \frac{kE}{N_s} - (\text{FIT} + \text{DISC}) \frac{N_o}{N_s} \\ &= \frac{kE}{N_s} - \text{FIT} \left(\frac{N_o}{N_s}\right) - \text{DISC} \left(\frac{N_o}{N_s}\right) \end{aligned} \quad (\text{vii})$$

where,

FIT = the nondiscretionary component of ESO value, or the expected ESO value, per option,

DISC = the discretionary component of ESO value or the unexpected ESO value, per option. DISC is measured by subtracting FIT from O, thus DISC is positive value if  $O > \text{FIT}$  and is negative if  $O < \text{FIT}$ , and

$(\text{FIT} + \text{DISC}) = O$ , i.e., reported value per option, expressed as the sum of the nondiscretionary component of ESO value (FIT) and the discretionary component of ESO value (DISC), per option.

Equation (v) shows that even though ESOs do not appear as common stocks, ESOs imply economic dilution and therefore the EPS decreases when the number of

ESOs ( $N_o$ ) increases. In addition, Equation (vi) suggests that ESO value deflated by the number of outstanding common shares, i.e.,  $[(O \cdot N_o) / N_s]$ , is negatively correlated to price per share of the firm's common stock.

Based on this line of reasoning, I predict a negative relation between share price and ESO value:

*H1: There is a negative relation between share price and ESO value.*

To address the core research question of this dissertation, the pricing effect of both discretionary and nondiscretionary components of ESO value, I first measure the nondiscretionary component of the ESO value by the BSM value using the fitted or predicted option-pricing model inputs from the Hodder et al (2006) expectation model. Using the fitted pricing model inputs is consistent with the guidelines delineated in SFAS123 (1995) and thus is less likely subject to managerial discretion. Next, I measure the discretionary component by taking the difference between the BSM value using fitted inputs, and that using reported inputs, which are potentially susceptible to managerial discretion.

The nondiscretionary component of ESO value is solely determined by historical data and industry mean, and thus represents the expected value of an ESO. In addition, equation (vii) indicates that the nondiscretionary component of ESO value, i.e.,  $[(FIT \cdot N_o) / N_s]$ , is negatively associated with share price (P). Therefore, I predict a

negative relation between this nondiscretionary component and stock price. I formulate the following hypothesis, stated in alternative form:

*H2: There is a negative relation between share price and the nondiscretionary component of ESO value.*

To examine the pricing effect of the discretionary component of ESO value, I partition my sample firms into two groups, i.e., overstating firms, meaning that their ESO values using reported inputs are greater than the predicted (or expected) ESO values<sup>17</sup>, and understating firms, meaning that their ESO values using reported inputs are less than the predicted ESO values.

Recent studies document evidence supporting the conjecture that firms tend to opportunistically undervalue their ESO value (Yermack 1998; Bartov et al. 2004; Aboody et al. 2006; Johnston 2006; Hodder et al. 2006). For example, managers may shorten the expected lives of stock options to reduce the apparent value of managerial compensation (Yermack 1998), or opportunistically use their discretion to lower the expected volatility when firm's option holdings are relatively large (Bartov et al. 2004, Hodder et al. 2006). Firms manipulate the ESO expense downward to mitigate the negative effect on their share price (Johnston 2006). Besides, increasing investors' perceptions of firm's profitability and decreasing perceived excessiveness of executive pay could also be incentives for managers to understate option value through their

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<sup>17</sup> See Chapter 3 for definition of the discretionary component of ESO value.

discretion in expected option volatility, expected dividend yield, and expected option life (Aboody et al. 2006). The foregoing evidence is in line with the view that underestimation of ESO value is likely attributable to opportunistic incentives.

In an efficient capital market, security prices respond only to information that revises the market's expectation of future net cash flows. The discretionary component driven by opportunistic manipulation is supposed to have little implication about expected future cash flows. Therefore, no significant relation between stock price and the discretionary component of ESO value is expected, if managerial opportunism is the motivation. This motivates the following hypothesis:

*H3a: For understating firms, if managerial opportunism is the motivation, then there is no relation between the discretionary component of ESO value and stock price.*

On the other hand, managers could also reflect their assessment of change in firms' future economic conditions (e.g., firms' operating or financial risk or the like) in ESO value estimates by exercising their discretion over option-pricing model inputs, resulting in a lower ESO value than expected and thereby signaling a lower future operating or financial risk to outside investors. For understating firms, though the prior research indicates that the underestimation of ESO value is likely attributable to opportunistic incentives; however, we cannot exclude the possibility that private information communication could be underlying incentives in such cases. Therefore, if information communication is the motivation and the market is efficient, I predict a

positive relation between stock price and the discretionary component of ESO value.

This motivates the following hypothesis:

*H3b: For understating firms, if information communication is the motivation, then there is a positive relation between the discretionary component of ESO value and stock price.*

Further, Aboody et al. (2006) argue that unlike other accounting accruals, grant-date option value estimates are not subsequently adjusted for any managerial discretion exercised in their estimation; once option values are determined at grant-date, they are not changed in subsequent periods. Thus, exercising discretion in estimating option values cannot be used to shift income across periods. Consequently, management incentives identified in prior studies to decrease earnings do not apply to SFAS 123 expense<sup>18</sup>. One possible interpretation of why firms overstate their ESO value is that managers try to communicate their superior private information to outside market participants by exercising their managerial discretion in pricing model inputs. Hodder et al. (2006) find that around half of their sample firms overstate their ESO value, and their result is consistent with the conjecture that, for overstating firms, managers

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<sup>18</sup> In fact, Aboody et al. (2006) acknowledge that SFAS 123 expense could be adjusted during the vesting period for differences between expected and actual forfeitures. However, since public information concerning expected forfeitures is unavailable, they do not consider the effect of exercising discretion in the expected forfeitures. In addition to the timing or amount of compensation cost related to ESOs could be altered or revised due to change in expected forfeitures (SFAS 123R, ¶A43), management is also likely to opportunistically over-report their current ESO values, thereby offsetting the effect of underestimated ESO values in prior periods, for certain managerial incentives, for example, mitigating political costs or reducing variance of reporting earnings (Watts et al. 1986).

increase their ESO value estimates to convey private information, primarily about future operating risk. In addition, they indicate that managers exercising discretion to report lower ESO value act on opportunistic incentives. These understating firms do not convey superior private information about future operating, financing decision, or dividend policy changes.

Alternatively, there could be opportunistic incentives to overstate option value in certain cases. For example, political costs theory (Watts and Zimmerman 1986) suggests that corporate managers may have an incentive to adopt accounting procedures that reduce reported earnings. Lower reported profits may reduce the likelihood of adverse government actions against the company, and increase the likelihood of government subsidies to the firm. Empirical evidence is generally consistent with this hypothesis (Zimmerman 1983; Jensen and Meckling 1978).

For overstating firms, I predict a negative relation between stock price and discretionary component of ESO value, if managers communicate their private information to investors by exercising their discretion in ESO value estimates. I predict no relation, if managerial opportunism is the motivation. Therefore, the hypotheses for overstating firms are as follows:

*H4a: For overstating firms, if managerial opportunism is the motivation, then there is no relation between the discretionary component of ESO value and stock price.*

*H4b: For overstating firms, if information communication is the motivation, then there is a negative relation between the discretionary component of ESO value and stock price.*

## CHAPTER 3

### RESEARCH DESIGN

#### 3.1 Option-Pricing Model: The Black-Scholes-Merton Formula

SFAS 123R does not specify a preference for a particular option-pricing model in estimating the ESO value. However, it suggests that a lattice model (for example, a binomial model) and a closed-form model (for example, the Black-Scholes-Merton formula) are among the valuation techniques that meet the criteria required by SFAS 123R for estimating the ESO value and similar instruments (SFAS 123R, ¶A13, 14). SFAS 123R requires that, at a minimum, an option-pricing model takes six inputs into consideration. Those six inputs include the exercise price, the expected option life, the current price of the underlying share, the expected volatility of the price of the underlying share, the expected dividends on the underlying share, and the risk-free interest rate for the expected term of the option. (SFAS 123R, ¶A18)

The requirement to use the six input assumptions has led most firms to use the Black-Scholes-Merton formula (hereafter, BSM formula) to estimate the ESO value<sup>19</sup>. I present the BSM formula (Merton 1973) as follows:

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<sup>19</sup> For example, in this study, out of S&P 500 firms, 455 firms (91%) use the BSM formula to estimate their ESO values. Only four firms (0.8%) use binomial method, i.e., Cincinnati Financial Corp, M&T Bank Corp, Ameren Corp, and Fisher Scientific International Inc. The above percentage of S&P 500 firms using BSM model is the lower bound, because some firms probably using BSM method but did not disclose the pricing-model information in their 10-K footnotes.

$$C = S \cdot e^{-dT} \cdot N(d_1) - X \cdot e^{-rT} \cdot N(d_2)$$

$$d_1 = \frac{\ln(S/X) + (r - d + \frac{1}{2} \cdot \sigma^2) \cdot T}{\sigma \sqrt{T}}$$

$$d_2 = d_1 - \sigma \sqrt{T}$$

C: Black-Scholes fair value per option.

S: Price of the underlying stock.

X: Exercise price.

d: Dividend yield.

r: risk-free interest rate.

$\sigma$ : Annualized volatility of the underlying stock.

T: Time to expiration (in years).

N (·): Cumulative probability distribution function for a standard normal distribution.

ln (·): Natural logarithm function.

While the BSM formula is complex, the application of the formula in practice is relatively straightforward. We may program the formula into a spreadsheet, and numerous programs and calculators exist that calculate the fair value of an option using the Black-Scholes-Merton formula. As a result, the formula is used widely by finance professionals to value a large variety of options (Ernest & Young, 2004).

### 3.2 Option-Pricing Model Inputs Expectation Model

To address my research questions, I operationally define the discretionary component of ESO value as the difference between the full ESO value and the

nondiscretionary component of ESO value. The full ESO value is measured by the BSM value of an ESO, using reported option-pricing model inputs in firms' 10-K footnote disclosures. The nondiscretionary component of ESO value is measured by the BSM value, using the fitted pricing model inputs, the predicted value from regressing reported inputs on two reference benchmarks: historical experience and industry averages as suggested by SFAS 123 (1995). The discretionary component, which cannot be explained by the historical experience and industrial benchmark, is most likely driven by managerial discretion. To the extent that the historical experience and industry benchmark fails to capture the nondiscretionary component, my inference about the value relevance of discretionary component of ESO value is weakened.

Following Hodder et al. (2006)<sup>20</sup>, I estimate the following model for each of the four option-pricing model inputs,

$$\text{REP\_VOL} = \beta_0 + \beta_1 \text{IND\_VOL} + \beta_2 \text{HIS\_VOL} + \varepsilon \quad (1.1)$$

$$\text{REP\_LIFE} = \beta_0 + \beta_1 \text{IND\_LIFE} + \beta_2 \text{HIS\_LIFE} + \varepsilon \quad (1.2)$$

$$\text{REP\_INT} = \beta_0 + \beta_1 \text{IND\_INT} + \beta_2 \text{HIS\_INT} + \varepsilon \quad (1.3)$$

$$\text{REP\_DIV} = \beta_0 + \beta_1 \text{IND\_DIV} + \beta_2 \text{HIS\_DIV} + \varepsilon \quad (1.4)$$

REP\_VOL, REP\_LIFE, REP\_INT, and REP\_DIV represent reported stock return volatility, reported option life, reported risk-free interest rate, and reported

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<sup>20</sup> Their expectation model is consistent with Alford et al. (1995), who examine the prediction of volatility and find that consideration of both historical experience and comparable-firms' average forecast provides the most accurate measure.

dividend yield, respectively. Reported pricing model inputs are disclosed in 10-K footnotes.

I measure the historical annualized volatility, HIS\_VOL, as the square root of the sample variance of natural logarithm of sample firm's daily stock returns from CRSP over all days from the beginning of the fiscal year backwards over the reported expected option life, multiplied by 254, the number of trading days in a typical year<sup>21</sup>. HIS\_LIFE is historical option life as reported in the prior year 10-K footnote disclosure. HIS\_INT is weighted-average zero coupon Treasury constant maturity rate as a term equal to the firm's expected option life. I calculate historical dividend yield, HIS\_DIV, by dividing the prior year dividend by the fiscal year-end closing price. The industry sector average variables, IND\_VOL, IND\_LIFE, IND\_INT, and IND\_DIV are the contemporaneous mean of each reported inputs, calculated over all other S&P 500 firms within the same industry. I use six-digit Global Industry Classification Standard (GICS) codes and require each industry to include at least six firms to ensure meaningful comparisons. The reason I use GICS in my study is that this standard defines peer groups tightly and avoids grouping unlike firms together, and thus allows meaningful comparisons of sectors and industries globally.<sup>22</sup> GICS is the official Standard and

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<sup>21</sup> The methodology I use to measure the historical annualized volatility is analogous to Yermack (1995). However, Yermack (1995) measures the historical volatility by arbitrarily using the last 120 trading days of the fiscal year (or 2,540 trading days) as the estimation period. I refine his estimation procedure by using "the most recent period that is generally commensurate with the expected option life" as my estimation period, which is suggested by FASB 123R (¶A32). My measure of historical volatility is also better than Hodder et al.'s (2006) in that Hodder et al. use price relative to calculate the expected volatility, which does not take into consideration the cash dividend.

<sup>22</sup> GICS was designed to classify a company according to its principal business activity. To make this determination, S&P and Morgan Stanley Capital International Inc. (MSCI) use revenues as a key measure of a firm's business activity. Earnings and market perception, however, are also recognized as important

Poor's (S&P's) industry classification system and all firms in the S&P's global family of indices have been classified according to the GICS structure. GICS is the most widely recognized industry classification standard for financial and industry analysis and its methodology have been also widely accepted as an industry analysis framework for investment research, portfolio management and asset allocation (S&P, 2006).

If firms incorporate both historical experience and industry benchmark information in estimating the expected pricing-model inputs, I expect both  $\beta_1$  and  $\beta_2$  to be positive. In contrast, if firms only consider historical input information, then I expect  $\beta_1$  equal to zero. In addition, the relative magnitude of  $\beta_1$  and  $\beta_2$  indicate the extent to which firms adjust historical inputs to reflect industrial benchmark as deriving the expected inputs parameters. If the sum of  $\beta_1$  and  $\beta_2$  is equal one, then it indicates historical experience information and industry benchmark information are the primary determinants of reported pricing-model inputs (Bartov et al. 2004).

### 3.3 Valuation Model

For each model input, nondiscretionary pricing model input is defined as the fitted value from equation (1.1) through (1.4). To measure the magnitude of discretion over ESO values, I calculate the aggregate effect of discretion over all four model inputs as follows,

$$\text{OFV\_DISC} = \text{OFV\_REP} - \text{OFV\_FIT}$$

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and relevant information for classification purposes and are taken into account during the review process. (www.standardandpoors.com)

OFV\_REP is the BSM value using the reported pricing model inputs and the fiscal year-end stock price for stock price and exercise price. OFV\_FIT is the BSM value using the fitted pricing model inputs from equation (1.1) through (1.4), and the fiscal year-end stock price for stock price and exercise price<sup>23</sup>.

OFV\_DISC is the difference between OFV\_REP and OFV\_FIT or the dollar amount effect per option arising from differences between the reported and fitted pricing model inputs. To test my hypotheses (1) and (2), I use the following regression models:

$$\begin{aligned}
 SP_{it} = & \alpha_0 + \alpha_1 BVE_{it} + \alpha_2 NI_{it} + \alpha_3 GW_{it} + \alpha_4 FVREP_{it} + \sum_{Y=1997}^{2001} \theta_{0Y} YR_{Yit} \\
 & + \sum_{I=1}^{27} \gamma_{0I} IND_{lit} + \varepsilon_{it}
 \end{aligned} \tag{2.1}$$

$$\begin{aligned}
 SP_{it} = & \beta_0 + \beta_1 BVE_{it} + \beta_2 NI_{it} + \beta_3 GW_{it} + \beta_4 FVFIT_{it} + \beta_5 FVDISC_{it} \\
 & + \sum_{Y=1997}^{2001} \theta_{0Y} YR_{Yit} + \sum_{I=1}^{27} \gamma_{0I} IND_{lit} + \varepsilon_{it}
 \end{aligned} \tag{2.2}$$

SP is share price, BVE is book value of equity, NI is net income, and GW is the expected earnings growth, all measured at fiscal year-end. FVREP is OFV\_REP times number of option granted, deflated by number of shares outstanding. FVFIT is OFV\_FIT times number of option granted, deflated by number of shares outstanding.

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<sup>23</sup> The method I use to measure OFV\_REP, OFV\_FIT, and OFV\_DISC is the same as Hodder et al. (2006).

FVDISC is OFV\_DISC times number of option granted, deflated by number of shares outstanding. YR is a dummy for years, equal to one if year is Y, zero otherwise. IND is a dummy for industries, equal to one if the firm is in industry I (based on GICS code), and zero otherwise; i and t denote firms and years.

