The Effect of Recognition versus Disclosure on Investment Efficiency*

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Comments welcome.

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Abstract

We investigate the implication of recognition versus disclosure on investment efficiency. Extant theories suggest that recognized amounts are more reliably measured than disclosed amounts and that inattentive investors process recognized and disclosed information differently. Both explanations imply that recognition is associated with higher investment efficiency than is disclosure. We test these two implications using the adoption of SFAS No. 123R, which requires recognition of previously disclosed employee stock option (ESO) expense. We find that investment efficiency improves in the post SFAS No. 123R period and, as expected, mainly for heavy ESO users. We also document that financially constrained firms, firms with large cash holdings, and firms with more inattentive investors experience a larger improvement in investment efficiency than their counterparts do. The latter findings are consistent with the mechanics proposed in extant theories for recognition and disclosure having different effects on investment efficiency.

JEL classification: G14; G18; J33; K20; M41

Keywords: Recognition; Disclosure; Investment efficiency; Accounting regulation; Employee stock options

1. Introduction

Prior empirical research has documented evidence that recognized items exhibit a higher association with stock prices or returns than do disclosed items, suggesting that recognized amounts are more value-relevant than disclosed amounts (e.g., Amir 1993; Aboody 1996; Ahmed et al. 2006; Davis-Friday et al. 1999; Cotter and Zimeer 2003; Yu 2013; Michels 2013). While these studies have shed light on the difference between recognition and disclosure, research design issues associated with using stock prices and returns have made it difficult to interpret the results (e.g., Kothari and Zimmerman 1995; Barth et al. 2001; Holthausen and Watts 2001; Schipper 2007). In this study, we explore an alternative approach to test whether recognition and disclosure are different. Specifically, we examine whether the recognition of previously disclosed employee stock option (ESO) cost affects investment efficiency.

The existing literature offers two explanations as to why the preparation, auditing, and use of recognized and disclosed information have different effects on corporate investment. First, managers and auditors exert more effort preparing and examining recognized amounts than disclosed items, making recognized values more reliably measured than disclosed amounts (Bernard and Schipper 1994; Libby et al. 2006). Given that higher financial reporting quality is associated with higher investment efficiency (e.g., Bushman and Smith 2001; Bens and Monahan 2004; McNichols and Stubben 2008; Hope and Thomas 2008; Biddle et al. 2009; Balakrishnan et al. 2014), it follows that the recognition of formerly disclosed information will enhance investment efficiency. Second, inattentive investors fixate on recognized items and ignore important disclosed information, allowing firms to issue overpriced stocks to fund additional investment (Hirshleifer and Teoh 2003). The recognition of previously disclosed items mitigates stock overpricing and, hence, reduces overinvestment.

We investigate these two explanations on the different investment effects of recognition and disclosure using the adoption of Statement of Financial Accounting Standards (SFAS) No. 123R (FASB 2004). Prior to SFAS No. 123R, SFAS No. 123 (FASB 1995) allowed companies to expense the cost of ESOs either at fair value or at intrinsic value with supplementary fair value disclosure. Almost all companies chose the intrinsic value approach, because it would allow them to report a zero ESO expense by granting ESOs at the money.[1] SFAS No. 123R requires companies to expense the fair value of ESO grants, thereby taking away the choice of simply disclosing it in a note. Hence, the passage of SFAS No. 123R offers a setting to test whether the recognition of formerly disclosed numbers enhances investment efficiency. Moreover, SFAS No. 123R offers a powerful and clean setting for us to test for the different investment effects of recognition and disclosure (section 2.2 provides further discussions).

We measure corporate investment as the sum of research and development (R&D) expenses and capital expenditures, less the proceeds from sales of property, plants, and equipment. Following prior research, we model corporate investment as a function of firms' fundamentals, managerial incentives, and macro-economic conditions. We use the estimated residual from this regression to capture abnormal investment. We conduct our empirical analysis on a sample of companies with CEO compensation and tenure data from *ExecuComp*, financial statement data from *Compustat*, and stock price data from *CRSP*. The sample covers the period from 1994 to 2010.

We find that average abnormal investment moves toward zero after the adoption of SFAS No. 123R. The improvement in investment efficiency is more pronounced for heavy users of ESOs, consistent with the improvement being attributed to the change in accounting for ESOs.

[1] The intrinsic value of ESOs granted at the money is zero. Hence, a firm would report a zero ESO expense by setting the exercise price of the ESOs to the closing price of its stocks on the grant date.

Furthermore, firms with less reliably measured ESO expense experience a significant drop in the magnitude of abnormal investment after mandatory recognition per SFAS No. 123R. This result is consistent with the recognized ESO expense being more reliable than the disclosed value, leading to an improvement in corporate investment decisions. Firms with inattentive investors also exhibit an improvement in investment efficiency after the adoption of SFAS No. 123R.

Having established the key results, we next idenify the specific mechanisms through which recognition and disclosure of ESO expense affect investment differently. In particular, we investigate over- and under-investing firms separately, and we partition the sample firms by financial constraints, excess cash holdings, and percentages of sophisticated investors. We doucment that after the adoption of SFAS No. 123R, financially constrained firms become less underinvested, and firms with large cash holdings and firms with low percentage of sophisticated investors become less overinvested. These results lend further support to the conjectures that the recognition of previously disclosed ESO expense (1) improves financial reporting quality, which in turn enhances investment efficiency by mitigating information asymmetry problem between insiders and outsiders (Myers and Majluf 1984; Bens and Monahan 2004; Biddle et al. 2009), and (2) reduces the cost of accessing ESO expense information by inattentive investors (Hirshleifer and Teoh 2003).