The valuation model is consistent with the Ohlson (1995) valuation model. Ohlson (1995) develop an accounting-based model that includes both BVE and NI as the variables of interest. Thus, the Ohlson model provides a direct link between accounting amounts and firm value. This feature of the model has resulted in the Ohlson (1995) model, and its subsequent refinements, becoming perhaps the most pervasive valuation model in accounting research today<sup>24</sup> (Barth 2000).

In addition to BVE and NI, Liu and Ohlson (2000) and Ohlson (2001) suggest that expected future abnormal earnings is also a relevant independent variable, because it captures “other information” affecting the contemporaneous market value, beyond current accounting data. GW is analysts earning growth forecast, and can capture benefits associated with ESO value not yet reflected in net incomes (Aboody et al. 2004). Skinner (1996) indicates that ignorance of future growth in earnings and book values will create a potentially important omitted variable problem. Therefore, I include GW in the above valuation models.

### 3.4 Instrumental Variable Approach

The estimated ESO value, OFV, suggested by option-pricing theory, is a function of the underlying share price, SP, and option-pricing model inputs, INPUT,

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<sup>24</sup> See for example Aboody (1996), Aboody et al. (2004), Bell et al. (2002), and Rees et al. (2001).

including expected stock price volatility, expected option life, expected risk-free interest rate, and expected dividend yield. For easy interpretation, I assume that OFV is a linear function of SP and INPUT, and use equation (a) to represent this relation<sup>25</sup>. Meanwhile, SP is a function of NI, BVE, GW, and OFV. Equation (b) represents this relation and is a simplified form of equation (2.2).

$$\text{OFV} = \alpha_0 + \alpha_1 \text{SP} + \sum_{i=1}^4 \gamma_i \text{INPUT}_i + v \quad (\text{a})$$

$$\text{SP} = \beta_0 + \beta_1 \text{BVE} + \beta_2 \text{NI} + \beta_3 \text{GW} + \beta_4 \text{OFV} + \mu \quad (\text{b})$$

A positive random shock in  $\mu$ , the error term in equation (b), will directly increase SP, which increases OFV through equation (a). However, OFV is the explanatory variable in equation (b). Therefore, there is a positive correlation between SP and OFV or OFV is not independent of the error term in equation (b) (Aboody 1996). More specifically, an increase in  $\mu$ , implying an increase in SP, is followed by an increase in OFV, which also implies an increase in SP. However, the OLS technique ascribes both of these increases in SP, rather than only the latter, to the accompanying increase in OFV, when estimating the relation between SP and OFV. Thus, the OLS

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<sup>25</sup> On some occasions, this simplifying assumption is not that impractical. For example, an option value is concavely increasing in the time to expiration (Hemmer et al. 1994), while the most relevant expected option life used for estimating an ESO value is between five and six years. In this study, the mean, the first quartile, the median, and the third quartile of the reported expected option life are 5.42, 5.00, 5.00, and 6.00 years, respectively. Coopers and Lybrand (1993) in a survey of 27 companies report that the average expected option life is 4.5 years. Accordingly, the linearity assumption could be a good approximation to the concavity where expected option life is limited to the “relevant range” of between four and six years. Another example is the convex relation between stock price and option value. The relation will be closer to a linear one where the option is “deeper” in the money. In previous literature, Aboody et al. (2004) also construct the instrumental variables under the linearity assumption.

estimator of the coefficient on OFV,  $\beta_4$  in equation (b), is biased upward, even asymptotically<sup>26</sup>.

The instrumental variable or two-stage least squares (2SLS) technique is a general estimation procedure applicable to such situations that OFV is not independent of the error term (Kennedy 1998). The first stage of this procedure is to regress each endogenous variable acting as a regressor in the equation being estimated on all the exogenous variables in the system of simultaneous equations (i.e. estimate the reduced form), and calculate the fitted value of these endogenous variables. The second stage is to use these fitted values and the included exogenous variables as regressors in an OLS regression.

If an appropriate instrumental variable can be found for this endogenous variable, the instrumental variable approach provides consistent estimates (Kennedy 1998). A good instrumental variable is one that is highly correlated with the regressor for which it is acting as an instrument. Exogenous variables in the system of simultaneous equations are considered the best candidates since they are correlated with the endogenous variables (through the interaction of simultaneous system) and are uncorrelated with the error term (by the assumption of exogeneity). This suggests regressing each endogenous variable being used as a regressor (in this case, OFV) on all

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<sup>26</sup> This is because the OLS procedure, in assigning “credit” to regressors for explaining variation in the dependent variable, assigns, in error, some of the disturbance-generated variation of the dependent variable to the regressor with which the disturbance term is contemporaneously correlated (Kennedy 1998, p.138). Gujarati (2003) also indicates that the OLS estimators are biased as well as inconsistent, if the independent variables [X’s] and error terms [u] are contemporaneously correlated.

the exogenous variables in the system and using the fitted values of these endogenous variables from this regression as the required instrumental variables<sup>27</sup>.

Based on the above rationale, I first regress each of my ESO value variables, FVREP, FVFIT, and FVDISC on instruments and predetermined variables in the structure equation. The instruments include reported option life, REP\_LIFE, reported option volatility, REP\_VOL, reported dividend yield, REP\_DIV, and reported risk-free interest, REP\_INT, since ESO value is the product of BSM value per option times the number of option grant, thus the best candidates for the instruments are the option-pricing model inputs used by firms to calculate option value. The predetermined variables include BVE, NI, GW, IND, and YR. I present the result from this first stage procedure in Appendix A. Next, I use the fitted values from these regressions as my instrumental variables.

To ensure those instrumental variables used in this study have the desired property, I adopt Hausman (1978) test. The test statistics for FVREP, FVFIT and FVDISC all reject the null hypothesis that the suspected variable has no simultaneity issue<sup>28</sup>. The test result suggests that the option value variables in equation (2.1) as well as (2.2) suffer from this simultaneity issue. On the other hand, the test results for instrumental variables FVREP\*, FVFIT\*, and FVDISC\* suggest that using these

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<sup>27</sup> Each fitted value is the “best” instrumental variable in the sense that, of all combinations of the exogenous variables, it has the highest correlation with the endogenous variables. (Kennedy 1998)

<sup>28</sup> The t statistics for FVREP and FVFIT are 3.81 (p=0.00), 4.50 (p=0.00). The F-statistic for the joint test that FVFIT and FVDISC are both uncorrelated with error term is 13.90 (p=0.00), which reject the null that FVFIT and FVDISC are both exogenous. These results are based on heteroscedasticity-robust t or F test, suggested by Wooldridge (2003, p.507). The reason I use F- test here is that in equation (2.3) there are two suspected endogenous variables, FVFIT and FVDISC, thus I test for the joint significance of their respective residuals in the structure equation to determine if they are both independent of the error term.

instrumental variables can mitigate this simultaneity issue. The t statistics for FVREP\* and FVFIT\* are 1.68 (p=0.09) and 1.24 (p=0.22). The F-statistic for joint test that FVFIT\* and FVDISC\* are both uncorrelated with the error term is 0.96 (p=0.38), which cannot reject the null that FVFIT and FVDISC are both exogenous. I notice that the test statistic for FVREP\* is still significant at 10% level; to the extent that the option value variables still positively correlated with SP, my estimated coefficient on these option value variables will bias against my hypothesis that there is a negative relation between share price and option value variables.

I use FVREP\*, FVFIT\*, and FVDISC\*, instead of FVREP, FVFIT, and FVDISC in the following regressions [IND and YR are omitted in equation (3.1) and (3.2)].

$$SP_{it} = \alpha_0 + \alpha_1 BVE_{it} + \alpha_2 NI_{it} + \alpha_3 GW_{it} + \alpha_4 FVREP^*_{it} + \varepsilon_{it} \quad (3.1)$$

$$SP_{it} = \beta_0 + \beta_1 BVE_{it} + \beta_2 NI_{it} + \beta_3 GW_{it} + \beta_4 FVFIT^*_{it} + \beta_5 FVDISC^*_{it} + \varepsilon_{it} \quad (3.2)$$

FVREP\* is the fitted value from a regression of FVREP on instruments and the predetermined variables in the structure equation and thus is less susceptible to the simultaneity issue.

Based on prior research, I predict  $\alpha_1$ ,  $\alpha_2$ , and  $\alpha_3$  are positive. I predict  $\alpha_4$  in equation (3.1) to be negative (H1).

To test my hypothesis (2), I partition the full ESO value into two components, that is, the predicted ESO value and the discretionary component of ESO value. I predict  $\beta_4$  in equation (3.2) to be negative (H2).

To test my hypotheses (3) and (4), I run the regression (3.2) for overstating and understating firms separately. For understating firms, a significantly positive  $\beta_5$  will support my hypotheses (H3b)<sup>29</sup>. Alternatively, for overstating firms, a significantly negative  $\beta_5$  will support my hypothesis (H4b). An observed insignificant  $\beta_5$  for understating (overstating) firms will be consistent with opportunism hypothesis, H3a (H4a).

The key difference between value relevance studies examining price levels and those examining price changes is that the former are interested in determining what is reflected in firm value and the latter are interested in determining what is reflected in changes in value over a specific period. Thus, if the research question involves determining whether the accounting amount is timely, examining changes in value is the appropriate research design choice (Barth et al. 2001). To examine whether the change in ESO value is reflected, on a timely basis, in changes in firm value or stock returns. In addition, to eliminate the alternative interpretation that my regression results is attributable to correlated omitted variable problem, I estimate the regression in “change” form, as suggested by Skinner (1996).

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<sup>29</sup> Conceptually, I predict to observe markets positively react to the discretionary component of ESO values for understating firms. However, for understating firms, the discretionary component of ESO value, defined as the difference by subtracting the BSM value using expected inputs from the BSM using reported inputs, is negative. Accordingly, I will observe a “negative” relation between these two variables, if markets “positively” react to the underestimation of ESO values. To avoid this confusion, I change the sign of discretionary component of ESO value variable for understating firms, from negative to positive and, in so doing, the greater the discretionary component of ESO value for understating firms, the higher degree of underestimation of ESO values. After this adjustment, I predict a positive relation between these two variables, if market has a “positive” reaction, which is more consistent with our intuition.

I use the following regressions [IND and YR are omitted in equation (4.1) and (4.2)]:

$$RET_{it} = \alpha_0 + \alpha_1 NI_{it} + \alpha_2 \Delta NI_{it} + \alpha_3 \Delta GW_{it} + \alpha_4 \Delta FVREP^*_{it} + \varepsilon_{it} \quad (4.1)$$

$$RET_{it} = \beta_0 + \beta_1 NI_{it} + \beta_2 \Delta NI_{it} + \beta_3 \Delta GW_{it} + \beta_4 \Delta FVFIT^*_{it} + \beta_5 \Delta FVDISC^*_{it} + \varepsilon_{it} \quad (4.2)$$

RET is annual stock return, NI,  $\Delta NI$ ,  $\Delta FVREP^*$ ,  $\Delta FVFIT^*$ , and  $\Delta FVDISC^*$  are deflated by market value of equity at the beginning of the fiscal year.  $\Delta$  denotes annual change.

An observed negative  $\alpha_4$  in equation (4.1) will be consistent with my hypothesis (1). In addition, an observed negative  $\beta_4$  in equation (4.2) will be consistent with my hypothesis (2).

## CHAPTER 4

### DATA AND DESCRIPTIVE STATISTICS

#### 4.1 Sample Selection and Description

I hand collect option-pricing model inputs in 10-K footnotes of the S&P 500 firms<sup>30</sup> from the Electronic Data Gathering, Analysis, and Retrieval system (EDGAR) from 1996 to 2001. The sample initially consists of 3,000 firm-year observations. I delete 13 firms or 94 firm-year observations because their 10-Ks are not available from EDGAR system, 6 firms or 42 observations with inappropriate pricing model input disclosures<sup>31</sup> and 12 firms or 110 observations with no option plan and thus no pricing model inputs are disclosed in these sample years. I also delete 107 firms or 643 observations with less than six peer firms within the same industry as well as one firm that is the ESO expense recognition (SFAS123) early adopter. I use CRSP daily stock returns over all days from the beginning of the fiscal year backwards over the reported expected option life to calculate the historical volatility; however, some firms has only incomplete historical daily stock return from CRSP, thus I delete 29 firms or 162 observations without historical volatility information. Finally, I delete 16 firms with incomplete financial data from Compustat and 15 firms without I/B/E/S analyst earnings growth forecasts.

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<sup>30</sup> Sample firms are based on the year 2001 list of S&P 500 from COMPUSTAT database.

<sup>31</sup> For example, some firms disclose their expected dividend yield in dollar amount, or disclose their current rather than expected dividend yield.

The above criteria result in 1,678 firm-year observations from 1996 to 2001 with data required to estimate the expectation regression model and test my pricing effect hypotheses. When firms disclosed a range of these inputs across various option grants within the year, I use the median of the range.

Table 1, Panel A presents the sample selection. Table 1, Panel B presents the distribution of firms by industry classification and shows that no single industry represents more than six percent of the sample, indicating sample firms are evenly distributed among various industries.

Table 2, Panel A, reveals that sample firm stock price on average is greater than book value of equity, BVE. It also shows that the mean (median) estimated value per option using reported input assumptions, OFV\_REP, is \$16.86 (\$13.95). In addition, the mean (median) of per option value using fitted inputs, OFV\_FIT, is \$17.10 (\$14.17). The mean (median) difference between OFV\_FIT and OFV\_REP is \$0.23 (\$0.10), and this difference is significantly different from zero. OFV\_REP appears greater than the mean weighted average value of options in Aboody et al. (2004)<sup>32</sup> and Aboody et al. (2006)<sup>33</sup> as well as the estimated value per option in Hodder et al. (2006)<sup>34</sup>. This difference could be attributable to different sample years. Aboody et al. (2004) and Hodder et al. use sample year from 1996 to 1998, and from 1995 to 1998, respectively,

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<sup>32</sup> The mean of the weighted average value of options granted in 1998, 1997, and 1996 is \$11.37, \$10.06, and \$8.40, and the mean of the unrecognized stock-based compensation deflated by the number of outstanding shares is \$0.11, \$0.09, and \$0.07, respectively. They use 767 firms from S&P 500, S&P 400 mid-cap, and 600 small-cap indices.

<sup>33</sup> The mean of the disclosed weighted average value of options is \$10.36 for 887 firms over the 1996 through 2001 period from S&P 500, S&P 400 mid-cap, and 600 small-cap indices.

<sup>34</sup> They use 682 firms selected from S&P 500, S&P 400 mid-cap, and 600 small-cap indices, and the mean of estimated value per option using reported inputs is \$11.01. The sample year is from 1995 to 1998.

Table 1 Sample Description

Panel A: Sample selection

	Number of distinct firms	Number of firm-year observations
Total S&P 500 observations from 1996 to 2001	500	3,000
Less: 10-K is not available from EDGAR	(13)	(94)
Inappropriate pricing model inputs	(6)	(42)
Firms with no option plans in these sample years	(12)	(110)
Firms with less than six peer firms within the same industry	(107)	(643)
Firms missing historical volatility calculated from CRSP	(29)	(162)
FAS 123 early adopter	(1)	(6)
Incomplete financial data from Compustat	(16)	(117)
Incomplete I/B/E/S analyst EPS growth forecast	(15)	(148)
Final sample	301	1,678

Panel B: Distribution of firms by industry

GISC (6-digit)	Industry classification	Number of firms	Percentage
101010	Energy Equipment & Services	6	2.0
101020	Oil, Gas & Consumable Fuels	18	6.0
151010	Chemicals	13	4.3
201010	Aerospace & Defense	7	2.3
201060	Machinery	11	3.7
202010	Commercial Services & Supplies	8	2.7
252010	Household Durables	11	3.7
253010	Hotels, Restaurants & Leisure	8	2.7
254010	Media	12	4.0
255030	Multiline Retail	8	2.7
255040	Specialty Retail	15	5.0
301010	Food & Staples Retailing	9	3.0
302020	Food Products	9	3.0
351010	Health Care Equipment & Supplies	14	4.7
351020	Health Care Providers & Services	12	4.0
352010	Biotechnology	6	2.0
352020	Pharmaceuticals	10	3.3
401010	Commercial Banks	18	6.0
402030	Capital Markets	10	3.3
403010	Insurance	12	4.0
451020	IT Services	8	2.7
451030	Software	15	5.0
452010	Communications Equipment	8	2.7
452020	Computers & Peripherals	9	3.0
452030	Electronic Equipment & Instruments	6	2.0
453010	Semiconductors & Semiconductor Equipment	16	5.3
501010	Diversified Telecommunication Services	7	2.3
551010	Electric Utilities	15	5.0
	Total	301	100.0

Table 2 Descriptive Statistics and Correlations  
(1,678 firm-year observations from 1996-2001)

Variable	Mean	Std. Dev.	First Quartile	Median	Third Quartile
<b>Panel A: Descriptive statistics</b>					
SP	47.09	30.96	29.25	41.53	58.88
BVE	14.20	13.69	6.85	10.95	17.80
NI	1.96	2.59	0.94	1.67	2.72
GW (%)	16.11	7.10	11.31	14.22	19.50
OFV_REP	16.86	12.85	9.32	13.95	20.53
OFV_FIT	17.10	12.81	9.39	14.17	20.95
OFV_DISC	-0.23***	2.86	-1.38	-0.10*	1.02
FVREP	0.63	1.62	0.11	0.25	0.57
FVFIT	0.65	1.63	0.12	0.25	0.57
FVDISC	-0.01***	0.23	-0.02	-0.00*	0.02
FVREP*	0.63	0.98	0.02	0.40	1.03
FVFIT*	0.65	0.98	0.03	0.41	1.02
FVDISC*	-0.01***	0.08	-0.05	-0.01***	0.02
<b>Panel B: Option-pricing model inputs</b>					
Volatility (%)					
REP_VOL	35.68	18.91	24.00	30.95	42.84
HIS_VOL	36.01	14.70	25.26	31.74	43.54
IND_VOL	35.67	13.52	25.82	31.58	41.36
Risk-free interest rate (%)					
REP_INT	5.66	0.71	5.14	5.70	6.20
HIS_INT	5.44	0.86	4.77	5.42	6.30
IND_INT	5.66	0.51	5.32	5.75	6.11
Dividend yield (%)					
REP_DIV	1.34	1.47	0.00	1.00	2.10
HIS_DIV	1.25	1.39	0.00	0.90	1.98
IND_DIV	1.33	1.11	0.42	1.19	2.01
Option life (year)					
REP_LIFE	5.42	1.59	5.00	5.00	6.00
HIS_LIFE	5.44	1.61	5.00	5.00	6.00
IND_LIFE	5.36	0.77	4.94	5.32	5.72
<b>Panel C: Comparing reported pricing model inputs to historical and industry benchmark</b>					
Volatility (%)					
REP_VOL – HIS_VOL	-0.33	11.23	-4.22	-0.98***	2.22
REP_VOL – IND_VOL	0.01	13.23	-5.04	-0.93***	4.20
Risk-free interest rate (%)					
REP_INT – HIS_INT	0.22***	0.83	-0.26	0.24***	0.77
REP_INT – IND_INT	0.00	0.49	-0.29	0.03*	0.29
Dividend yield (%)					
REP_DIV – HIS_DIV	0.08***	0.73	-0.01	0.00***	0.21
REP_DIV – IND_DIV	0.00	0.97	-0.54	-0.09***	0.45
Option life (year)					
REP_LIFE – HIS_LIFE	-0.02	0.64	0.00	0.00	0.00
REP_LIFE – IND_LIFE	0.05	1.40	-0.89	0.05	0.89

Table 2-continued

Panel D: Pearson (Spearman) correlations in upper (lower) triangle

	<u>SP</u>	<u>BVE</u>	<u>NI</u>	<u>GW</u>	<u>FVREP</u>	<u>FVFIT</u>	<u>FVDISC</u>	<u>REP_VOL</u>	<u>REP_LIFE</u>	<u>REP_DIV</u>	<u>REP_INT</u>	<u>FVREP*</u>	<u>FVFIT*</u>	<u>FVDISC*</u>
SP		<b>0.58</b>	<b>0.57</b>	<b>0.07</b>	<b>0.47</b>	<b>0.47</b>	0.01	<b>-0.14</b>	<b>0.08</b>	-0.01	0.04	<b>0.52</b>	<b>0.51</b>	<b>0.15</b>
BVE	<b>0.32</b>		<b>0.63</b>	<b>-0.28</b>	<b>0.24</b>	<b>0.21</b>	<b>0.17</b>	<b>-0.24</b>	<b>0.11</b>	<b>0.21</b>	0.01	<b>0.40</b>	<b>0.35</b>	<b>0.48</b>
NI	<b>0.52</b>	<b>0.54</b>		<b>-0.28</b>	<b>0.18</b>	<b>0.17</b>	<b>0.09</b>	<b>-0.28</b>	<b>0.10</b>	<b>0.20</b>	<b>0.08</b>	<b>0.30</b>	<b>0.28</b>	<b>0.23</b>
GW	0.00	<b>-0.48</b>	<b>-0.44</b>		<b>0.38</b>	<b>0.39</b>	<b>-0.14</b>	<b>0.56</b>	<b>-0.25</b>	<b>-0.62</b>	-0.00	<b>0.63</b>	<b>0.66</b>	<b>-0.38</b>
FVREP	<b>0.40</b>	<b>-0.07</b>	0.01	<b>0.48</b>		<b>0.99</b>	0.02	<b>0.24</b>	<b>-0.06</b>	<b>-0.21</b>	0.01	<b>0.60</b>	<b>0.60</b>	0.00
FVFIT	<b>0.43</b>	<b>-0.08</b>	0.02	<b>0.48</b>	<b>0.99</b>		<b>-0.12</b>	<b>0.23</b>	<b>-0.07</b>	<b>-0.21</b>	0.01	<b>0.60</b>	<b>0.60</b>	-0.05
FVDISC	-0.15	<b>0.06</b>	<b>-0.05</b>	<b>-0.06</b>	-0.03	<b>-0.13</b>		<b>0.06</b>	<b>0.07</b>	-0.01	0.01	0.00	-0.03	<b>0.36</b>
REP_VOL	<b>-0.24</b>	<b>-0.37</b>	<b>-0.45</b>	<b>0.63</b>	<b>0.44</b>	<b>0.40</b>	<b>0.16</b>		<b>-0.32</b>	<b>-0.45</b>	<b>-0.13</b>	<b>0.40</b>	<b>0.38</b>	<b>0.17</b>
REP_LIFE	<b>0.11</b>	<b>0.09</b>	<b>0.15</b>	<b>-0.21</b>	<b>-0.11</b>	<b>-0.13</b>	<b>0.20</b>	<b>-0.32</b>		<b>0.22</b>	<b>0.11</b>	<b>-0.10</b>	<b>-0.12</b>	<b>0.19</b>
REP_DIV	<b>0.08</b>	<b>0.37</b>	<b>0.41</b>	<b>-0.77</b>	<b>-0.49</b>	<b>-0.47</b>	-0.03	<b>-0.67</b>	<b>0.17</b>		0.04	<b>-0.35</b>	<b>-0.34</b>	-0.04
REP_INT	<b>0.05</b>	0.01	<b>0.10</b>	0.01	<b>0.05</b>	0.04	<b>0.06</b>	<b>-0.14</b>	<b>0.09</b>	0.02		0.01	0.01	0.03
FVREP*	<b>0.29</b>	0.02	0.03	<b>0.58</b>	<b>0.55</b>	<b>0.54</b>	-0.05	<b>0.44</b>	<b>-0.12</b>	<b>-0.47</b>	0.02		<b>0.99</b>	0.00
FVFIT*	<b>0.30</b>	0.00	0.03	<b>0.59</b>	<b>0.54</b>	<b>0.55</b>	<b>-0.09</b>	<b>0.42</b>	<b>-0.13</b>	<b>-0.46</b>	0.01	<b>0.99</b>		<b>-0.08</b>
FVDISC*	-0.03	<b>0.40</b>	<b>0.15</b>	<b>-0.34</b>	<b>-0.06</b>	<b>-0.12</b>	<b>0.45</b>	0.02	<b>0.22</b>	0.01	0.03	<b>-0.08</b>	<b>-0.15</b>	

\*\*\*, \*\*, \*Significant at one percent, five percent, and ten percent level (two-tailed test)

Correlation significantly different from zero at p-value less than five percent are in bold type.

SP is fiscal year-end stock price per share. BVE is fiscal year-end equity book value deflated by number of shares outstanding. NI is annual net income deflated by number of shares outstanding. GW is fiscal year-end I/B/E/S mean analyst earnings growth forecast.

OFV\_REP is per option Black-Scholes value calculated using all four reported inputs from 10-K footnote disclosure and fiscal year-end closing price for stock price and exercise price. OFV\_FIT is per option Black-Scholes value calculated using all four fitted inputs from regression and fiscal year-end closing price for stock price and exercise price. OFV\_DICS is the difference between OFV\_REP and OFV\_FIT.

FVREP is OFV\_REP times number of option granted, deflated by number of shares outstanding. FVFIT is OFV\_FIT times number of option granted, deflated by number of shares outstanding. FVDISC is OFV\_DICS times number of option granted, deflated by number of shares outstanding.

## Table 2-continued

REP\_VOL is stock option-pricing model volatility as reported in the 10-K footnote disclosure. REP\_DIV is stock option-pricing model dividend yield as reported in the 10-K footnote disclosure. REP\_LIFE is stock option-pricing model expected option life as reported in the 10-K footnote disclosure. REP\_INT is stock option-pricing model risk-free interest rate as reported in the 10-K footnote disclosure.

HIS\_VOL is annualized volatility, estimated as the square root of the sample variance of natural logarithm of CRSP daily stock returns over all days from the beginning of the fiscal year backwards over the reported expected option life, multiplied by 254, the number of trading days in a typical year. HIS\_DIV, historical dividend yield, is calculated by dividing the prior year dividend by the fiscal year-end closing price. HIS\_LIFE is expected option life as reported in the prior year 10-K footnote disclosure. HIS\_INT is weighted-average zero coupon Treasury constant maturity rate as a term equal to the firm's expected option life (from Board of Governors of the Federal Reserve System).

IND\_VOL is contemporaneous mean of reported volatilities of all S&P 500 firms within GICS code (with minimum of six members) and year. IND\_DIV is contemporaneous mean of reported dividend yield of all S&P 500 firms within GICS code (with minimum of six members) and year. IND\_LIFE is contemporaneous mean of reported expected option life of all S&P 500 firms within GICS code (with minimum of six members) and year. IND\_INT is contemporaneous mean of reported risk-free interest rate of all S&P 500 firms within GICS code (with minimum of six members) and year.

3 FVREP\* is the fitted value from a regression of FVREP on REP\_VOL, REP\_LIFE, REP\_INT, REP\_DIV, BVE, NI, GW, IND, and YR. PVFIT\* is the fitted value from a regression of FVFIT on REP\_VOL, REP\_LIFE, REP\_INT, REP\_DIV, BVE, NI, GW, IND, and YR. FVDISC\* is the fitted value from a regression of FVDISC on REP\_VOL, REP\_LIFE, REP\_INT, REP\_DIV, BVE, NI, GW, IND, and YR.

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whereas my sample covers the period of 1996 to 2001. This difference could also be driven by the composition of the sample firms. My sample is only selected from S&P 500, whereas theirs is composed of firms selected from S&P 500, S&P 400 mid-capitalization, and S&P 600 small-capitalization indices. Additionally, the use of estimated value per option in this study rather than disclosed weighted average value per option could also contribute to this difference.

Untabulated statistics indicate that the mean (median) weighted average value per option disclosed in firms' 10K footnotes for my sample years is \$12.47 (\$10.93)<sup>35</sup>. In addition, the mean (median) difference between the weighted average value per option and OFV\_REP is \$4.39 (\$1.99), and the difference is significantly different from zero (p=0.01). In addition, the mean (median) difference between the weighted average value per option and OFV\_FIT, the benchmark value per option, is \$4.63 (\$2.47), indicating that my measure of the discretionary component of ESO value may not capture the full amount of the effect of managerial discretion on the option value estimates.

The option value per share, using reported pricing model inputs, FVREP, is \$0.63, which is on average \$0.01 less than the option value per share, using fitted pricing model inputs, FVFIT, and this difference is significant. Similarly, the mean (median) of the difference between FVREP\* and FVFIT\* is \$0.01 (\$0.01) and the difference is different from zero. This result indicates that managerial discretion results

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<sup>35</sup> The standard deviation of the weighted average value per option is \$9.36. The first and third quartile is \$7.09 and \$15.87, respectively.

in statistically significant underestimation of ESO value averaging about \$0.01 per share.

#### 4.2 Comparing Reporting Inputs to Historical and Industry Benchmark

Table 2, Panel B reveals that the mean of reported stock return volatility (REP\_VOL) is 35.68%, which is less than the historical average (HIS\_VOL), 36.01%, but is greater than the industry average (IND\_VOL), 35.67%. As shown in Panel C, the mean of the difference between REP\_VOL and HIS\_VOL is 0.33%. The median of the difference between REP\_VOL and HIS\_VOL (IND\_VOL) is 0.98% (0.93%), and is significantly different from zero.

The mean (median) of reported risk-free interest rate (REP\_INT) is 5.66% (5.70%). REP\_INT is greater than the mean (median) of the historical average (HIS\_INT) by 0.22% (0.24%), which is significantly different from zero.

The mean (median) reported dividend yield is 1.34% (1.00%), and the mean (median) difference between the reported dividend yield and its historical average is 0.08% (0.00%). Both are significantly different from zero.

Table 2, Panel D, indicates that SP is significantly positively correlated with FVREP and with FVFIT; the correlation coefficients are 0.47 and 0.47, respectively. These correlations are consistent with a positive mechanical relation between stock price and option value. In addition, the spearman correlation between SP and FVREP is 0.40 and that between SP and FVFIT is 0.43.

The instrumental variables, FVREP\*, FVFIT\* and FVDISC\* are all highly correlated with their corresponding endogenous variables, FVREP (0.60, P=0.00),

FVFIT (0.60, P=0.00), and FVDISC (0.36, P=0.00), which is consistent with the argument that each fitted value is the “best” instrumental variable in the sense that, of all combinations of the exogenous variables, it has the highest correlation with the endogenous variables (Kennedy 1998).

#### 4.3 Regressions of Reported Inputs on Historical and Industry Benchmark

Table 3, Panel A, suggests that industry average and historical experience can capture the variation of the disclosed pricing model inputs. All coefficient estimates are significantly positive at any conventional significance level with adjusted R-squared range from 0.52 to 0.85. The sum of the coefficient estimates for industry average and historical average is very close to one, indicating that these two explanatory variables are the major determinants of reported pricing model inputs. The relative magnitude of the coefficients suggests that firms rely more heavily on historical experience than on industry sector contemporaneous mean, except for risk-free interest rate, consistent with Hodder et al. (2006).

Table 3, Panel B shows that, out of 1,678 observations, 804 observations overstate their option value (48%) and 874 observations understate their option value (52%). Binomial test result indicates these proportions are statistically different from each other (p=0.01) and the proportion of overstating (or understating) firms is different from 50% (p=0.05). This result suggests that there is a greater incidence of understating firms as opposed to overstating firms. In addition, the mean (median) of FVDISC for overstating firm is \$0.05 (\$0.02); both are significantly different from zero. Similarly, the mean (median) of FVDISC for understating firms is \$-0.08 (\$-0.02); both

Table 3 Summary Statistics from Regressions of Reported Pricing Model Inputs on Historical Experience and Industry Benchmark (1,678 firm-year observations from 1996-2001)

Panel A: Regressions of reported inputs on historical and industry benchmark

$$\text{REP\_VOL} = \beta_0 + \beta_1 \text{IND\_VOL} + \beta_2 \text{HIS\_VOL} + \varepsilon \quad (1.1)$$

$$\text{REP\_LIFE} = \beta_0 + \beta_1 \text{IND\_LIFE} + \beta_2 \text{HIS\_LIFE} + \varepsilon \quad (1.2)$$

$$\text{REP\_INT} = \beta_0 + \beta_1 \text{IND\_INT} + \beta_2 \text{HIS\_INT} + \varepsilon \quad (1.3)$$

$$\text{REP\_DIV} = \beta_0 + \beta_1 \text{IND\_DIV} + \beta_2 \text{HIS\_DIV} + \varepsilon \quad (1.4)$$

	$\beta_0$	$\beta_1$	$\beta_2$	Adj. R <sup>2</sup>
Pred. sign	?	+	+	
Reg. (1.1)	-0.05*** (-5.95)	0.30*** (9.60)	0.82*** (28.01)	0.67
Reg. (1.2)	-0.10 (-0.93)	0.14*** (6.24)	0.88*** (82.74)	0.85
Reg. (1.3)	0.00 (0.27)	0.92*** (33.27)	0.08*** (4.97)	0.52
Reg. (1.4)	-0.00 (-0.32)	0.32*** (13.94)	0.74*** (40.95)	0.78

Panel B: Net effect of managerial discretion on option value

	N	%	Mean	Std Dev	First quartile	Median	Third quartile
FVDISC>0	804	48	0.05***	0.19	0.01	0.02***	0.05
FVDISC<0	874	52	-0.08***	0.24	-0.06	-0.02***	-0.01
FVDISC	1,678	100	-0.01***	0.23	-0.02	-0.00*	0.02

Panel C: Percentage of discretion exercised in ESO value explained by each option-pricing model input

Option-Pricing Model Input	Full sample (%)	Overstating firms (%)	Understating firms (%)
VOL	77.06	44.87	49.77
LIFE	11.81	19.01	17.91
DIV	10.78	23.74	21.77
INT	0.35	12.38	10.55
Total	100.00	100.00	100.00

Table 3-continued

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\*\*\*, \*\*, \*Significant at one percent, five percent, and ten percent level (one-tailed test if signed, else two-tailed test). t-statistics (in parentheses) are based on OLS standard errors.