Finally, we examine a sample of firms that voluntarily recognized ESO expense prior to SFAS No. 123R. We find that this set of firms experienced an improvement in investment efficiency around the time they started to voluntarily recognize ESO expense at fair value, but not when SFAS No. 123R became mandatory. Taken together, these findings are consistent with the recognition of previously disclosed ESO cost improving investment efficiency.

This study contributes to three strands of literature in accounting. First, we add to research in the recognition-versus-disclosure literature. We examine the implications of recogniton versus disclosure for investment efficiency, thereby avoiding the research design issues associated with using stock prices or returns in the value-relevance-based studeis (e.g., Amir 1993; Aboody 1996; Davis-Friday et al. 1999 and 2004; Cotter and Zimmer 2003; Ahmed et al. 2006; Bratten et al. 2013; Yu 2013; Michels 2013). Another line of studies direclty examines the bias and accuracy of ESO fair-value estimates (Hodder et al. 2006; Johnston 2006; Choudhary 2011). Since actual ESO fair values are unknown, their results are senstive to the choice of the fair-value benchmarket. In sum, we provide triangulating evidence that complements evidence from these prior studies that disclosure is not a substitute for recognition.

Second, our study augments the literature on the relationship between financial reporting quality and investment efficiency. Our study differs from prior studies in that we focus only on the financial reporting for ESOs, while prior studies examine financial reporting quality in general (which is difficult to measure). By focusing on the adoption of a specific accounting standard (SFAS No. 123R), we can better identify any change in financial reporting quality.[2] Third, we add to the ESO accounting debate. The accounting for ESOs has been a controversial subject (e.g., see Zeff and Dharan 1997; Cohn 1999; Morgenson 2000a,b). There have been concerns that the absence of ESO expense would result in security mispricing (Guay et al. 2003) and allow executives to extract excessive compensation (Hall and Murphy 2003; Carter et al. 2007). On the other hand, the effects of ESO-related accounting considerations have been widely examined (e.g., see Bens et al. 2002, 2003; Carter and Lynch 2003; Choudhary et al. 2009; Carter et al.

[2] Shroff (2012) examines 44 new accounting standards to identify changes in managers' information sets that lead to improvement in corporate investment decisions.

2007; Brown and Lee 2011). We add to this literature by showing that the recognition of formerly-disclosed ESO expense enhances investment efficiency.

The next section reviews the literature and develops testable hypotheses. Section 3 describes the data. Section 4 examines whether the recognition of previously disclosed ESO expense affects investment efficiency. Section 5 evaluates the two theories on the different effects of recognition versus disclosure around the adoption of SFAS No. 123R. Section 6 examines a sample of firms that voluntarily recognized ESO expense before being required to do so. Section 7 documents the results of additional empirical analyses. Section 8 concludes.

2. Background and Hypotheses

Statement of Financial Accounting Concepts (SFAC) No. 5 (FASB 1984) defines recognition as "the process of formally recording or incorporating an item into the financial statements… with the amount included in the totals of the financial statements (para. 6)." It states that "some useful information is better provided by financial statements and some is better provided, or can only be provided, by notes to financial statements… (para. 7)." While some note disclosures include additional information about the items recognized in the financial statement, other notes include information that is relevant, but does not meet all recognition criteria.[3] SFAC No. 5 further clarifies that disclosure of information about financial statement items "is not a substitute for recognition in financial statements for items that meet recognition criteria" and that "the most useful information… should be recognized in the financial statements (para. 9)."

[3] SFAC No. 5, paragraph 63 states that an item should be recognized when four criteria are met: It is an element of financial statements (definitions), it has a relevant attribute measurable with sufficient reliability (measurability), the information about it is capable of making a difference in decision making (relevance), and the information is representationally faithful, verifiable, and neutral (reliability).

Finally, Schipper (2007, p. 307) argues that "disclosure is sometimes intended to compensate for recognition and/or measurement that requires (or permits) a less preferred accounting treatment."[4]

2.1. Theories and Prior Research

Extant theories provide two explanations for why recognition and disclosure have different effects on real investment. They are based on how managers prepare, auditors audit, or investors use disclosed and recognized information differently. First, managers and auditors place less emphasis on disclosed than recognized information and, as a result, disclosed amounts are less reliably measured than recognized amounts (Bernard and Schipper 1994; Libby et al. 2006). This implies that recognition is associated with higher investment efficiency than is disclosure. This implication is based on the accounting literature that earnings quality enhances investment efficiency (e.g., Bushman and Smith 2001; Bens and Monahan 2004; McNichols and Stubben 2008; Hope and Thomas 2008; Biddle et al. 2009; Balakrishnan et al. 2014). The second reason that recognition and disclosure have different effects on investment is that investors treat or process recognized information and disclosed information differently. Hirshleifer and Teoh (2003) analyze the effect of investor inattention on stock valuation. They show that if a firm only discloses ESO expense, inattentive investors will overvalue the firm, allowing it to issue overpriced equities and fund additional investment.