REP\_VOL is stock option-pricing model volatility as reported in the 10-K footnote disclosure. REP\_DIV is stock option-pricing model dividend yield as reported in the 10-K footnote disclosure. REP\_LIFE is stock option-pricing model expected option life as reported in the 10-K footnote disclosure. REP\_INT is stock option-pricing model risk-free interest rate as reported in the 10-K footnote disclosure.

HIS\_VOL is annualized volatility, estimated as the square root of the sample variance of natural logarithm of CRSP daily stock returns over all days from the beginning of the fiscal year backwards over the reported expected option life, multiplied by 254, the number of trading days in a typical year. HIS\_DIV, historical dividend yield, is calculated by dividing the prior year dividend by the fiscal year-end closing price. HIS\_LIFE is expected option life as reported in the prior year 10-K footnote disclosure. HIS\_INT is weighted-average zero coupon Treasury constant maturity rate as a term equal to the firm's expected option life (from Board of Governors of the Federal Reserve System).

IND\_VOL is contemporaneous mean of reported volatilities of all S&P 500 firms within GICS code (with minimum of six members) and year. IND\_DIV is contemporaneous mean of reported dividend yield of all S&P 500 firms within GICS code (with minimum of six members) and year. IND\_LIFE is contemporaneous mean of reported expected option life of all S&P 500 firms within GICS code (with minimum of six members) and year. IND\_INT is contemporaneous mean of reported risk-free interest rate of all S&P 500 firms within GICS code (with minimum of six members) and year.

OFV\_REP is per option Black-Scholes value calculated using all four reported inputs from 10-K footnote disclosure and fiscal year-end closing price for stock price and exercise price. OFV\_FIT is per option Black-Scholes value calculated using all four fitted inputs from regression and fiscal year-end closing price for stock price and exercise price. OFV\_DISC is the difference between OFV\_REP and OFV\_FIT.

FVREP is OFV\_REP times number of option granted, deflated by number of shares outstanding. FVFIT is OFV\_FIT times number of option granted, deflated by number of shares outstanding. FVDISC is OFV\_DISC times number of option granted, deflated by number of shares outstanding.

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significantly different from zero. This result suggests that the discretion exercised in the input assumptions has a significant impact on the option value estimates.

#### 4.4 The Primary Option-Pricing Model Input explaining for Overestimation or Underestimation of ESO Value

To address the issue of which input(s) may account for the underestimation or overestimation of ESO value, I calculate the expected BSM value by using four fitted or expected option-pricing model inputs as the benchmark ESO value. Next, to measure the marginal or partial effect of the discretion exercised in a particular option-pricing model input on expected BSM value, I calculate the BSM value by using the reported

option-pricing model input of interest and the other three fitted inputs, and then compare it to the benchmark ESO value. For example, to measure the marginal effect of the discretion exercised in volatility input on the option value, I calculate the BSM value by using reported volatility, and expected life, expected interest rate, and expected dividend yield, and then compare it to the benchmark ESO value.

To determine the relative contribution of each input assumption to the difference between benchmark ESO value and estimated ESO value using reported inputs, I compute the percentage of partial effect of each input to the total effect of the four inputs, representing the extent to which each input accounts for the discretion exercised in ESO value estimates.

I present the percentages separately in Panel C of Table 3. For the sample set as a whole, discretion over volatility explains 77.06 percent of the total discretion in ESO value estimates. This result indicates that volatility is the main driver for overestimation or underestimation of ESO values.

Next, I partition the dataset into two groups, overstating ( $FVDISC > 0$ ) vs. understating firms ( $FVDISC < 0$ ). For overstating firms, volatility and dividend yield explain a substantial portion of the discretion (44.87 percent and 23.74 percent, respectively). Similarly, for understating firms, I find that volatility and dividend together explain 71.54 percent of total discretion in ESO value. These results indicate that volatility is the primary driver for overestimation or underestimation of ESO value. It also suggests that both volatility and dividend yield explain most of the discretion in ESO value for overstating as well as understating firms.

## CHAPTER 5

### EMPIRICAL RESULTS

#### 5.1 OLS Regression Results for Testing H1 and H2

Table 4 reports the results for regression models (2.1) and (2.2). The coefficients on BVE, NI, and GW are all significantly positive, consistent with prior studies. The coefficient on FVREP (in regression (2.1)) is significantly positive at the 1% level. The coefficient on FVFIT (in regression (2.2)) is also significantly positive. These results are expected in that there is a simultaneity relation between the ESO value and stock price, and are inconsistent with my hypotheses (1) and (2). The simultaneity test rejects the null hypothesis that no correlation between my option value variables and error terms in equations (2.1) and (2.2), indicating that the results from these regressions are probably biased and inconsistent. To fix this simultaneity issue, I use instrumental variables instead for my regression analysis and the results are reported in the next section.

#### 5.2 Two-Stage Least Square Regression Results for Testing H1 and H2

Table 5 presents summary statistics from regressions of SP on BVE, NI, GW, and the instrumental variables, FVREP\*, FVFIT\*, and FVDISC\*. It reveals that the coefficients on BVE, NI, and GW are all significantly positive, which are consistent with Table 4. However, in contrast to Table 4, the coefficient (t-value) on FVREP\* in

Table 4 Summary Statistics from Regressions of Share Price on Book Value of Equity, Net Income, Expected Earnings Growth, and ESO Value (IND and YR are omitted in Regressions (2.1) and (2.2))

$$SP_{it} = \alpha_0 + \alpha_1 BVE_{it} + \alpha_2 NI_{it} + \alpha_3 GW_{it} + \alpha_4 FVREP_{it} + \varepsilon_{it} \quad (2.1)$$

$$SP_{it} = \beta_0 + \beta_1 BVE_{it} + \beta_2 NI_{it} + \beta_3 GW_{it} + \beta_4 FVFIT_{it} + \beta_5 FVDISC_{it} + \varepsilon_{it} \quad (2.2)$$

Variable Pred.	BVE +	NI +	GW +	FVREP -	FVFIT -	FVDISC -	Adj. R <sup>2</sup>
Reg. (2.1)	0.88*** (3.87)	3.94*** (4.14)	0.81*** (4.56)	4.65*** (3.75)			0.597
Reg. (2.2)	0.92*** (4.09)	3.88*** (4.12)	0.77*** (4.56)		4.71*** (4.51)	-5.92 (-1.01)	0.603
N=1,678							

\*\*\*, \*\*, \*Significant at one percent, five percent, and ten percent level (one-tailed test)

SP is fiscal year-end stock price per share. BVE is fiscal year-end equity book value deflated by number of shares outstanding. NI is annual net income deflated by number of shares outstanding. GW is fiscal year-end I/B/E/S mean analyst earnings growth forecast. YR is dummy variable for years. YR equals 1 if year is Y, 0 otherwise. IND is dummy variable for industry classification. IND equals 1 if the firm is in industry I (based on the 28 GICS code in Table 1, Panel B), and 0 otherwise.

FVREP is OFV\_REP times number of option granted, deflated by number of shares outstanding. FVFIT is OFV\_FIT times number of option granted, deflated by number of shares outstanding. FVDISC is OFV\_DISC times number of option granted, deflated by number of shares outstanding. i and t denote firm and year.

OFV\_REP, OFV\_FIT, and OFV\_DISC are as defined as Table 3.

t-statistics (in parentheses) are based on White (1980) heteroskedasticity-consistent standard errors. The year and industry intercepts are not tabulated.

Table 5 Summary Statistics from Regressions of Share Price on Book Value of Equity, Net Income, Expected Earnings Growth, and ESO Value Derived from the Instrumental Variable Approach (IND and YR are omitted in Regressions (3.1) and (3.2))

$$SP_{it} = \alpha_0 + \alpha_1 BVE_{it} + \alpha_2 NI_{it} + \alpha_3 GW_{it} + \alpha_4 FVREP^*_{it} + \varepsilon_{it} \quad (3.1)$$

$$SP_{it} = \beta_0 + \beta_1 BVE_{it} + \beta_2 NI_{it} + \beta_3 GW_{it} + \beta_4 FVFIT^*_{it} + \beta_5 FVDISC^*_{it} + \varepsilon_{it} \quad (3.2)$$

Variable	BVE	NI	GW	FVREP*	FVFIT*	FVDISC*	Adj. R <sup>2</sup>
Pred	+	+	+	-	-	-	
Reg. (3.1)	2.10*** (4.96)	5.82*** (5.51)	3.41*** (4.31)	-22.90*** (-2.73)			0.562
Reg. (3.2)	1.51*** (3.09)	4.42*** (3.77)	1.68** (1.87)		-5.98 (-0.63)	-48.71*** (-2.77)	0.566
N=1,678							

\*\*\*, \*\*, \*Significant at one percent, five percent, and ten percent level (one-tailed test)

SP is fiscal year-end stock price per share. BVE is fiscal year-end equity book value deflated by number of shares outstanding. NI is annual net income deflated by number of shares outstanding. GW is fiscal year-end I/B/E/S mean analyst earnings growth forecast. YR is dummy variable for years. YR equals 1 if year is Y, 0 otherwise. IND is dummy variable for industry classification. IND equals 1 if the firm is in industry I (based on the 28 GICS code in Table 1, Panel B), and 0 otherwise.

FVREP\* is the fitted value from a regression of FVREP on REP\_VOL, REP\_LIFE, REP\_INT, REP\_DIV, BVE, NI, GW, IND, and YR. FVFIT\* is the fitted value from a regression of FVFIT on REP\_VOL, REP\_LIFE, REP\_INT, REP\_DIV, BVE, NI, GW, IND, and YR. FVDISC\* is the fitted value from a regression of FVDISC on REP\_VOL, REP\_LIFE, REP\_INT, REP\_DIV, BVE, NI, GW, IND, and YR. i and t denote firm and year.

t-statistics (in parentheses) are based on White (1980) heteroskedasticity-consistent standard errors. The year and industry intercepts are not tabulated.

regression (3.1), -22.90 (t=-2.73), is significantly negative, which is consistent with hypothesis (1) that there is a negative relation between share price and ESO value. The coefficient (t-value) on FVFIT\* in regression (3.2), -5.98 (t=-0.63), is also negative, but insignificant. These results are consistent with the interpretation that the positive coefficients on option variables in Table 4 are mainly driven by the simultaneity

Table 6 Summary Statistics from Regressions of Stock Return (Fiscal Year-End) on Net Income, Change in Net Income, Change in Expected Earnings Growth, and Change in ESO Value Derived from the Instrumental Variable Approach (IND and YR are omitted in Regressions (4.1) and (4.2))

$$RET_{it} = \alpha_0 + \alpha_1 NI_{it} + \alpha_2 \Delta NI_{it} + \alpha_3 \Delta GW_{it} + \alpha_4 \Delta FVREP^*_{it} + \varepsilon_{it} \quad (4.1)$$

$$RET_{it} = \beta_0 + \beta_1 NI_{it} + \beta_2 \Delta NI_{it} + \beta_3 \Delta GW_{it} + \beta_4 \Delta FVFIT^*_{it} + \beta_5 \Delta FVDISC^*_{it} + \varepsilon_{it} \quad (4.2)$$

Variable	NI	$\Delta NI$	$\Delta GW$	$\Delta FVREP^*$	$\Delta FVFIT^*$	$\Delta FVDISC^*$	Adj. R <sup>2</sup>
Pred.	+	+	+	-	-	-	
Reg. (4.1)	2.09*** (3.13)	0.10 (0.28)	0.07*** (7.73)	-2.86** (-1.96)			0.191
Reg. (4.2)	2.15*** (3.45)	0.03 (0.07)	0.06*** (5.64)		-2.27 (-1.05)	-4.70*** (-3.33)	0.191
N=1,378							

\*\*\*, \*\*, \*Significant at one percent, five percent, and ten percent level (one-tailed test)

RET is annual stock return. NI is annual net income. GW is fiscal year-end I/B/E/S mean analyst earnings growth forecast. YR is dummy variable for years. YR equals 1 if year is Y, 0 otherwise. IND is dummy variable for industry classification. IND equals 1 if the firm is in industry I (based on the 28 GICS code in Table 1, Panel B), and 0 otherwise.

FVREP\* is the fitted value from a regression of FVREP on REP\_VOL, REP\_LIFE, REP\_INT, REP\_DIV, BVE, NI, GW, IND, and YR. PVFIT\* is the fitted value from a regression of FVFIT on REP\_VOL, REP\_LIFE, REP\_INT, REP\_DIV, BVE, NI, GW, IND, and YR. FVDISC\* is the fitted value from a regression of FVDISC on REP\_VOL, REP\_LIFE, REP\_INT, REP\_DIV, BVE, NI, GW, IND, and YR. i and t denote firm and year.  $\Delta$  denotes annual change. NI,  $\Delta NI$ ,  $\Delta FVREP^*$ ,  $\Delta PVFIT^*$ , and  $\Delta FVDISC^*$  are deflated by market value of equity at the beginning of the fiscal year.

t-statistics (in parentheses) are based on White (1980) heteroskedasticity-consistent standard errors. The year and industry intercepts are untabulated.

relation between share price and option value. After controlling for this simultaneity bias, ESO value variables are negatively associated with stock prices.

I also use the “change-form” regression to test hypotheses (1) and (2). I present the results in Table 6. Consistent with Table 5, the results indicate a negative relation between stock returns and change in the ESO value variables. This finding suggests that

change in ESO value is negatively related to stock returns, which is consistent with my hypotheses (1) and (2).

Moreover, Table 5 shows that the coefficient (t-value) on FVDISC\*, -48.71 (t=-2.77), is negatively associated with share price. This result suggests that the market incorporates this component into its valuation assessment.

Combining overstating and understating firms in the above regression analysis actually masks the sources of pricing effect of FVDISC\*, since it is unclear whether the pricing effect of the discretionary component of ESO value is mainly driven by overstating or understating firms.

To further examine the source of the pricing effect of the discretionary component of ESO value, I partition the overall sample into overstating and understating firms, and I conduct further regression analysis in the next section.

### 5.3 Two-Stage Least Square Regression Results for Testing H3 and H4

Table 7 shows summary statistics from regressions of SP on BVE, NI, GW, and the instrumental variables, FVREP\*, FVFIT\*, and FVDISC\*, for understating versus overstating firms. There are 804 firm-year observations for overstating firms, and 874 firm-year observations for understating firms.

It reveals that the coefficients on BVE, NI, and GW are all significantly positive as shown in Table 5. The coefficient (t-value) on FVDISC\*, 143.60 (t=7.63), for understating firms is significantly positive, which is consistent with information communication hypothesis (H3b). On the other hand, the coefficient (t-value) on FVDISC\*, -7.57 (t=-0.51), for overstating firms is negative but insignificant, which is

Table 7 Summary Statistics from Regressions of Share Price on Book Value of Equity, Net Income, Expected Earnings Growth, and ESO Value Derived from the Instrumental Variable Approach, for Overstating and Understating Firms (IND and YR are omitted in Regression (3.2))

$$SP_{it} = \beta_0 + \beta_1 BVE_{it} + \beta_2 NI_{it} + \beta_3 GW_{it} + \beta_4 FVFIT^*_{it} + \beta_5 FVDISC^*_{it} + \epsilon_{it} \quad (3.2)$$

Variable	BVE	NI	GW	FVFIT <sup>*</sup>	FVDISC <sup>*</sup>	Adj. R <sup>2</sup>
Pred.	+	+	+	-	-	
OVER (N=804)	1.85*** (3.99)	6.58*** (6.22)	3.19*** (3.35)	-18.15** (-1.86)	-7.57 (-0.51)	0.695
UNDER (N=874)	1.98*** (3.84)	3.24*** (2.76)	1.87** (1.88)	-13.86 (-1.29)	143.60*** (7.63)	0.414

\*\*\*, \*\*, \*Significant at one percent, five percent, and ten percent level (one-tailed test)

SP is fiscal year-end stock price per share. BVE is fiscal year-end equity book value deflated by number of shares outstanding. NI is annual net income deflated by number of shares outstanding. GW is fiscal year-end I/B/E/S mean analyst earnings growth forecast. YR is dummy variable for years. YR equals 1 if year is Y, 0 otherwise. IND is dummy variable for industry classification. IND equals 1 if the firm is in industry I (based on the 28 GICS code in Table 1, Panel B), and 0 otherwise.

FVREP<sup>\*</sup> is the fitted value from a regression of FVREP on REP\_VOL, REP\_LIFE, REP\_INT, REP\_DIV, BVE, NI, GW, IND and YR. FVFIT<sup>\*</sup> is the fitted value from a regression of FVFIT on REP\_VOL, REP\_LIFE, REP\_INT, REP\_DIV, BVE, NI, GW, IND and YR. FVDISC<sup>\*</sup> is the fitted value from a regression of FVDISC on REP\_VOL, REP\_LIFE, REP\_INT, REP\_DIV, BVE, NI, GW, IND, and YR.

t-statistics (in parentheses) are based on White (1980) heteroskedasticity-consistent standard errors. The year and industry intercepts are untabulated.

consistent with hypothesis (H4a) that for overstating firms, the discretionary component of ESO value is mainly attributable to managerial opportunism.