Many empirical studies have examined whether recognized and disclosed amounts exhibit different properties, as well as whether and why financial statement users treat recognized and disclosed items differently. The first set of these studies uses the value-relevance methodology to examine the market pricing of recognized and disclosed information. In general, they find that the

[4] Schipper (2007) gives SFAS No. 123 as an example, and observes that political pressures and lobbying could play a role in these types of exceptional cases, when accounting standard setters reject the recognition of a conceptually preferred treatment in favor of disclosure.

market puts more weight on recognized amounts than disclosed amounts, consistent with recognized items being more reliably measured than disclosed items (e.g., Amir 1993; Aboody 1996; Ahmed et al. 2006; Davis-Friday et al. 1999 and 2004; Cotter and Zimeer 2003; Michels 2013).[5] Israeli (2014) attribute the small valuation weights on disclosed items to the fact that disclosed amounts have weaker correlations with future changes in operating cash flows than recognized amounts have. Yu (2013) documents that greater institutional ownership and analyst followings reduce the valuation difference between disclosed and recognized information, lending support to the notion that inattentive investors induce the pricing difference. Similarly, Muller et al. (2013) find that the pricing difference between disclosed and recognized fair values disappear for firms with more analyst following and external appraisals of the fair value estimates. However, research design issues associated with using stock prices and returns have made it difficult to interpret the results (e.g., Kothari and Zimmerman 1995; Barth et al. 2003; Holthausen and Watts 2001; Schipper 2007).[6] We contribute to this literature by instead examining the implications of recognition versus disclosure for investment efficiency, without using stock prices/returns in our tests.

The second set of studies directly investigates the bias and accuracy of ESO fair-value estimates. Hodder et al. (2006) examine disclosed ESO fair-value estimates in the SFAS No. 123 period. They find that some managers use their discretion over ESO valuation inputs to understate ESO fair values, but almost half of their sample firms use discretion to increase ESO fair values. Johnston (2006) compares disclosed ESO expense with voluntarily recognized ESO expense using

[5] After holding reliability and processing cost constant, Bratten et al. (2013) show that the association between cost of capital proxies and operating lease obligations calculated from note information is not significantly different from that between the proxies and recognized capital lease obligations.

[6] Issues include whether the regression model should be in level or changes, whether the accounting variables should be in level, changes, or both, whether the regression model adequately controls for other factors that affected stock prices or stock returns, whether the estimated coefficients are different form the theoretical values, etc.

SFAS No. 123 data. He finds that firms that voluntarily recognize ESO expense manipulate their ESO fair values downward by understating the volatility used in computing ESO fair values. Choudhary (2011) compares the properties of recognized ESO fair values per SFAS No. 123R to either the disclosed values or the voluntarily recognized values under SFAS No. 123. She shows that firms understate mandatorily recognized ESO expenses by using a lower volatility value, but such a bias has an insignificant effect on the accuracy of the estimates. Further, she finds no significant difference in the biases of mandatorily and voluntarily recognized values, but the fair-value estimates are more accurate under mandatory recognition. A limitation of this approach is that actual ESO fair values are not known and, therefore, researchers have to estimate ESO fair values based on the most objective assumptions. As a result, the tests are sensitive to the choice of the fair-value benchmark.[7] In contrast, we infer changes in the quality of ESO expense estmiates through changes in firms' investment.

In the third set of studies, Libby et al. (2006) conduct an experiment with the assistance of 44 Big 4 audit partners and find that these auditors tolerate more misstatements in disclosed ESO expenses than they do for the same amounts of recognized ESO expenses. However, they caution that managers may misstate recognized ESO expense more than disclosed amounts, thereby reducing the net effect of recognition on reliability. Recently, Clor-Proell and Maines (2014) have found that Chief Financial Officers and Controllers exert more effort and exhibit less intentional bias when making estimates for recognized liability than for disclosed liability. Taken together, these two studies suggest that both managers and audiotrs put more effort on recognized items than disclosed items. However, the net effect of recognizing previously disclosed item on

[7] For example, Choudhary (2011) finds no improvement in the accuracy of volatility input after SFAS No. 123R when historical or implied volatility is used as the benchmark, but documents an improvement when using realized volatility as the benchmark.

reliability is still an open question, because the incentive of managers to manipulate the recognized numbers may outweigh the effect of increased efforts. Our study examines the effect the recongiton of ESO expense has on investment efficiency to infer whether recgnition has a positive net effect on earnings quality.[8]

2.2. Empirical Setting

In this study, we investigate whether recognition and disclosure are different by examining whether the recogniton of formerly disclsoed ESO expense, as required by SFAS No. 123R, affects investment efficiency. Prior to SFAS No. 123R, SFAS No. 123 allowed companies to expense ESO grants either at fair value or at intrinsic value with supplementary fair value disclosure. However, almost all companies chose the latter accounting treatment. SFAS No. 123R requires firms to recognize ESO expense at fair value, thereby taking away the choice to simply disclose it in a note to financial statements.

We select SFAS No. 123R to test our hypotheses, because it provides a powerful and clean setting for us to test for the different effects of recognition and disclosure. First, ESO expense is a big component of earnings and, therefore, any improvement in the measurement of ESO expenses as a result of applying SFAS No. 123R will have a material effect on the quality of earnings numbers. Specifically, Standard & Poor's (S&P) estimated that the recognition of ESO expenses

[8] Three studies uses firms' questioning of the reliability of ESO fair-value estimates to infer whether disclosed items are less reliably measured than recognized items. Frederickson et al. (2006) study user assessments of ESO expenses under SFAS No. 123 and SFAS No. 123R. They find that sophisticated users consider ESO expenses recognized under SFAS No. 123R to be more reliable than those disclosed or voluntarily recognized. Moreover, in a comparison of two ESO expense disclosures, one with disavowal of the reliability of the fair-value estimate and one without, user assessments of the reliability of the disclosed ESO expense are lowered by the disavowal. Blacconiere et al. (2011) document that 13.6% of their sample firms question the reliability of the disclosed ESO fair values in the pre-SFAS No. 123R period, and that these disavowal disclosures are informative, rather than opportunistic. They further find that only 23 of the 96 disavowal firms continued to do so after the adoption of SFAS No. 123R. Core (2011) also documents that the percentage of disavowal firms drops from 14.3% in the SFAS No. 123 period to 9.9% in the SFAS No. 123R period. However, Core (2011) cautions that the results may be attributed to the higher cost of disavowing recognized items than of questioning disclosed items and to the fact that the disavowal disclosures are opportunisitc. Our approach provides a more objective examination of whehter the quality of earnings improves after ESO costs are required to be expensed at fair value.

would reduce the earnings per share (EPS) for the S&P 500 companies by 8.6% and 7.4% in 2003 and 2004, respectively (Taub 2004). For the 100 fastest-growing U.S. companies, Botosan and Plumlee (2001) find that the effect of expensing ESO costs at fair value would reduce diluted EPS by an average of 45.4%, with 48% of these firms reporting at least a 10% drop in their diluted EPS.