#### 5.4 Two-Stage Least Square Regression Results for Each Sample Year

To test whether the result shown in Table 5 is robust across the sample years, I repeat the regression procedure for each sample year. I present the results in Table 8. Panel A of Table 8 reveals that the coefficients on BVE, NI, and GW are consistent with Table 5. The coefficient on FVREP\* is negative as predicted for all sample years. Except for year 1997 and 1999, they are all significantly negative, consistent with hypothesis (1) and result shown in Table 5.

Table 8, Panel B indicates that FVFIT\* has the negative sign, as predicted, for all years, except for 1999. In addition, FVDISC\* has significantly negative sign for all years. This result suggests that the markets view the full ESO value as well as the discretionary component of ESO value as an expense of the firm.

For overstating versus understating firms, I also run the regression for each sample year. I present the result in Table 9. It shows that the overall result is consistent with Table 7. FVDISC\* is significantly negative for only two years, 1998 and 2001. Alternatively, for understating firms, FVDISC\* is significantly positively related to stock price for all years, consistent with Table 7 and hypothesis (3b). This result, again, suggests that the discretionary component of ESO value is mainly driven by information hypothesis and is robust across different years.

#### 5.5 Habitual Overstating vs. Understating Firms

To examine whether capital markets will differently interpret the information underlying the discretionary component of ESO value for firms consistently overvalue

Table 8 Summary Statistics from Regressions of Share Price on Book Value of Equity, Net Income, Expected Earnings Growth, and ESO Value Derived from the Instrumental Variable Approach for each year (IND is omitted in Regressions (3.1) and (3.2))

Panel A:

$$SP_{it} = \alpha_0 + \alpha_1 BVE_{it} + \alpha_2 NI_{it} + \alpha_3 GW_{it} + \alpha_4 FVREP^*_{it} + \epsilon_{it} \quad (3.1)$$

Variable Pred/ Year	BVE +	NI +	GW +	FVREP* -	Adj. R <sup>2</sup>	N
1996	2.46*** (3.50)	10.07*** (6.29)	4.32*** (3.01)	-43.04*** (-2.88)	0.717	249
1997	1.89** (1.85)	8.01*** (3.59)	2.73* (1.44)	-19.16 (-0.96)	0.727	266
1998	3.13*** (3.10)	8.93*** (3.73)	5.03*** (2.60)	-41.49** (-2.02)	0.653	276
1999	1.20*** (3.52)	5.52*** (5.76)	3.10*** (4.31)	-7.14 (-1.05)	0.666	290
2000	2.26** (2.15)	8.25*** (4.28)	5.71*** (2.64)	-45.89** (-1.95)	0.327	298
2001	2.21*** (3.98)	4.57*** (3.95)	3.93*** (3.55)	-34.74*** (-2.94)	0.326	299
Pooled	2.10*** (4.96)	5.82*** (5.51)	3.41*** (4.31)	-22.90*** (-2.73)	0.562	1,678

Table 8-continued  
Panel B:

$$SP_{it} = \beta_0 + \beta_1 BVE_{it} + \beta_2 NI_{it} + \beta_3 GW_{it} + \beta_4 FVFIT^*_{it} + \beta_5 FVDISC^*_{it} + \varepsilon_{it} \quad (3.2)$$

Variable	BVE	NI	GW	FVFIT*	FVDISC*	Adj. R <sup>2</sup>	N
Pred/ Year	+	+	+	-	-		
1996	2.33*** (3.38)	9.40*** (5.65)	3.72*** (2.61)	-37.49*** (-2.57)	-64.40*** (-2.65)	0.717	249
1997	1.75** (1.71)	7.36*** (2.99)	2.07 (1.04)	-13.15 (-0.65)	-44.60* (-1.33)	0.728	266
1998	2.72*** (2.72)	7.54*** (2.96)	3.47** (1.73)	-26.89* (-1.30)	-87.35*** (-2.64)	0.656	276
1999	-0.02 (-0.03)	3.02** (2.09)	-0.21 (-0.13)	25.51* (1.63)	-34.79** (-2.24)	0.671	290
2000	2.09** (2.12)	7.68*** (4.37)	5.06*** (2.62)	-39.86** (-1.87)	-64.78* (-1.64)	0.326	298
2001	1.34** (2.08)	2.50** (1.91)	1.28 (0.93)	-8.71 (-0.62)	-82.02*** (-3.85)	0.352	299
Pooled	1.51*** (3.09)	4.42*** (3.77)	1.68** (1.87)	-5.98 (-0.63)	-48.71*** (-2.77)	0.566	1,678

\*\*\*, \*\*, \*Significant at one percent, five percent, and ten percent level (one-tailed test)

SP is fiscal year-end stock price per share. BVE is fiscal year-end equity book value deflated by number of shares outstanding. NI is annual net income deflated by number of shares outstanding. GW is fiscal year-end I/B/E/S mean analyst earnings growth forecast. IND is dummy variable for industry classification. IND equals 1 if the firm is in industry I (based on the 28 GICS code in Table 1, Panel B), and 0 otherwise.

FVREP\* is the fitted value from a regression of FVREP on REP\_VOL, REP\_LIFE, REP\_INT, REP\_DIV, BVE, NI, GW, IND and YR. FVFIT\* is the fitted value from a regression of FVFIT on REP\_VOL, REP\_LIFE, REP\_INT, REP\_DIV, BVE, NI, GW, IND and YR. FVDISC\* is the fitted value from a regression of FVDISC on REP\_VOL, REP\_LIFE, REP\_INT, REP\_DIV, BVE, NI, GW, IND, and YR.

t-statistics (in parentheses) are based on White (1980) heteroskedasticity-consistent standard errors. The year and industry intercepts are untabulated.

Table 9 Summary Statistics from Regressions of Share Price on Book Value of Equity, Net Income, Expected Earnings Growth, and ESO Value Derived from the Instrumental Variable Approach for Overstating vs. Understating Firms by Year (IND is omitted in Regression (3.2))

$$SP_{it} = \beta_0 + \beta_1 BVE_{it} + \beta_2 NI_{it} + \beta_3 GW_{it} + \beta_4 FVFIT^*_{it} + \beta_5 FVDISC^*_{it} + \varepsilon_{it} \quad (3.2)$$

Panel A: Overstating firms

Variable Pred/ Year	BVE +	NI +	GW +	FVFIT* -	FVDISC* -	Adj. R <sup>2</sup>	N
1996	2.69*** (2.54)	9.34*** (3.93)	4.64** (2.15)	-43.16** (-1.78)	-29.25 (-0.72)	0.833	94
1997	-2.10 (-1.02)	3.45 (1.00)	-6.25* (-1.44)	73.01* (1.65)	47.72 (0.61)	0.827	100
1998	3.70*** (2.99)	9.88*** (3.21)	6.18** (2.19)	-49.17** (-1.69)	-62.04* (-1.38)	0.829	131
1999	1.69*** (2.37)	6.01*** (3.45)	3.75** (2.34)	-18.84 (-1.07)	18.81 (1.26)	0.778	160
2000	2.00* (1.45)	7.50*** (3.36)	6.06** (2.28)	-42.59* (-1.42)	-56.43 (-1.02)	0.362	165
2001	0.71 (1.13)	4.03*** (2.89)	0.62 (0.43)	2.04 (0.14)	-67.23*** (-3.29)	0.420	154
Pooled	1.85*** (3.99)	6.58*** (6.22)	3.19*** (3.35)	-18.15** (-1.86)	-7.57 (-0.51)	0.695	804

Table 9-continued  
Panel B: Understating firms

Variable Pred/ Year	BVE +	NI +	GW +	FVFIT* -	FVDISC* -	Adj. R <sup>2</sup>	N
1996	1.75** (1.79)	9.57*** (4.54)	2.57* (1.32)	-27.96* (-1.38)	136.74*** (3.38)	0.632	155
1997	2.68*** (2.37)	5.79** (1.96)	3.11* (1.34)	-31.38 (-1.24)	165.46*** (3.75)	0.618	166
1998	1.92 (1.27)	5.69* (1.43)	1.84 (0.61)	-23.62 (-0.73)	214.92*** (3.23)	0.286	145
1999	-0.58 (-0.29)	-0.23 (-0.07)	-2.61 (-0.59)	49.97 (1.09)	119.55** (1.94)	0.505	130
2000	2.61** (1.83)	8.36*** (2.90)	4.24* (1.49)	-38.34* (-1.29)	136.15*** (2.88)	0.285	133
2001	2.71** (2.31)	3.18** (1.69)	3.22* (1.32)	-32.63 (-1.28)	131.02*** (3.24)	0.373	145
Pooled	1.98*** (3.84)	3.24*** (2.76)	1.87** (1.88)	-13.86 (-1.29)	143.60*** (7.63)	0.414	874

\*\*\*, \*\*, \*Significant at one percent, five percent, and ten percent level (one-tailed test)

SP is fiscal year-end stock price per share. BVE is fiscal year-end equity book value deflated by number of shares outstanding. NI is annual net income deflated by number of shares outstanding. GW is fiscal year-end I/B/E/S mean analyst earnings growth forecast. IND is dummy variable for industry classification. IND equals one if the firm is in industry I (based on the 28 GICS code in Table 1, Panel B), and 0 otherwise.

FVREP\* is the fitted value from a regression of FVREP on REP\_VOL, REP\_LIFE, REP\_INT, REP\_DIV, BVE, NI, GW, IND and YR. PVFIT\* is the fitted value from a regression of FVFIT on REP\_VOL, REP\_LIFE, REP\_INT, REP\_DIV, BVE, NI, GW, IND and YR. FVDISC\* is the fitted value from a regression of FVDISC on REP\_VOL, REP\_LIFE, REP\_INT, REP\_DIV, BVE, NI, GW, IND, and YR.

t-statistics (in parentheses) are based on White (1980) heteroskedasticity-consistent standard errors. The industry intercepts are untabulated.

or consistently undervalue their ESO values, I partition my sample set into three groups: firms that consistently overstated their ESO for all sample years, firms that consistently understated their ESO for all sample years, and firms that switched. The rationale

behind this test is that markets might interpret the information underlying the ESO value for consistently overstating or understating firms as a more credible signal than that for switching firms.

I find 41 distinct firms (14%) that consistently overstated their ESOs, 52 firms (17%) that consistently understated their ESOs, and 208 firms (69%) that switched during my sample years. I run the regression (3.2) for each group. In addition, for switching firms, I conduct the regression procedure for overstating versus understating firms separately. I present the results in Table 10.

Contrary to the result for overstating firms in Table 7, I find a significant negative result for consistent overstating firms, consistent with the information communication perspective. This result indicates that markets interpret the information underlying the discretionary component of ESO value for habitually overstating firms differently from that for overstating firms. Alternatively, for consistent understating firms, the discretionary component of ESO value is significantly positive at 1% level, which is consistent with that for understating firms in Table 7.

For all switching firms as a whole, the result is consistent with that for overall sample, as shown in Table 5. Moreover, the result for overstating versus understating firms in the switching group is similar to that in Table 7. In other words, the discretionary component of ESO value for understating firms is positively associated with share price as well as no significant result for overstating firms. These analyses indicate that my result still holds for the understating firms and for understating firms in the switching group.

Table 10 Summary Statistics from Regressions of Share Price on Book Value of Equity, Net Income, Expected Earnings Growth, and ESO Value Derived from the Instrumental Variable Approach, for Consistent Overstating, Understating, and Switching Firms (IND and YR are omitted in Regression (3.2))

$$SP_{it} = \beta_0 + \beta_1 BVE_{it} + \beta_2 NI_{it} + \beta_3 GW_{it} + \beta_4 FVFIT^*_{it} + \beta_5 FVDISC^*_{it} + \epsilon_{it} \quad (3.2)$$

Variable	BVE	NI	GW	FVFIT*	FVDISC*	Adj. R <sup>2</sup>
Pred.	+	+	+	-	-	
CONSISTENT OVERSTATING (41 firms)	1.98** (1.96)	2.54 (1.24)	2.62 (1.27)	-0.88 (-0.04)	-70.47* (-1.59)	0.891 (N=208)
CONSISTENT UNDERSTATING (52 firms)	0.899 (0.79)	6.24*** (2.52)	-0.34 (-0.13)	1.85 (0.07)	154.70*** (3.56)	0.532 (N=282)
SWITCHING (208 firms)	1.02*** (2.60)	2.88*** (3.23)	1.49** (1.86)	-3.45 (-0.40)	-40.67*** (-2.90)	0.382 (N=1,188)
SWITCHING: OVER	1.48*** (3.69)	5.22*** (5.59)	3.06*** (3.33)	-19.41** (-2.03)	-13.42 (-1.13)	0.432 (N=596)
SWITCHING: UNDER	1.90*** (2.98)	2.63*** (2.35)	2.24** (1.77)	-14.80 (-1.08)	113.69*** (4.95)	0.378 (N=592)

\*\*\*, \*\*, \*Significant at one percent, five percent, and ten percent level (one-tailed test)

SP is fiscal year-end stock price per share. BVE is fiscal year-end equity book value deflated by number of shares outstanding. NI is annual net income deflated by number of shares outstanding. GW is fiscal year-end I/B/E/S mean analyst earnings growth forecast. YR is dummy variable for years. YR equals 1 if year is Y, 0 otherwise. IND is dummy variable for industry classification. IND equals 1 if the firm is in industry I (based on the 28 GICS code in Table 1, Panel B), and 0 otherwise.

FVREP\* is the fitted value from a regression of FVREP on REP\_VOL, REP\_LIFE, REP\_INT, REP\_DIV, BVE, NI, GW, IND and YR. FVFIT\* is the fitted value from a regression of FVFIT on REP\_VOL, REP\_LIFE, REP\_INT, REP\_DIV, BVE, NI, GW, IND and YR. FVDISC\* is the fitted value from a regression of FVDISC on REP\_VOL, REP\_LIFE, REP\_INT, REP\_DIV, BVE, NI, GW, IND, and YR.

t-statistics (in parentheses) are based on White (1980) heteroskedasticity-consistent standard errors. The year and industry intercepts are untabulated.

### 5.6 Stock Price on Fiscal Year-End vs. on 10K Filing Date

I use fiscal year-end stock prices in my pricing effect analysis. However, the option-pricing model inputs are disclosed in firms' footnotes on the 10K filing date. In general, stockholders and investors can only access to these option input-related information after the filing date. The 10K annual report filed 90 days after the end of a firm's fiscal year, thus there is a time lag between stock price at fiscal year-end and that at 10K filing date. I run through all regression analyses to see whether my result still holds by using stock price at 10K filing date instead of stock price at fiscal year-end. I present the results on Table 11.

The result indicates that, for the pooled sample, the relation between stock price at 10K filing date and reported ESO value is still significantly negative (Panel A of Table 11). Moreover, I still find a negative relation between stock price at 10K filing date and the expected ESO value, though is insignificant for pooled sample (Panel B of Table 11). Table 11, Panel C indicates a similar result as Table 9, i.e., for overstating firms, I still find no significant relation between stock price and the discretionary component of ESO value, for the pooled sample. For understating firms, I find that the discretionary component of ESO value significantly positively relates to stock price at 10K filing date for each year (except for 1999) and for pooled sample. These results indicate my inference is robust to whether I use fiscal year-end stock prices or prices at 10K filing date.

Table 11 Summary Statistics from Regressions of Share Price (on 10K Filing Date) on Book Value of Equity, Net Income, Expected Earnings Growth, and ESO Value Derived from the Instrumental Variable Approach (IND is omitted in Regressions (3.1) and (3.2))

Panel A:

$$SP_{it} = \alpha_0 + \alpha_1 BVE_{it} + \alpha_2 NI_{it} + \alpha_3 GW_{it} + \alpha_4 FVREP^*_{it} + \varepsilon_{it} \quad (3.1)$$

Variable Pred/ Year	BVE +	NI +	GW +	FVREP* -	Adj. R <sup>2</sup>	N
1996	2.66*** (3.23)	11.13*** (6.23)	4.58*** (2.76)	-47.73*** (-2.74)	0.684	249
1997	2.36** (2.25)	9.43*** (4.22)	3.83** (1.94)	-29.68* (-1.44)	0.724	266
1998	2.44** (2.24)	8.06*** (3.19)	4.05** (1.93)	-28.52 (-1.26)	0.598	276
1999	0.86*** (2.58)	5.63*** (3.60)	3.64*** (2.89)	-3.13 (-0.41)	0.564	290
2000	2.46*** (3.50)	9.03*** (6.71)	5.72*** (3.92)	-51.00*** (-3.34)	0.271	298
2001	1.83*** (3.52)	3.95*** (3.58)	3.19*** (3.09)	-24.72** (-2.25)	0.372	299
Pooled	1.99*** (5.09)	5.97*** (5.74)	3.38*** (4.37)	-21.34*** (-2.74)	0.475	1,678

Table 11-continued  
 Panel B:

$$SP_{it} = \beta_0 + \beta_1 BVE_{it} + \beta_2 NI_{it} + \beta_3 GW_{it} + \beta_4 FVFIT^*_{it} + \beta_5 FVDISC^*_{it} + \varepsilon_{it} \quad (3.2)$$

Variable Pred/ Year	BVE +	NI +	GW +	FVFIT* -	FVDISC* -	Adj. R <sup>2</sup>	N
1996	2.49*** (3.05)	10.30*** (5.46)	3.83** (2.28)	-40.81*** (-2.37)	-74.36*** (-2.67)	0.686	249
1997	2.22** (2.11)	8.78*** (3.56)	3.18* (1.55)	-23.72 (-1.14)	-54.91* (-1.60)	0.724	266
1998	2.08** (1.95)	6.86*** (2.60)	2.69 (1.28)	-15.78 (-0.71)	-68.50** (-1.93)	0.599	276
1999	-0.91 (-1.25)	2.02 (1.18)	-1.14 (-0.68)	44.07*** (2.51)	-43.09** (-2.21)	0.570	290
2000	2.32*** (3.34)	8.55*** (6.30)	5.18*** (3.55)	-45.97*** (-3.02)	-66.75*** (-2.59)	0.270	298
2001	1.01* (1.64)	2.01* (1.55)	0.71 (0.53)	-0.34 (-0.03)	-69.01*** (-3.65)	0.393	299
Pooled	1.27*** (2.64)	4.27*** (3.62)	1.26* (1.39)	-0.70 (-0.07)	-52.80*** (-2.99)	0.479	1,678

Table 11-continued  
 Panel C: Overstating firms

$$SP_{it} = \beta_0 + \beta_1 BVE_{it} + \beta_2 NI_{it} + \beta_3 GW_{it} + \beta_4 FVFIT^*_{it} + \beta_5 FVDISC^*_{it} + \epsilon_{it} \quad (3.2)$$

Variable Pred/ Year	BVE +	NI +	GW +	FVFIT* -	FVDISC* -	Adj. R <sup>2</sup>	N
1996	2.81** (2.37)	10.12*** (3.99)	4.66** (1.93)	-44.70** (-1.69)	-31.58 (-0.68)	0.811	94
1997	-1.15 (-0.53)	6.18* (1.57)	-4.15 (-0.88)	50.58 (1.07)	5.06 (0.06)	0.816	100
1998	3.50*** (2.50)	9.41*** (2.98)	6.03** (2.03)	-45.73* (-1.43)	-77.91* (-1.51)	0.776	131
1999	0.74 (0.84)	3.47* (1.54)	1.90 (1.10)	4.51 (0.20)	19.02* (1.33)	0.702	160
2000	2.68*** (2.48)	8.55*** (4.31)	6.64*** (3.02)	-55.22** (-2.30)	-77.63** (-1.72)	0.260	165
2001	0.50 (0.77)	3.85*** (2.76)	0.32 (0.21)	7.47 (0.48)	-49.69*** (-2.84)	0.408	154
Pooled	1.66*** (3.43)	6.34*** (5.29)	2.81*** (2.80)	-13.97* (-1.31)	-12.78 (-0.83)	0.633	804

Table 11-continued  
Panel D: Understating firms

$$SP_{it} = \beta_0 + \beta_1 BVE_{it} + \beta_2 NI_{it} + \beta_3 GW_{it} + \beta_4 FVFIT^*_{it} + \beta_5 FVDISC^*_{it} + \varepsilon_{it} \quad (3.2)$$

Variable Pred/ Year	BVE +	NI +	GW +	FVFIT* -	FVDISC* -	Adj. R <sup>2</sup>	N
1996	1.87** (1.65)	10.56*** (4.49)	2.64 (1.15)	-31.44* (-1.31)	155.02*** (3.42)	0.617	155
1997	3.48*** (2.96)	7.18*** (2.46)	4.68** (1.95)	-46.22** (-1.79)	175.77*** (3.68)	0.598	166
1998	1.00 (0.62)	4.93 (1.19)	0.46 (0.14)	-6.60 (-0.19)	176.33*** (2.52)	0.247	145
1999	-1.06 (-0.38)	0.56 (0.09)	-2.02 (-0.29)	57.05 (0.84)	131.70 (1.14)	0.420	130
2000	1.97* (1.56)	10.08*** (4.02)	3.75* (1.53)	-35.96* (-1.41)	96.70*** (2.37)	0.245	133
2001	2.16** (1.82)	2.68* (1.40)	2.37 (0.96)	-20.80 (-0.81)	104.66*** (2.54)	0.411	145
Pooled	1.74*** (2.97)	3.13*** (2.49)	1.40 (1.20)	-7.09 (-0.58)	143.29*** (5.87)	0.316	874

\*\*\*, \*\*, \*Significant at one percent, five percent, and ten percent level (one-tailed test)

SP is fiscal year-end stock price per share. BVE is fiscal year-end equity book value deflated by number of shares outstanding. NI is annual net income deflated by number of shares outstanding. GW is fiscal year-end I/B/E/S mean analyst earnings growth forecast. IND is dummy variable for industry classification. IND equals 1 if the firm is in industry I (based on the 28 GICS code in Table 1, Panel B), and 0 otherwise.

FVREP\* is the fitted value from a regression of FVREP on REP\_VOL, REP\_LIFE, REP\_INT, REP\_DIV, BVE, NI, GW, IND and YR. FVFIT\* is the fitted value from a regression of FVFIT on REP\_VOL, REP\_LIFE, REP\_INT, REP\_DIV, BVE, NI, GW, IND and YR. FVDISC\* is the fitted value from a regression of FVDISC on REP\_VOL, REP\_LIFE, REP\_INT, REP\_DIV, BVE, NI, GW, IND, and YR.

t-statistics (in parentheses) are based on White (1980) heteroskedasticity-consistent standard errors. The industry intercepts are untabulated.

## CHAPTER 6

### ADDITIONAL ANALYSIS

#### 6.1 Introduction

In the preceding chapter, I find a positive association between the discretionary component of ESO value for understating firms and stock price, which is consistent with the view that understating firms communicate their private information, i.e., change in firms' future operating or financial risk, to market participants by exercising their managerial discretions in estimating the value of ESOs. In this chapter, I use a theoretical valuation model to link firms' operating and financial risk with the cost of equity capital, and in turn, the stock price. Next, I examine whether the discretionary component of ESO value for understating firms is associated with proxies for change in firms' future risk, after controlling for variables previously identified in the literature (Hodder et al. 2006, Aboody et al. 2006) as explaining the discretionary component of ESO value. In other words, the focus of this chapter is on whether the proxies for change in firms' operating and financial risks are associated with the underestimation of ESO value, after controlling for firms' opportunities and incentives to under-report their option value estimates as well as for other firm characteristics. In the following sections, I first discuss the theoretical framework for determinants of the discretionary component of ESO value.

## 6.2 The Determinants of the Discretionary Component of ESO Value

### Operating Risk and Financial Risk:

I start my analysis by first presenting the dividend discount model as follows<sup>36</sup>.

$$V_0^E = \sum_{t=1}^{\infty} \frac{d_t}{\rho_E^t} \quad (1)$$

$V_0^E$ : the value of equity at time 0.

$d_t$ : expected dividends at time t.

$\rho_E$ : equals one plus equity cost of capital.

The model shows that the value of equity equals the present value of expected future dividends. It also shows that valuation involves both expected payoffs and risk. Payoffs must be discounted at a rate that reflects their risk; in other words, the risk determines an investor required return<sup>37</sup>. To explore the possible explanation of the

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<sup>36</sup> In theory, there are alternative valuation models, for example, equity valuation model. Equity valuation model shows that the value of equity equals the sum of the book value of equity and the present value of expected residual earnings (Penman 2001). I present the equity value model as follows,

$$V_0^E = B_0 + \sum_{t=1}^{\infty} \frac{RE_t}{\rho_E^t}$$

$B_0$  denotes the current book value of equity.  $RE_t$  denotes the residual earnings (or abnormal earning, defined as the earnings in excess of the expected or required earnings).  $\rho_E^t$  denotes one plus equity cost of capital at time t. Since my analysis focuses on the equity cost of capital,  $\rho_E$ , my inference will not be influenced by either model I choose.

<sup>37</sup> From the equity valuation model perspective, equity value is at risk because expected residual earning is at risk. That is, the firm might not earn the earnings relative to book value that are expected, so

pricing effect of the discretionary component of ESO value for understating firms, I assume the information underlying the discretionary component of ESO value is associated with change in firm's future risk, which has been incorporated in equity cost of capital.

The risk in the operations,  $\rho_F$ , is referred to as firm risk or the weighted-average cost of capital, or WACC, because of the following relationships (Penman 2001):

$$\rho_F = \frac{V_0^E}{V_0^A} \cdot \rho_E + \frac{V_0^D}{V_0^A} \cdot \rho_D \quad (2)$$

$V_0^E$  : Equity value at time 0.

$V_0^D$  : Debt value at time 0.

$V_0^A = V_0^E + V_0^D$ , that is, firm value equals the sum of equity value and debt value, at time 0.

$\rho_F$  : WACC, a measure of firm risk or the cost of capital for operations.

$\rho_D$  : equals one plus cost of debt.

After algebraic manipulation, we can rearrange the equation (2) as follows,

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anticipated value might not be delivered. On the other hand, book values might be used up with losses in operations. Accordingly, expected residual earnings are "discounted" for this possibility with a required return,  $\rho_E$ , which incorporates this risk. Consequently, the calculated value reflects risk as well as expected return (Penman 2001).

$$\rho_E = \rho_F + \frac{V_0^D}{V_0^E}(\rho_F - \rho_D) \quad (3)$$

Equation (3) shows that equity cost of capital equal the cost of capital for operations,  $\rho_F$ , and the financial leverage<sup>38</sup>,  $(V_0^D/V_0^E)$ , times the spread between the cost of capital for operations and that for debt,  $(\rho_F - \rho_D)$ . In other words, the equity cost of capital has two components, operating risk and financial risk components; both are the basic fundamental determinants of equity risk (Penman 2001).

From accounting perspective, an equivalent version of equation (3) can be expressed as follows<sup>39</sup>,

$$ROE = ROA + \frac{FO}{SE}(ROA - BC) \quad (4)$$

ROE: rate of return on common equity

ROA: rate of return on net operating assets

FO: net financial obligation

SE: common share equity

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<sup>38</sup> Financial leverage is related to the extent to which a firm relies on debt financing rather than equity. Measures of financial leverage are tools in determining the probability that the firm will default on its debt contracts. There are several ways to express the extent to which a firm uses debt, such as debt ratio (debt/assets), debt-to-equity ratio (debt/equity), and equity multiplier (assets/equity) (Ross et al. 2002).

<sup>39</sup> The equity return in both of equation (3) and (4) is driven by the return on operating activities plus a premium for financing activities, where the latter is given by the financing leverage and the spread. The only difference in equation (3) and (4) is that equation (3) refers to required returns rather accounting returns and the leverage is market leverage rather than book leverage. For details, see Penman (2001, p. 433).

BC: net borrowing cost

ROA-BC: operating spread (or the difference) between the return on net operating assets and the net borrowing cost.

Equation (4) indicates that ROE is determined by operating profitability, financial leverage, and the operating spread. Penman (2001) suggests that the potential variation in return on net operating assets (ROA) generates operating risk. Thus, for each sample year, I measure the firm's operating risk as the standard deviation of quarterly operating income to total assets. Further, I use one-year percentage change in the standard deviation of quarterly operating income to total assets as a proxy for change in operating risk (Core et al. 1999, Hodder et al. 2006). Specifically, one-year percentage change in operating risk for year t is computed as follows.

$$\text{Percentage change in operating risk for year } t = \frac{SD_{t+1} - SD_t}{SD_t} \times 100 \quad (5)$$

$SD_t$ : the standard deviation of quarterly operating income to total assets for year t

Under the conjecture that managers of understating firms exercise their managerial discretions to under-value their ESOs, thereby signaling a lower future operating or financial risk to outside investors, which results in a positive market reaction, I predict a negative relation between the proxies for change in firms' operating

and financial risk and the absolute value of discretionary component of ESO value for understating firms<sup>40</sup>.

Accounting measures, however, are more subject to managerial manipulations (Dechow and Dichev 2002) as well as reported earnings will change as accounting standards change. Compared to accounting measures, cash flow is a more straightforward application of familiar net present value techniques. In addition, cash flow information is not affected by accounting rules (Hodder et al. 2006). Consistent with this view, Gombola et al. (1983) argue that cash flow ratio may contain some information that is not found in accounting profitability ratio with respect to firm performance. Bowen et al. (1986) also suggest that accrual earnings and cash flow numbers convey different signals in terms of predicting firms' future cash flows, as well as that earnings numbers may not provide better forecasts of future cash flow than do cash flow numbers<sup>41</sup>. Additionally, to examine whether cash flows possess incremental risk information beyond accrual earnings in the context of explaining market risk, Ismail et al. (1989) suggest that cash flow risk measures provide significant incremental explanatory power over that provided by the earnings risk measures in explaining the variability in market betas<sup>42</sup>. Therefore, I use an alternative proxy for operating risk,

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<sup>40</sup> I change the sign of the discretionary component of ESO value for understating firms, from negative to positive, the same adjustment procedure as I did for test of the pricing effect of the discretionary component of ESO value for understating firms. See footnote 22 for details. Accordingly, an observed negative association between proxy for change in operating risk and the discretionary component of ESO value for understating firms means that higher degree of underestimation of ESO values is associated with lower levels of operating risk.

<sup>41</sup> Finger (1994) also provides evidence indicating that cash flow is a better short-term predictor of future cash flow than are earnings, and the two are approximately equivalent in the long-term.

<sup>42</sup> Ismail et al. use monthly stock returns over 1967-1985 period to derive market betas, and then estimate accounting betas using various accounting measures, including earnings, funds flow, as well as cash flow.

measured as one-year-ahead percentage change in the standard deviation of operating cash flows to total assets. In other words, this proxy for operating risk is measured on the cash flow basis rather than the accrual accounting basis. I also predict a negative relation between the operating risk variable and the absolute value of discretionary component of ESO value for understating firms.

Penman (2001) also suggests that financial risk is driven by the amount of financial leverage and the variation in the spread. Thus, I measure the financial risk as one-year percentage change in the mean of financial leverage, which is computed as the ratio of total liability to total assets, measured at the end of each quarter (Hodder et al. 2006). Specifically, one-year percentage change in financial risk for year t is computed as follows.

$$\text{Percentage change in financial risk for year } t = \frac{\text{AFL}_{t+1} - \text{AFL}_t}{\text{AFL}_t} \times 100 \quad (6)$$

AFL<sub>t</sub>: the average of financial leverage, measured at the end of each quarter, for  
year t

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Next, they conduct incremental explanatory power test by using market beta as the dependent variable and accounting betas as the independent variables. The focus of their test was on the F-test of the incremental R-squared to determine whether the two-independent variable regression models significantly improve the R-squared of the single-independent variable regression model.

I predict to observe a negative relation between the discretionary component of ESO value and the proxies for financial risk as well<sup>43</sup>.

I also include the following variables in my regression analysis to control for conditions that may affect managers' exercise of discretion in option values. These control variables also intend to control for firm characteristics that could explain difference in option values unrelated to my predictions. I do not make predictions about the relation between the underestimation of ESO value and these control variables.

#### *Excess CEO Compensation*

Previous studies find evidence that managers who are concerned about the political costs of unexplained excessive CEO compensation may systematically underreport the value of their option awards (Yermack 1998; Baker 1999). More specifically, CEOs receive unexplained excessive pay relative to performance tend to report lower grant date values for their CEOs' option awards. Thus, I include a proxy for the excess CEO compensation to my regression analysis. Following Yermack (1998), Baker (1999), and Aboody et al. (2006), I use the residual term from a regression of total CEO compensation on proxies for firm size, firm performance, growth, risk, and industry membership as a proxy for excess CEO pay. I present the regression in Appendix B.

#### *The magnitude of the ESO expense*

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<sup>43</sup> These predictions of the relation between the discretionary component of ESO value and firms' operating or financial risk, are consistent with the role of information in affecting a firm's cost of capital. Easley and O'Hara (2004) show that firms can influence their cost of capital by affecting the precision and quantity of information available to investors. The understating firms can reduce their cost of capital, to the extent that managers communicate credible information underlying the discretionary component of ESO value for understating firms to investors.

Though SFAS 123 expense is not recognized, prior studies provide evidence consistent with the view that financial statement users view SFAS 123 expense disclosure as an expense to the firm (Aboody 1996; Aboody et al. 2004). Therefore, managers have incentives to underreport their ESOs value if they believe that doing so will improve the firm's perceived profitability. For example, Aboody et al. (2006) find the understatement of option value estimates is increasing in the magnitude of the expense. Besides, from the equity valuation perspective, a firm might want to manage its option value downward to mitigate the adverse effect of ESO expense on the firm's share price (Johnston 2006). I use the number of options granted during the year deflated by the number of common shares outstanding at fiscal year-end as the proxy for the magnitude of ESO expense (Hodder et al. 2006, Aboody et al. 2006).