Second, the documented effect, if any, is more likely attributed to the change in accounting treatment of ESOs, rather than to the heightened awareness of the deficiency in the prior accounting treatment (Schipper 2007). This is because the accounting for ESOs has been a contentious issue since the early 1990s (see, e.g., FASB 1993; Dechow et al. 1996; Zeff and Dharan 1997). Hence, the deliberation leading to the passage of SFAS No. 123R was not likely to draw additional attention to the real cost of ESOs and alter how companies incorporated ESO cost in their investment decisions.

Third, companies may respond to restrictive accounting rules by altering the use of the items being affected by the proposed rules. In fact, research has shown that companies reacted to the adoption of SFAS No. 123R by accelerating the vesting of ESOs (Balsam et al. 2008; Choudhary et al. 2009) or reducing the use of ESOs (Carter et al. 2007; Brown and Lee 2011; Hayes et al. 2012; Skantz 2012). If the favorable accounting treatment of ESOs prior to SFAS No. 123R distorted managerial incentives (Hall and Murphy 2002), the reduction in ESO usage would improve investment efficiency. Nonetheless, this effect is not likely to confound our tests, because Hayes et al. (2012) have documented that the drop in ESO use induced by SFAS No. 123R did not lead to a significant change in investment. To further ensure that our results are not affected by the reduced use of ESOs, we also explicitly control for ESO incentives in the estimation of investment efficiency.

2.3. Testable Hypotheses

We conjecture that the mandatory recognition requirement per SFAS No. 123R will improve the investment efficiency of companies that used to merely disclose ESO expense. It also follows that heavy ESO users will be affected more than light users of ESOs from this change in the accounting treatment of ESOs, because their reported earnings will be affected more than those of the light ESO users.

H1a: After the mandatory recognition of ESO expense per SFAS No. 123R, firms experience an improvement in investment efficiency.

H1b: After the mandatory recognition of ESO expense per SFAS No. 123R, heavy ESO users experience more improvement in investment efficiency than light ESO users.

After establishing the association between investment efficiency and recognition of ESO expense, we explicitly test the above two explanations. If the improvement in investment efficiency is due to the enhanced quality of financial information through the reporting of ESO expense at fair value, firms with noiser ESO fair-value estimates prior to SFAS No. 123R will exhibit a larger improvement in investment efficiency. We note that this is a joint test of the conjectures that recognized values are more reliable than disclosed amounts and financial reporting quality is positively associated with investment efficiency. On the other hand, the differential effects on investment of recognition and disclosure of ESO expense can be due to the fact that investors treat or process recognized information and disclosed information differently. Specifically, the analysis of Hirshleifer and Teoh (2003) implies that the recognition of ESO expense mitigates overvaluation and, hence, overinvestment, caused by inattentive investors. We state the following set of hypotheses:

H2: After the mandatory recognition of ESO expense per SFAS No. 123R, firms with less reliable estimates of ESO fair values experience a larger improvement in investment efficiency than their counterparts.

H3: After the mandatory recognition of ESO expense per SFAS No. 123R, firms with more inattentive investors experience a larger improvement in investment efficiency than their counterparts.

Next we explore the cross-sectional variations in the effect of recognizing previously disclosed ESO expense on investment efficiency to shed light on the specific mechanisms through which the recognition of ESO expense improves investment efficiency. Regarding the quality of financial information, we focus on two channels that have been identified by the literature thus far. The first strand of this literature (e.g., Biddle et al. 2009; Balakrishnan et al. 2011) is motivated by Myers and Majluf (1984), which examines a setting in which better-informed managers have the incentive to sell overpriced securities and less-informed investors protect their interests by discounting the firms' shares. As firms refrain from selling stocks at discounted prices, they underinvest. We predict that firms that are more severely financially constrained (and as a result, more subject to underinvestment problem) would be more likely to mitigate underinvestment after the adoption of SFAS 123R, and similarly, the improvement in investment efficiency is more pronounced for heavy users of ESOs. This leads to the following hypotheses (in alternative form):

H2.1a: After the adoption of SFAS No. 123R, (underinvesting) financially constrained firms experience an improvement in investment efficiency.

H2.1b: After the adoption of SFAS No. 123R, the effect of financial constraint on investment efficiency is more pronounced for heavy ESO users than for light ESO users.

The second strand of literature is motivated by the managerial incentive to build empires at the expense of shareholders (e.g., Bens and Monahan 2004; Biddle et al. 2009; Hope and Thomas 2008). These studies hypothesize and find that better monitoring of managers via higher quality earnings reports mitigates such a moral hazard problem. We conjecture that firms with large cash holdings are more likely to overinvest (i.e., engage in empire building). Better monitoring of

managers via high-quality earnings reports after the adoption of SFAS 123R will better reduce overinvestment for these firms. This leads to the following hypotheses (in alternative form):

H2.2a: After the adoption of SFAS No. 123R, (overinvesting) firms with large cash holdings experience an improvement in investment efficiency.

H2.2b: After the adoption of SFAS No. 123R, the effect of cash holdings on investment efficiency is more pronounced for heavy ESO users than for light ESO users.

Finally, we examine the investor earnings fixation channel. Hirshleifer and Teoh (2003) analyze the effect of investor inattention on stock valuation. They show that when ESO expenses are only disclosed, inattentive investors overvalue firms, allowing these firms to issue overpriced equities for funding greater investment. These firms will appear to be overinvested based on their underlying fundamentals. Consistent with this conjecture, Yu (2013) documents that recognition increases the value relevance of formerly disclosed items, but the increases are less pronounced for firms with a higher level of institutional ownership and analyst following. Moreover, Michels (2013) finds that investors react to subsequent event disclosures with a delay. Hence, the recognition of previously disclosed information will mitigate mispricing and overinvestment induced by inattentive investors. We hypothesize:

H3.1a: After the adoption of SFAS No. 123R, (overinvesting) firms with inattentive investors experience an improvement in investment efficiency.

H3.1b: After the adoption of SFAS No. 123R, the effect of inattentive investors on investment efficiency is more pronounced for heavy ESO users than for light ESO users.

3. Data

The initial sample includes all industrial companies in the *ExecuComp* database, covering the period 1994–2010. We start the sample in 1994 because that is the first year that the database has complete data on the S&P 1,500 firms, including those in the S&P 500, S&P Midcap 400, and

S&P Smallcap 600. We retrieve financial statement data from *Compustat* and stock price data from *CRSP*.

Prior to SFAS No. 123R, SFAS No. 123 (FASB 1995) allowed companies to expense ESO costs using either the fair value approach or the intrinsic value approach with supplementary fair value disclosure.[9] SFAS No. 123R (2004) requires companies to recognize ESO expense at fair value and drops the fair value disclosure option. SFAS No. 123R became effective in the first fiscal year beginning after June 15, 2005. Hence, we define the pre-SFAS No. 123R period to include the fiscal years 1994 to 2005. The post-SFAS No. 123R period covers fiscal years beginning after June 15, 2005 and up through fiscal year 2010.

Table 1 reports summary statistics on firm characteristics over the sample period. Following prior studies, we set R&D expense to zero if it is missing in *Compustat*, because companies are not required to disclose their R&D expenses if they are immaterial. R&D expense is on average $99.13 million. Both the mean and median amounts of capital expenditure are larger than those of R&D. Average firm total investment (defined as the sum of R&D and capital expenditure, net of proceeds from sales of property, plant, and equipment) is $391.61 million. Mean sales and assets are $4.4 billion and $4.7 billion, respectively. The average market value of equity is $6.0 billion.

[9] A KPMG survey found that under SFAS No. 123, a majority of the U.S. companies granted their ESOs at the money (hence, intrinsic value is zero) and selected the intrinsic value approach to calculate employee stock option expense. Li and Wong (2005) document that only two of their S&P 500 industrial companies chose the fair value approach to expense the cost of ESOs during the period 1996-2001.

4. Investment effect of recognizing previously disclosed ESO expense

In this section, we examine whether recognizing ESO expense in financial statements has an effect on real investment. We first model investment in section 4.1, and then in section 4.2 use the estimated residual to study the effect of recognition on abnormal investment.

4.1. Modeling corporate investment

We estimate the following investment equation over the sample period as a function of firm-specific and economy-wide characteristics:

$$INV_t = a_0 + a_1 MB_t + a_2 SURCH_t + a_3 LOGTENURE_t + a_4 CASHCOMP_t + a_5 VEGA_t + a_6 DELTA_t + a_7 LOGSALES_t + a_8 LOGSALES^2{}_t + a_9 GROWTH_t + a_{10} LEV_t + a_{11} ARET_t + a_{12} STDROA_t + a_{13} MRET_t + a_{14} GDPG_t + \varepsilon_t \quad , \qquad (1)$$

where the dependent variable, *INV*, is the sum of R&D expense and capital expenditure, less the proceeds from sales of property, plant, and equipment, deflated by total assets.

The specification of the regression model (1) follows the spirit of Servaes (1994), Bhagat and Welch (1995), and Coles et al. (2006). We use the market-to-book ratio, *MB*, and surplus cash, *SURCH*, to capture the firm's investment opportunities and availability of funds, respectively. *MB* is calculated as total assets, minus book value of common shares plus market value of common shares, scaled by total assets. *SURCH* is net cash flow from operating activities, minus depreciation and amortization plus R&D expense, scaled by total assets. Both *MB* and *SURCH* are expected to have a positive association with investment. The CEO's level of risk aversion is proxied by his/her tenure, *LOGTENURE*, and cash compensation, *CASHCOMP*. *LOGTENURE* is the natural logarithm of the number of years since the CEO first became the CEO of the firm. *CASHCOM* is total current salary and bonus, scaled by total compensation.

Berger et al. (1997) argue that entrenched CEOs, characterized by longer tenures and higher cash compensation, are less likely to take on risky projects. However, Guay (1999) argues that CEOs with higher cash compensation take on more risky projects, as they can easily diversify their portfolios. Hence, we expect *LOGTENURE* to exhibit a negative association with investment, but have no prediction on the sign of the estimated coefficient on *CASHCOMP*.

We control for the effects of CEO equity incentives, *VEGA* and *DELTA*, on investments. Balsam et al. (2008) and Choudhary et al. (2009) show that firms accelerate the vesting of ESOs. Carter et al. (2007), Brown and Lee (2011), Hayes et al. (2012), and Skantz (2012) find that firms respond to SFAS No. 123R by reducing the use of ESOs. Hence, we control for the effect that this drop in CEO equity incentives may have on investments, even though Hayes et al. (2012) find that the drop in ESO usage did not lead to a significant change in corporate investment after the adoption of SFAS No. 123R. *VEGA*, or option vega, the sensitivity of the value of the CEO's option holding to stock return volatility, is measured as the change in the dollar value (in millions) of the CEO's option holding for a 1% change in the annualized standard deviation of the firm's stock returns. *DELTA*, the sensitivity of CEO wealth to stock price, is the change in the dollar value (in millions) of the CEO's stock and option holdings for a 1% change in the stock price.