#### Corporate Governance

Previous research in corporate governance suggests that, when CEO also serves as chair and when board size increases, it would become easier for CEO to exercise control over the board, and thus, monitoring effectiveness could be impaired (Beasley 1996; Core et al. 1997). Moreover, increased scrutiny from institutional investors leads to the tendency to underreport the value of stock options (Baker 1999). Aboody et al. (2006) also provide evidence that the understatement of ESO expense increases with weaker corporate governance. Thus, to capture the effect of corporate governance

structure on the discounting of ESO value, I use the “corporate governance score<sup>44</sup>” as a proxy for the strength of corporate governance.

### Volatility

Firms with more volatile stock prices may have a wider range of historical volatility, which may affect managers’ use of discretions (Aboody et al. 2006, Hodder et al. 2006). Thus, I include prior year stock price volatility in regression model. In addition, firms may consider volatility from a recent year to be more indicative of future volatility than from earlier periods (Aboody et al. 2006). Accordingly, I also consider stock price volatility over the subsequent year, because this input could reflect expected future volatility.

### Firm size

I also use firm size to control for firm complexity (Hodder et al. 2006). For example, large firms probably are well established, and are likely to have lower volatility and longer expected option life (Aboody et al. 2006). These factors will influence the option value estimates, but are unrelated to my predictions.

## 6.3 Research Design

The additional analysis presented in this chapter focuses on determining whether the proxies for change in firms’ operating and financial risk are associated with the underestimation of ESO value, after controlling for firms’ opportunities and incentives

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<sup>44</sup> This corporate governance score is based on detailed listings of corporate governance provisions, compiled by the Investors Responsibility Research Center (IRRC). This governance score is based upon 24 governance rules that measure the level of shareholder rights (Gompers, Ishii, and Metrick, 2003). I am grateful to the IRRC for permitting academic use of this index as well as the contribution of Gompers, Ishii, and Metrick (2003).

to under-report their option value estimates as well as other firm characteristics.

Particularly, I use the following regression models:

$$\begin{aligned}
 FVDISC_{it} = & \alpha_0 + \alpha_1 OR\_OI_{it} + \alpha_2 FR\_LVGCH_{it} + \alpha_3 OPTGNT_{it} + \alpha_4 EXCPAY_{it} + \alpha_5 GOVIDX_{it} \\
 & + \alpha_6 SIZE_{it} + \alpha_7 MB_{it} + \alpha_8 GWSALES_{it} + \alpha_9 VOLIYR\_PRE_{it} + \alpha_{10} VOLIYR\_POST \\
 & + \sum_{Y=1997}^{2001} \theta_{0Y} YR_{Yit} + \sum_{I=1}^{27} \gamma_{0I} IND_{lit} + \varepsilon_{it}
 \end{aligned}
 \tag{7.1}$$

$$\begin{aligned}
 FVDISC_{it} = & \alpha_0 + \alpha_1 OR\_OCF_{it} + \alpha_2 FR\_LVGCH_{it} + \alpha_3 OPTGNT_{it} + \alpha_4 EXCPAY_{it} + \alpha_5 GOVIDX_{it} \\
 & + \alpha_6 SIZE_{it} + \alpha_7 MB_{it} + \alpha_8 GWSALES_{it} + \alpha_9 VOLIYR\_PRE_{it} + \alpha_{10} VOLIYR\_POST \\
 & + \sum_{Y=1997}^{2001} \theta_{0Y} YR_{Yit} + \sum_{I=1}^{27} \gamma_{0I} IND_{lit} + \varepsilon_{it}
 \end{aligned}
 \tag{7.2}$$

FVDISC is as defined in section 3.3. OR\_OI is the one-year percentage change in the standard deviation of quarterly operating income, deflated by total assets. OR\_OCF is the one-year percentage change in the standard deviation of quarterly operating cash flow, deflated by total assets. FR\_LVGCH is the one-year percentage change in the mean financial leverage. Financial leverage is defined as total liability divided by total equity and measured at the end of each quarter. OPTGNT is the number of options granted during the year deflated by the number of common shares outstanding at fiscal year-end. EXCPAY is the residual from a regression of total annual CEO compensation on proxies for firm performance, size, risk, and growth. GOVIDX is a dummy, equal to one for firms with “corporate governance score” above the median (i.e., firms with weaker corporate governance), and zero otherwise. “Corporate

governance score” (GOV) is a measure compiled by the Investor Responsibility Research Center (IRRC), based on 24 corporate governance provisions that measure shareholders’ rights. SIZE is the logarithm of market value of equity at fiscal year-end. MB is the market value of equity divided by book value of equity at fiscal year-end<sup>45</sup>. GWSALES is the one-year percentage increase in net sales. VOL1YR\_PRE (VOL1Y\_POST) is annualized stock price volatility calculated over the prior (subsequent) year.

I predict both  $\alpha_1$  and  $\alpha_2$  in equation (7.1) and (7.2) to be negative, if information communication is the motivation for understating firms.

#### 6.4 Data and Descriptive Statistics

The sample starts with 1,678 firm-year observations with available option input assumptions from prior chapters. I obtain the executive compensation data from Execucomp; I delete 24 firm-year observations due to missing total annual CEO compensation data, 23 firm-year observations because of incomplete sales and one-year growth in sales data, as well as 29 observations missing market-to-book value of equity. The above procedure results in 1,602 firm-year observations from 1996 to 2001 with data available to estimate the compensation regression (B1).

To measure the financial risk and operating risk, I collect quarterly financial data from Compustat. I deleted 482 and 43 firm-year observations with incomplete

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<sup>45</sup> Market value is measured by the closing price for the fiscal year-end multiplied by number of the company’s common shares outstanding (Compustat Executive Compensation variable name: MKTVL). Book value of equity is measured by sum of common stock, capital surplus, preferred stock, and treasury stock adjustments (Compustat Executive Compensation variable name: SEQ).

quarterly cash flow data and quarterly operating income data. The final sample comprises 1,077 firm-year observations with all data required for my tests.

Table 12 presents descriptive statistics relating to the variables that I use in the tests. The mean (median) FVDISC is -0.01 (-0.00), which is consistent with that in Table 2. The mean (median) OR\_OI is 55.43% (-3.33%); the mean (median) OR\_OCF is 18.35% (2.06%). These statistics indicate that during the sample years, the percentage change in standard deviation of operating income is greater than that of operating cash flows; the latter has a lower standard deviation than the former. The mean (median) FR\_LVGCH is 10.24% (0.28%), which is somewhat lower than both OR\_OI and OR\_OCF.

The large magnitude of standard deviation for OR\_OI and OR\_OCF suggests that the two risk measures are highly variable during the sample years; the positive mean but negative median of OR\_OI indicates that OR\_OI is skewed to the right. To mitigate this issue, I winsorise both sides of the data distribution by one percentile. The untabulated statistics for the winsorised data show that the mean (median) and standard deviation of OR\_OI are 47.55% (-3.33%) and 177.44%; the mean (median) and standard deviation of OR\_OCF are 14.39% (2.06%) and 62.13%. These statistics show that, compared to the original data, the mean and standard deviation of OR\_OI for winsorised data drop by 14% and 26%, respectively. In addition, the mean and standard deviation of OR\_OCF for winsorised data drop by 21% and 44%, respectively. I also conduct regression analysis for the winsorised data in the following section.

Table 12 Descriptive Statistics for Sample of 1,077 Firm-year Observations over the 1996 through 2001 Period, Relating to Regressions of FVDISC on Operating Risk, Financial Risk, and Firm Characteristics

Variable	Mean	Median	Std. Dev.
FVDISC	-0.01	-0.00	0.12
OR_OI (%)	55.43	-3.33	240.75
OR_OCF (%)	18.35	2.06	112.51
FR_LVGCH (%)	10.24	0.28	132.77
OPTGNT	0.02	0.02	0.03
EXCPAY	0.01	0.04	1.14
GOV	10.02	10.00	2.54
SIZE	9.18	9.05	1.17
MB	5.04	3.29	7.63
GWSALES (%)	13.94	8.53	34.92
VOL1YR_PRE (%)	38.42	34.53	19.45
VOL1YR_POST (%)	42.48	37.59	17.47

FVDISC is as defined as Table 2. OR\_OI is the one-year percentage change in the standard deviation of quarterly operating income, deflated by total assets. OR\_OCF is the one-year percentage change in the standard deviation of quarterly operating cash flow, deflated by total assets. FR\_LVGCH is the one-year percentage change in the mean of financial leverage, i.e., total liabilities divided by total equity, measured at the end of each quarter.

OPTGNT is the number of options granted during the year deflated by the number of common shares outstanding at fiscal year-end. EXCPAY is the residual from a regression of total annual CEO compensation on proxies for firm performance, size, risk, and growth. GOV 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. MB is the market value of equity divided by book value of equity at fiscal year-end. GWSALES is the one-year percentage increase in net sales. VOL1YR\_PRE (VOL1YR\_POST) is annualized stock price volatility calculated over the prior (subsequent) year.

Regarding the proxy for the magnitude of stock option-based expense, the mean (median) OPTGNT indicates that firms' outstanding options average 2% (2%) of total outstanding shares. The mean (median) EXCPAY is 0.01 (0.04), which is close to zero by its construction, because it is a residual from compensation regression. The mean (median) of GOV, the IRRC corporate governance score, is 10.02 (10.00), suggesting that, on average, firms have ten of the 24 provisions comprising the measure.

With regard to other control variables, the firm size measure, SIZE, has a mean (median) of 9.18 (9.05). The mean (median) MB is 5.04 (3.29) and GWSALES is 13.94% (8.53%), suggesting sample firms have relatively high growth. The short horizon volatility measure, VOL1YR\_PRE, has a mean (median) 38.42% (34.53%), and VOL1YR\_POST has a mean (median) 42.48% (37.59%).

### 6.5 Findings

Table 13 presents my findings relating to estimating (7.1) and (7.2), which test for the relation between financial risk and the discretionary component of ESO value, as well as the relation between operating risk and the discretionary component of ESO value. My analysis focuses on the result for understating firms.

Panel A of Table 13 indicates that for understating firms the financial risk variable is negatively associated with FVDISC; the coefficient (t-value) on FR\_LVGCH is -0.01 (t=-1.08), which is consistent with my prediction. However, it is not significant at the 10% level. On the other hand, contrary to my prediction, the operating risk variable is positively associated with FVDISC. The coefficient (t-value) on OR\_OI is 0.01 (t=2.23). One possible interpretation for this result is that accounting earnings is

Table 13 Summary Statistics from Regressions of FVDISC on Operating Risk, Financial Risk, and Firm Characteristics (YR and IND are omitted)

Panel A: Operating risk is measured as one-year-ahead percentage change in the standard deviation of operating income to total assets

Sample, Subsamples, and Depend. Var./Independent Var.	Full Sample	Overstating Firms	Pred. Sign	Understating Firms
	FVDISC	FVDISC		FVDISC
OR_OI	-0.01** (-1.67)	-0.00 (-0.31)	-	0.01** (2.23)
FR_LVGCH	-0.00* (-1.37)	0.00* (1.56)	-	-0.01 (-1.08)
OPTGNT	-1.54*** (-2.80)	1.37*** (6.52)	?	3.52*** (5.12)
EXCPAY	-0.00 (-0.27)	-0.01* (-1.70)	?	-0.01 (-1.54)
GOVIDX	-0.01 (-1.11)	-0.00 (-0.30)	?	0.02* (1.90)
SIZE	-0.02*** (-4.51)	0.00 (0.39)	?	0.02*** (4.57)
GW_MB	-0.00* (-1.65)	0.00 (1.03)	?	0.00 (1.02)
GWSALES	-0.00 (-0.68)	0.00 (1.09)	?	-0.00 (-0.88)
VOL1YR_PRE	0.00 (0.10)	-0.00 (-0.06)	?	-0.00 (-1.27)
VOL1YR_POST	0.00*** (2.57)	0.00 (1.45)	?	-0.00 (-0.25)
Adj. R <sup>2</sup>	0.20	0.43		0.52
N=	1,077	512		565

Table 13-continued

Panel B: Operating risk is measured as one-year-ahead percentage change in the standard deviation of operating cash flows to total assets

Sample, Subsamples, and Depend. Var./Independent Var.	Full Sample FVDISC	Overstating Firms FVDISC	Pred. Sign	Understating Firms FVDISC
OR_OCF	0.01** (2.32)	0.00* (1.47)	-	-0.01*** (-3.50)
FR_LVGCH	-0.00* (-1.37)	0.00 (1.17)	-	-0.01* (-1.44)
OPTGNT	-1.37*** (-2.62)	1.38*** (6.63)	?	3.34*** (4.61)
EXCPAY	-0.00 (-0.45)	-0.01 (-1.50)	?	-0.01 (-0.91)
GOVIDX	-0.00 (-0.35)	0.00 (0.65)	?	0.01 (1.51)
SIZE	-0.02*** (-3.93)	0.00 (0.94)	?	0.02*** (4.21)
GW_MB	-0.00** (-2.87)	0.00 (0.95)	?	0.00** (2.03)
GWSALES	-0.00 (-1.16)	0.00 (1.25)	?	-0.00 (-0.28)
VOL1YR_PRE	0.00 (0.06)	0.00 (0.50)	?	-0.00 (-1.31)
VOL1YR_POST	0.00*** (3.87)	0.00 (1.21)	?	-0.00* (-1.92)
Adj. R <sup>2</sup>	0.15	0.41		0.47
N=	1,077	512		565

## Table 13-continued

\*\*\*, \*\*, \*Significant at one percent, five percent, and ten percent level (one-tailed test if signed, else two-tailed test)

FVDISC is as defined as Table 2. OR\_OI is the one-year percentage change in the standard deviation of quarterly operating income, deflated by total assets. OR\_OCF is the one-year percentage change in the standard deviation of quarterly operating cash flow, deflated by total assets. FR\_LVGCH is the one-year percentage change in the mean of financial leverage, i.e., total liabilities divided by total equity, measured at the end of each quarter.

OPTGNT is the number of options granted during the year deflated by the number of common shares outstanding at fiscal year-end. EXCPAY is the residual from a regression of total annual CEO compensation on proxies for firm performance, size, risk, and growth. GOV is a measure compiled by the Investor Responsibility Research Center (IRRC), based on 23 corporate governance provisions that measure shareholders' rights. GOVIDX is a dummy, equal to one for firms with "Corporate Governance Score" above the median (i.e., firms with weaker corporate governance), and zero otherwise. SIZE is the logarithm of market value of equity at fiscal year-end. MB is the market value of equity divided by book value of equity at fiscal year-end. GWSALES is the one-year percentage increase in net sales. VOL1YR\_PRE (VOL1YR\_POST) is annualized stock price volatility calculated over the prior (subsequent) year.

t-statistics (in parentheses) are based on White (1980) heteroskedasticity-consistent standard errors. The year and industry intercepts are not tabulated

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subject to managerial manipulation, thus it serves as a noisy proxy for operating risk.

Using alternative accounting measure to proxy for the operating risk, I also get similar results<sup>46</sup>.

Table 13 panel B reveals that, for understating firms, the coefficient (t-value) on OR\_OCF is -0.01 (t=-3.50), the result indicating that the proxy for change in operating risk is negatively associated with FVDISC, consistent with my prediction. In addition, the coefficient (t-value) on FR\_LVGCH is -0.01 (t=-1.44), indicating that the relation between the proxy for change in financial risk and FVDISC is negative as well. This

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<sup>46</sup> I measure the operating risk by using two alternative accounting numbers, earnings per share from operations (Compustat Data #177) and net income (Compustat Data #69). The t-value (p-value) for the coefficient on the former proxy for operating risk is 2.02 (p=0.02). The t-value (p-value) for the coefficient on the latter proxy for operating risk is 2.01 (p=0.03). Alternatively, I use another proxy for financial risk, calculated as the one-year-ahead percentage change in the standard deviation of quarterly financial leverage, to estimate (7.1) again. The t-value (p-value) for the coefficient on OR\_OI is 2.18 (p=0.02).

result supports the information hypothesis that managers communicate their private information about firms' future operating risk by exercising their managerial discretions in ESO value estimates. More importantly, this statistical association provides a theoretical interpretation as to the pricing effect of the discretionary component of ESO values for understating firms, in an efficient market.

On the other hand, for overstating firms, I find a significant positive result for the operating risk variable; however, no significant result for the financial risk variable.

As a robustness check, I repeat the analysis procedure using one-year percentage change in the standard deviation of operating cash flow deflated by total equity in lieu of that deflated by total assets as an alternative proxy for change in firms' operating risk. The t-value (p-value) for OR\_OCF and FR\_LVGCH are -1.95 (p=0.03) and -0.85 (p=0.20)<sup>47</sup>. In addition, I use one-year percentage change in the standard deviation of operating cash flow deflated by number of shares outstanding at fiscal year-end as another proxy for change in firms' operating risk, and the t-value (p-value) for OR\_OCF and FR\_LVGCH are -1.91 (p=0.03) and -1.20 (p=0.12)<sup>48</sup>. These results indicate that the negative association between FVDISC and operating risk for understating firms is robust to various measures of operating cash flow as well as to the alternative measure of financial risk.