Other control variables are as follows. We use the logarithm of sales, *LOGSALES*, and the squared term of *LOGSALES*, $LOGSALES^2$, to proxy for firm size, and the growth in annual sales, *GROWTH*, to proxy for growth. Capital structure is proxied by *LEV*, which is total long-term debt divided by the sum of total long-term debt plus market value of common shares. The one-year holding period stock return, *ARET*, controls for managerial expectation of future prospects, and time- and firm-specific stock market conditions. The standard deviation of *ROA* in the past five years, *STDROA*, captures the riskiness of the firm. Finally, we use annual market return, *MRET*,

and growth in the domestic gross product, *GDPG*, to control for time-varying economy-wide factors that could affect firm investment. The construction of these regression variables is summarized in the appendix.

Table 2, panel A, shows descriptive statistics for these variables. *INV* is on average 9.7%. *MB* is on average 2.057 and mean *SURCH* is 8.8%. Average *LOGTENURE* is 1.639 and mean *CASHCOM* is 45.3%. *LOGSALES* is on average 7.127, while *GROWTH* averages 9.1% per year. Average *LEV* is 17.6%. Average *ARET* is 16.0%, and *STDROA* is on average 4.7%. *VEGA* and *DELTA* have means of 0.141 and 1.597 respectively. *MRET* and *GDPG* average 9.9% and 2.5% per year, respectively. Panel B reports the correlation matrix of the variables. As found in prior studies, these variables are generally correlated with one another at less than the 10% level, but the magnitudes of the correlation are not large. Only the following pairs have correlation coefficients larger than 0.5 in absolute value: *SURCH* and *MB*, *LEV* and *MB*; and *VEGA* and *CASHCOM*.

To account for unobservable heterogeneity across industries, we estimate equation (1) over the entire sample period 1994-2010 for each of the twelve Fama-French industry groups. The regressions are estimated using all companies with nonmissing data.[10] Table 3 reports the means and *t*-statistics of the estimated coefficients across the twelve industry groups.

The estimated coefficients on *MB* and *SURCH* are, respectively, 0.010 and 0.147, both exhibiting significant association with *INV*. These findings suggest that firms invest more when they have more investment opportunities and sufficient cash flows. Consistent with managerial risk aversion, *CASHCOMP* exhibits a negative association with *INV*. Furthermore, investment is

[10] Our sample includes firms that mandatorily adopted SFAS 123R in 2006 and firms that voluntarily started to recognize ESO expense in 2002 and 2003. If we exclude the latter set of firms from the estimation of equation (1), the results are qualitatively similar to those reported. We examine this subsample of firms separately in section 6.

significantly lower for firms with high CEO option vega (*VEGA*) and high past stock return (*ARET*) as well as for large firms (*LOGSALES*), but significantly higher for riskier firms (*STDROA*). Finally, total investment is also affected by macroeconomic conditions, as shown by the significant and positive coefficients on market return (*MRET*) and GDP growth (*GDPG*).

4.2. Abnormal investment in the pre- and post-SFAS No. 123R periods

We capture abnormal investment, *AbnINVEST*, using the residual from the estimated equation (1). We also partition our sample firms into over- and under-investing firms based on whether firms have positive or negative *AbnINVEST*. We focus on firms that mandatorily expense the fair value of ESOs per SFAS No. 123R in the main part of the analysis. We analyze firms that chose to recognize ESO expense in 2002 and 2003 in section 6. If the recognition of previously disclosed ESO expenses improves investment efficiency, we expect the extent of both over- and under-investment to be mitigated after the adoption of SFAS No. 123R. Our measure of abnormal investment, *AbsAbnINV*, is calculated as the absolute value of *AbnINVEST*. Moreover, *AbsAbnINV+* and *AbsAbnINV-* are the absolute value of *AbnINVEST* for overinvested firms and underinvested firms, respectively.

Table 4 reports the summary statistics of our estimates of abnormal investments for both the pre- and post-SFAS No. 123R periods. Panel A shows that mean (median) abnormal investment, *AbsAbnINV*, is 0.045 (0.034) in the pre-SFAS No. 123R period, compared with 0.040 (0.032) in the post-SFAS No. 123R period. The differences are statistically significant (*t*-statistic = -9.145 and z-statistic = -5.976), suggesting that abnormal investment is moved closer to zero after SFAS No. 123R.

The statistics for the over- and under-investing subsamples tell the same story. Specifically, moving from the disclosure regime to the recognition regime, mean abnormal

overinvestment, *AbsAbnINV+*, decreases significantly from 0.054 to 0.046, while mean abnormal underinvestment *AbsAbnINV–*, decreases significantly from 0.039 to 0.037. The same is also true for the medians. In sum, the results presented in table 4 are consistent with hypothesis H1 that the requirement of SFAS No. 123R to recognize ESO expense in the financial statements is associated with improvement in investment efficiency.

We formally test hypothesis H1a using the following regression equations:

$$Dep\ Var_t = b_0 + b_1 POST_t + d_i + \varepsilon_t \qquad (2)$$

where *Dep Var* is *AbsAbnINV*, *AbsAbnINV+,* or *AbsAbnINV-*. *POST* is an indicator variable that is set to one for years 2006 – 2010, and zero otherwise. We control for industry fixed effects by including twelve indicator variables, d_i (i=1,… ,12), for the twelve Fama-French industry groups. We calculate *t*-statistics using standard errors clustered by firm and year.

Table 5, column (1) summarizes the results from the estimation of equation (2) for the full sample. The estimated coefficient on *POST* is statistically negative (-0.006 with a *t*-statistic of -3.41), suggesting a significant decrease in the absolute value of abnormal investment (*AbsAbnINV*) in the post-SFAS No. 123R period. Hence, this result is consistent with the prediction of hypothesis H1.

To provide further evidence that the results documented for the full sample under column (1) are indeed attributable to the required expensing of ESO grants per SFAS No. 123R, we investigate whether the effect on improvement in the investment efficiency is more salient for firms that are heavy ESO users. Hence, we re-estimate equation (2) on two subsamples. We calculate ESO usage for each firm as the average of ESO expense divided by total assets over the period 1994–2005. The Low-ESO (High-ESO) subsample consists of firms with ESO expense less (greater) than the sample median. We expect the estimated coefficient on *POST* to be more

negative in the High-ESO subsample than that in the Low-ESO subsample. The subsample test results for the estimation of equation (2) are reported under columns (2) and (3) of table 5. They show that the estimated coefficient on *POST* is significantly negative (-0.011 with *t*-statistic of -4.83) for High-ESO firms, but insignificant (-0.002 with *t*-statistic of -1.01) for Low-ESO firms. A formal test of the difference in the estimated coefficients on *POST* between the High- and Low-ESO subsamples shows that the difference is statistically significant in the predicted direction (-0.009 with a *t*-statistic of -6.79). In sum, these results are consistent with the predictions of hypothesis H1b.

Next we examine whether overinvesting and underinvesting firms are affected by the mandatory recognition requirement differently. If recognition of ESO expense improves accounting quality by providing more reliable fair value estimates, we expect to see improvement in investment efficiency in both over- and under-investing firms, and the improvement should be more pronounced for heavy ESO users. Table 5 columns (4) and (5) report that the estimated coefficient on *POST* is highly significant for overinvesting firms that are heavy ESO users (-0.014 with a *t*-statistic of -4.03), but this is not the case for overinvesting firms that are light ESO users (-0.005 with a *t*-statistic of -1.46). The difference in the coefficients on *POST* between the High- and Low-ESO subsamples is -0.009 and is significant at the 1% level (*t*-statistic of -3.48). The results for underinvesting firms, reported under columns (6) and (7), are qualitatively similar to those for overinvesting firms. Specifically, the estimated coefficient on *POST* is highly significant for underinvesting firms that are heavy ESO users (-0.008 with a *t*-statistic of -3.46), while this coefficient is not significantly different from zero for light ESO users (0.001 with a *t*-statistic of 0.49), and the difference in the coefficients on *POST* between the High- and Low-ESO subsamples is -0.009 (*t*-statistic of -5.40).

Taken together, the results presented in table 5 are consistent with SFAS No. 123R enhancing investment efficiency by reducing both over- and under-investment. The documented effects are concentrated on firms that are heavy ESO users, providing some assurance that the improvement in investment efficiency can be attributed to the change in the accounting for ESOs under SFAS No. 123R.

5. Cross-sectional variations in the investment effect of recognizing previously disclosed ESO expense

5.1. Estimate reliability versus investor (in)attention

In this section, we investigate the two reasons why the recognition of formerly disclosed ESO expense per SFAS No. 123R enhances investment efficiency: (1) mandatory recognition increases the reliability of ESO expense, and (2) mandatory recognition mitigates earnings fixation by inattentive investors.

To capture the reliability of the estimated ESO expense, we focus on one important input companies used to calculate the fair value of ESOs: the volatility of the underlying stocks. Prior research shows that volatility estimation involves substantial discretion (Bartov et al. 2007; Choudhary 2011; Blacconiere et al. 2011). Following Blacconiere et al. (2011), we construct variables to capture four situations that make it difficult for a firm to estimate its stock volatility. First, if the firm's shares have a short trading history, the distribution of its historical volatility is largely unknown. We define *TRADE<5* to be an indicator variable equal to one if the firm's shares have been traded publicly for fewer than five years, and zero otherwise. Second, the standard deviation of the firm's volatility distribution is large. We capture this factor by *STDHVOL,* which is the logarithm of the standard deviation of the volatility over the past five

years. Annual volatility is calculated from CRSP monthly stock returns scaled by historical volatility, measured as the standard deviation of past 60 monthly returns.[11] Third, the firm has no long-term traded options and, therefore, a firm-specific measure of long-term implied volatility cannot be computed. We create an indicator variable, *NOTRADEOPT,* which equals one if the firm does not have traded stock options with expiration dates at least 365 days from the beginning of the fiscal year, and zero otherwise. Finally, a firm has an estimate of long-term implied volatility that is significantly different from its historical volatility. We capture this situation using *DIFFVOL,* defined as the logarithm of the absolute difference between historical volatility and implied volatility. We measure historical volatility as the standard deviation of past 60 monthly returns. Furthermore, we extract the first principal component from *TRADE<5*, *STDHVOL*, *NOTRADEOP*, and *DIFFVOL* to construct a composite measure, *UNREL*, to capture the noise (lack of reliability) in estimating volatility in the pre-SFAS No. 123R period. We create an indicator variable *HUNREL*, which takes the value of one for firms with above median *UNREL*, and zero otherwise.