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<sup>47</sup> In this scenario, I use another proxy for financial risk, computed as the one-year percentage change in the standard deviation of quarterly financial leverage, to estimate (7.2). The t-value (p-value) for operating and financial risk variables are -1.96 (p=0.03) and 0.82 (p=0.20), respectively.

<sup>48</sup> In this scenario, I also use another proxy for financial risk, computed as the one-year percentage change in the standard deviation of quarterly financial leverage, to estimate (7.2). The t-value (p-value) for operating and financial risk variables are -2.50 (p=0.01) and 1.08 (p=0.14), respectively.

To exclude the possibility that measurement issue of other variables may drive this result, I use another proxy for the financial risk, calculated as the one-year percentage change in the standard deviation of quarterly financial leverage, to estimate (7.1). The t-value (p-value) for the coefficient on OR\_OCF is -3.55 (p=0.00). Next, I use GOV instead of GOVIDX to proxy for the corporate governance strength, and the result still holds. The t-value (p-value) for the coefficients on OR\_OCF and FR\_LVGCH are -3.53 (p=0.00) and -1.53 (p=0.07). Moreover, I use another proxy for firm size, the natural logarithm of sales instead of natural logarithm of market value of equity at fiscal year-end, for the test. The t-value (p-value) for the coefficient on OR\_OCF and FR\_LVGCH are -3.47 (p=0.00) and -1.34 (p=0.09). Therefore, given the consistent results from the foregoing tests, the negative association between FVDISC and my proxy for operating risk is robust to various measures of other variables.

Additionally, to ensure whether my result is sensitive to the extreme data, I re-run the regression using the winsorised data. The t-value (p-value) for the coefficients of OR\_OI and FR\_LVGCH are 2.26 (p=0.01) and -1.18 (p=0.12). In addition, the t-value (p-value) for the coefficients of OR\_OCF and FR\_LVGCH are -0.79 (p=0.21) and -1.34 (p=0.09). These results suggest that, for understating firms, my financial risk variable is still negatively associated with FVDISC for winsorised data.

With respect to other control variables for understating firms, the coefficient (t-value) on OPTGNT, GOVIDX are 3.34 (t=4.61) and 0.01 (t=1.51). The result suggests that the underestimation of option values is increasing in the size of the option expense and is, to a lesser extent, greater for firms with weaker corporate governance. The

preceding section suggests that the discretionary component of ESO values is priced by the markets, thus this pricing effect may provide another motive for managers to under-report their ESO value estimates. The literature has documented various incentives, such as increasing the perceived profitability or decreasing the excessiveness of the executive pay. The evidence in this study is consistent with their assertion. More importantly, after controlling for these factors, the negative association between understatement of ESO values and proxy for operating risk may provide insightful interpretation as to the pricing effect of the discretionary component of ESO value in an efficient market.

#### 6.6 Summary

The focus of this chapter is on whether the proxies for change in firms' operating and/or financial risk are associated with the understatement of ESO value. I use two alternative proxies for change in firms' future operating risk. One is measured on the cash basis and the other is on the accrual accounting basis. I find a significant negative association between the understatement of ESO values and the proxy for operating risk, which is computed as one-year percentage change in the standard deviation of operating cash flow. This result suggests that the greater extent of underestimation of ESO value is associated with lower levels of firms' future operating risk. This result supports the information hypothesis that managers communicate their private information about firms' future operating risk by exercising their managerial discretion in ESO value estimates. More importantly, this statistical association provides evidence consistent with the theoretical interpretation as to the pricing effect of

the discretionary component of ESO values for understating firms, in an efficient market.

On the other hand, I do not find similar result if operating risk is measured by accrual accounting number, i.e., operating income. One plausible interpretation of the result is that accounting earnings could serve as a noisy proxy for operating risk.

## CHAPTER 7

### SUMMARY AND CONCLUDING REMARKS

#### 7.1 Summary

First, this dissertation investigates the pricing effect of ESO values. Consistent with Aboody et al. (1996), Aboody et al. (2004), and Balsam et al (2005), I find a negative association between ESO values and stock price. This finding supports the view that markets view the value of an ESO as an expense of the firm.

My dissertation further examines whether discretionary, nondiscretionary, or both portions of ESO value account for the pricing effect of ESO values. As predicted, I find a negative relation between the nondiscretionary component of ESO value and stock price. This finding indicates that markets view the full ESO value as well as the nondiscretionary component of ESO values as an expense of the firm. Additionally, I find the discretionary component of ESO values is also negatively associated with stock price. This finding suggests that markets also price the discretionary component of ESO value.

Anecdotal evidence suggests that the discretionary component of ESO value for understating firms is likely driven by opportunistic motivation and that the discretionary portion of ESO value for overstating firms could be attributable to information incentives. To further examine the sources of the pricing effect of the discretionary component of ESO value and whether the competing perspectives, information and

opportunism perspective, can explain the pricing effect of the discretionary component of ESO value, I partition the sample set into two groups, understating and overstating firms. I find a positive association between stock price and understatement of ESO values. Under the efficient markets hypothesis, this result is consistent with the notion that the discretionary component of the ESO value for understating firms is likely driven by information incentives. In other words, for understating firms, managers communicate their private information about their firms' future operating or financial risk by exercising their discretions over input assumptions, resulting in a lower option value estimates and thereby signaling a lower level of future risk assessment. I do not find significant result for overstating firms, which suggests that the discretionary component of ESO values for overstating firms is unlikely attributable to information incentives. This finding is inconsistent with the conjecture that firms over-reporting their ESO values are likely to communicate their private information to outside investors (Aboody et al. 2006, Hodder et al. 2006)

An alternative interpretation of the positive relation between share price and the discretionary component of ESO value for understating firms is that if managers believe that exercising managerial discretions over input assumptions as reflected in the discretionary component of ESO value can affect a firm's perceived profitability and therefore its stock price, the pricing effect of ESO value for understating firms may be caused by managerial opportunism.

To further examine the "information incentive" interpretation of the results for the understating firms, I conduct a second set of analysis concerning the relation

between change in firms' future risk, i.e., operating and financial risk, and the discretionary component of ESO value.

I use two alternative proxies for change in firms' future operating risk. One is measured on the accrual accounting basis and the other is on the cash basis. I find a significant negative association between the understatement of ESO value and the proxy for operating risk, which is computed as one-year percentage change in the standard deviation of quarterly operating cash flow. This result suggests that the greater extent of underestimation of ESO value is associated with lower levels of firms' future operating risk. This result supports the information communication hypothesis that managers communicate their private information about firms' future operating risk by exercising their managerial discretion in ESO value estimates. In addition, I use percentage change in financial leverage as proxy for change in firms' financial risk. However, I do not find any significant association between proxy for change in financial risk and the underestimation of ESO value.

In addition, I also find that underestimation of option value is increasing in the size of the option expense and is, to a lesser extent, greater for firms with weaker corporate governance. This finding is consistent with the assertion that the discretionary component of ESO value for understating firms is priced by the markets may provide another motive for managers to under-value their ESOs. More importantly, after controlling for these factors, the negative association between understatement of ESO value and firms' future operating risk provides a theoretical interpretation as to the

pricing effect of the discretionary component of ESO value for understating firms, in an efficient market.

This study extends Aboody (1996) study by further examining the effect of managerial discretions exercised in option-pricing model input assumptions on the pricing effect of ESO value. Thus, evidence provided by this study could improve our understanding of how capital markets process ESO information.

Moreover, the findings of this study have implications for accounting standard-setters. To the extent that managers believe exercising managerial discretion over the option-pricing model inputs as reflected in the discretionary component of ESO value can influence investor perception of a firm's profitability and therefore a firm's stock price, they will exercise their discretions in ESO value estimates in an opportunistic manner. Alternatively, in this study I find that, for understating firms, information communication incentive could also motivate managers to exercise their managerial discretions to under-report their ESO values, and thereby signaling a lower level of firms' future operating risk to outside investors. The purpose of this study is to examine how the markets process the information underlying the value of an ESO. Accordingly, I leave to standard setters the determination whether it is desirable to allow managers to exercise their discretions, afforded by SFAS No. 123 in option-pricing model input choice, and therefore ESO value estimates.

## 7.2 Limitation of the Analysis

My inference is limited to the following assumptions. First, I assume the Hodder et al. expectation model can correctly decompose the full ESO value into expected ESO

value and unexpected ESO value. My inference about the pricing effect of expected or unexpected ESO value will be weakened if the expectation model fails to correctly capture the expected portion of ESO value.

Second, the full ESO value estimates are based on reported option-pricing model inputs disclosed in the 10-K footnotes as well as the fiscal year-end stock price. Following Hodder et al (2006), I use fiscal year-end stock price as the exercise price and stock price instead of the grant-date stock price, when calculating the BSM value. This procedure causes my estimated ESO values might differ from the weighted average ESO values disclosed in firms' 10-K footnote. In addition, this procedure causes this difference become a function of the ratio of fiscal year-end stock price to grant-date stock price<sup>49</sup>. Since there is no reason to doubt that this measurement error will be biased towards either way as to the pricing effect of ESO values, I just assume away the effect of this measurement error on my inference about the pricing effect of ESO values.

Finally, to mitigate the simultaneity bias, I use instrumental variable approach to test the pricing effect of ESO values. However, the relation between input assumptions and option values is nonlinear and instrumental variable technique requires the instruments used to construct the instrumental variable be linear to the suspected endogenous variable, i.e., the ESO value. Though Hausman test result indicates that the

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<sup>49</sup> This inference is based upon a simplifying assumption that the input assumptions I use to estimate the option values are the same as the firms. If so, the difference between my estimated ESO values solely come from the difference in the stock prices we used. However, firms actually disclosed a range of input assumptions they used to estimate the option value if firms grant options to their employees more than once in that year. In the foregoing situation, I use the median of the range to calculate the BSM value, which may causes my estimated ESO values differ from the disclosed ones as well.

simultaneity issue has been largely mitigated by this approach, I still cannot exclude the possibility that the result could be driven by the effect of this nonlinearity relation.

APPENDIX A

THE INSTRUMENTAL VARIABLE APPROACH:  
THE FIRST STAGE REGRESSION

In the first stage, I regress each of the ESO value variables, FVREP, FVFIT, and FVDISC on the instruments and the predetermined variables in the structure equation, using the pooled sample. The instruments include reported option life, REP\_LIFE, reported option volatility, REP\_VOL, reported dividend yield, REP\_DIV, and reported risk-free interest rate, REP\_INT. Since BSM option value is a function of the option-pricing model inputs, thus the best candidates for the instruments are those inputs used to calculate option value. The predetermined variables include BVE, NI, GW, IND, and YR. I present the regression results in Table 14. IND and YR are omitted in equation (A1) through (A3).

After estimating the coefficients for variables in equation (A1) through (A3), I find the fitted or predicted values of FVREP, FVFIT, and FVDISC from these regressions. In the second stage, I use these fitted values of FVREP\*, FVFIT\*, and FVDISC\*, as the instrumental variables, and estimate the OLS coefficients of the valuation equations (3.1) and (3.2).

$$\begin{aligned} \text{FVREP}_{it} = & \alpha_0 + \alpha_1 \text{BVE}_{it} + \alpha_2 \text{NI}_{it} + \alpha_3 \text{GW}_{it} + \alpha_4 \text{REP\_VOL}_{it} \\ & + \alpha_5 \text{REP\_INT}_{it} + \alpha_6 \text{REP\_LIFE}_{it} + \alpha_7 \text{REP\_DIV}_{it} + \varepsilon_{it} \end{aligned} \quad (\text{A1})$$

$$\begin{aligned} \text{FVFIT}_{it} = & \alpha_0 + \alpha_1 \text{BVE}_{it} + \alpha_2 \text{NI}_{it} + \alpha_3 \text{GW}_{it} + \alpha_4 \text{REP\_VOL}_{it} \\ & + \alpha_5 \text{REP\_INT}_{it} + \alpha_6 \text{REP\_LIFE}_{it} + \alpha_7 \text{REP\_DIV}_{it} + \varepsilon_{it} \end{aligned} \quad (\text{A2})$$

$$\begin{aligned} \text{FVDISC}_{it} = & \alpha_0 + \alpha_1 \text{BVE}_{it} + \alpha_2 \text{NI}_{it} + \alpha_3 \text{GW}_{it} + \alpha_4 \text{REP\_VOL}_{it} \\ & + \alpha_5 \text{REP\_INT}_{it} + \alpha_6 \text{REP\_LIFE}_{it} + \alpha_7 \text{REP\_DIV}_{it} + \varepsilon_{it} \end{aligned} \quad (\text{A3})$$

Table 14 Summary Statistics from First Stage Regressions of ESO value on Book Value of Equity, Net Income, Expected Earnings Growth, and Reported Option-Pricing Model Inputs (IND and YR are omitted in Regressions (A1) through (A3))

Equation/ Variable	(A1) FVREP	(A2) FVFIT	(A3) FVDISC
BVE	0.04*** (13.25)	0.04*** (12.07)	0.00*** (6.52)
NI	0.07*** (4.26)	0.07*** (4.39)	-0.00 (-1.04)
GW	0.09*** (12.71)	0.10*** (13.61)	-0.01*** (-6.25)
REP_VOL	0.60** (2.43)	0.24 (0.95)	0.36*** (9.00)
REP_INT	-4.43 (-0.72)	-5.50 (-0.88)	1.07 (1.06)
REP_LIFE	0.03 (1.18)	0.02 (0.89)	0.01* (1.69)
REP_DIV	2.86 (0.83)	5.91* (1.70)	-3.04*** (-5.42)
Adj. R <sup>2</sup>	0.347	0.345	0.111
N=	1,678	1,678	1,678

\*\*\*, \*\*, \*Significant at one percent, five percent, and ten percent level (two-tailed test)

FVREP is OFV\_REP times number of option granted, deflated by number of shares outstanding. FVFIT is OFV\_FIT times number of option granted, deflated by number of shares outstanding. FVDISC is OFV\_DISC times number of option granted, deflated by number of shares outstanding. *i* and *t* denote firm and year.

BVE is fiscal year-end equity book value deflated by number of shares outstanding. NI is annual net income deflated by number of shares outstanding. GW is fiscal year-end I/B/E/S mean analyst earnings growth forecast. YR is dummy variable for years. YR equals 1 if year is Y, 0 otherwise. IND is dummy variable for industry classification. IND equals 1 if the firm is in industry I (based on the 28 GICS code in Table 1, Panel B), and 0 otherwise.

REP\_VOL is stock option-pricing model volatility as reported in the 10-K footnote disclosure. REP\_DIV is stock option-pricing model dividend yield as reported in the 10-K footnote disclosure. REP\_LIFE is stock option-pricing model expected option life as reported in the 10-K footnote disclosure. REP\_INT is stock option-pricing model risk-free interest rate as reported in the 10-K footnote disclosure.

t-statistics (in parentheses) are based on White (1980) heteroskedasticity-consistent standard errors. The year and industry intercepts are not tabulated

APPENDIX B

MEASURE OF EXCESSIVE CEO COMPENSATION

Following Yermack (1998), Baker (1999) and Core, Holthausen, and Larker (1999), EXCPAY is defined as the residual derived from a regression of total annual CEO compensation on the economic determinants of CEO pay, including firm size, performance, growth, risk, and industry membership. The estimation regression is:

$$\begin{aligned} \ln(\text{CEOPAY})_{it} = & \alpha_0 + \alpha_1 \ln(\text{SALES})_{it} + \alpha_2 \text{MB}_{it} + \alpha_3 \text{GWSALES}_{it} + \alpha_4 \text{RET}_{it} + \alpha_5 \text{ROA}_{it} \\ & + \alpha_6 \text{VOL}_{it} + \sum_{Y=1997}^{2001} \theta_{0Y} \text{YR}_{Yit} + \sum_{I=1}^{27} \gamma_{0I} \text{IND}_{Iit} + \varepsilon_{it} \end{aligned} \quad (\text{B1})$$

CEOPAY is total compensation for the individual year, comprised of cash salary, bonus, restricted stock granted, stock options granted (using BSM values), and all other annual compensation, which is reported by Execucomp. I use net sales, SALES, as a proxy for firm size and operations complexity, market-to-book ratio (MB), and one-year percentage change in net sales (GWSALES), as proxies for growth opportunities. I use return on assets, ROA, and annual stock return, RET, as proxies for firm performance. I also include stock price volatility estimated over the previous five years, VOL. I also control for industry and year effect.  $\ln$  denotes natural logarithm. The above regression is analogous to the one used in Aboody et al. (2006).

To estimate the residual from (B1), I use all available firm-year observations from 1996 to 2001. Untabulated summary indicates that, except for ROA ( $t=-1.00$ ), the coefficients on  $\ln$  (SALES), MB, GWSALES, RET, and VOL are all positive as

predicted and are consistent with prior research ( $t=12.79, 1.95, 2.73, 0.97, 2.00$ )<sup>50</sup>. This regression explains 21% of the variation in total CEO compensation, which is greater than the 16% for the three -factor model in Yermack (1998).

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<sup>50</sup> The coefficient estimates are based on 1,602 firm-year observations. t-statistics are based on White (1980) heteroskedasticity-consistent standard errors.

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