We use the size of institutional investor holdings and the number of analyst followings to capture the extent of investor inattention. *INSTINV* is the proportion of a firm's shares outstanding that is owned by institutional investors, multiplied by -1 (so a high value means more inattentive investors), and *ANALYINV* is the logarithm of 1 plus the number of analysts following the firm, multiplied by -1. We also construct a composite measure of investor inattention, *INATTN*, by extracting the first principal component from *INSTINV* and *ANALYINV*. Finally, we create an

[11] If the firm has traded for fewer than 60 months, we calculate historical volatility over the firm's trading history. If a firm has insufficient trading history to calculate annual volatility for the prior five years, we set this variable equal to the industry mean (Fama and French 48 categories) for that year.

indicator variable, *HINATTN*, equal to one for firms with *INATTN* above the sample median, and zero otherwise.

Table 6 panel A reports the summary statistics for these variables. *UNREL* has a mean of zero and standard deviation of 1.060. Around 4% of the firms have trading histories of less than five years, and 77% of the firms do not have traded stock options with expiration dates at least 365 days from the beginning of the fiscal year. The average standard deviation of the past five annual volatilities is 0.25, and the mean absolute difference between historical volatility and implied volatility is 0.28. On average, 34.1% of the shares outstanding is held by institutional investors.

We conduct the cross-sectional tests using the following regression models, which control for industry fixed effects with twelve indicator variables, d_i (i=1,… ,12), for the twelve Fama-French industry groups:

$$Dep\ Var_t = c_0 + c_1 POST_t + c_2 HUNREL_t + c_3 POST_t \times HUNREL_t + c_4 HINATTN_t + c_5 POST_t \times HINATTN_t + d_i + \varepsilon_t \ , \quad (3a)$$

$$Dep\ Var_t = c_0 + c_1 POST_t + c_2 TRADE < 5_t + c_3 POST_t \times TRADE < 5_t + c_4 STDHVOL_t + c_5 POST_t \times STDHVOL_t + c_6 NOTRADEDOPT_t + c_7 POST_t \times NOTRADEDOPT_t + c_8 DIFFVOL_t + c_9 POST_t \times DIFFVOL_t + c_{10} INSTINV_t + c_{11} POST_t \times INSTINV_t + c_{12} ANALYINV_t + c_{13} POST_t \times ANALYINV_t + d_i + \varepsilon_t \ , \quad (3b)$$

where *Dep Var* is *AbsAbnINV*, *AbsAbnINV+*, or *AbsAbnINV-* Since the recognition of ESO expense only affects ESO users (which is supported by the results reported in table 5), we estimate these two equations for the subsample of firms that are heavy ESO users (i.e., the High-ESO firms in the previous section).

Table 6, columns (1) – (3) in panel B report the estimation results using the composite measures of (un)reliability and investor inattention. When the absolute value of abnormal investment, *AbsAbnINV*, is the dependent variable (column 1), the coefficient estimate on *HUNREL* is highly significant and positive (0.010 with a *t*-statistic of 6.70), suggesting that the more unreliable the estimate of the ESO expense, the lower the investment efficiency in the pre-SFAS No. 123R period. Similarly, the estimated coefficient on *HINATTN* is significantly positive (0.008 with a *t*-statistic of 4.41), suggesting that investor inattention is associated with investment inefficiency. Our main focus, the effect of SFAS No. 123R mandatory recognition on investment efficiency, is captured by the two interaction variables, *POST*×*HUNREL* and *POST*×*HINATTN*. The statistically negative coefficient estimates, -0.004 on *POST*×*HUNREL* (*t*-statistic of -2.34) and -0.010 on *POST*×*HINATTN* (*t*-statistic of -4.38), indicate that the switch from disclosure to recognition of ESO expense moves abnormal investment toward zero for firms with above median volatility estimation noise (unreliability) and investor inattention. These results are consistent with the predictions of hypotheses H2 and H3.

The results for the overinvesting and underinvesting subsamples are summarized in columns (2) and (3). Specifically, the estimated coefficient on *POST*×*HUNREL* is significant and negative for the underinvesting firms, but not significant for the overinvesting firms. This implies that improvement in investment efficiency from the increased reliability of ESO estimates after mandatory recognition comes mainly from the underinvesting firms. One potential explanation is that the lower accounting quality (arising from less reliable ESO expense estimates) deters investors from buying the company's shares, creating an underinvestment problem. This problem is mitigated when earnings quality is improved after the adoption of SFAS No. 123R. On the other hand, the estimated coefficient on *POST*×*HINATTN* is statistically negative in the overinvesting

subsample (-0.017 with a *t*-statistic of -7.44), but insignificant in the underinvesting subsample (-0.004 with a *t*-statistic of -1.33). These results are consistent with mandatory recognition per SFAS No. 123R mitigating overinvestment induced by inattentive investors ignoring disclosed ESO expenses (Hirshleifer and Teoh 2003).

Table 6, columns (4) – (6) in panel B report the estimation results using the individual components of the unreliability and investor attention measures. The regression results are largely similar to those using the composite measures reported under columns (1) – (3). Among the four individual reliability measures, two of the measures exhibit the expected effect on abnormal investment. Specifically, the estimated coefficients on *POST*×*NONTRADEOPT* and *POST*×*DIFFVOL* are statistically negative in both the full sample and the underinvesting subsample. Moreover, both individual measures of investor inattention display the expected effects on investment efficiency. The estimated coefficients on *POST*×*INSTINV* and *POST*×*ANALYINV* are negative and significant in both the full sample and the overinvesting subsample. These results lend further support to hypotheses H2 and H3.

5.2. Mechanisms through which recognition and disclosure have differential real effects

Prior studies show that a higher earnings quality mitigates underinvestment by financially constrained firms (Myers and Majluf 1984; Biddle et al. 2009; Balakrishnan et al. 2014) and overinvestment by firms with large cash holdings (Bens and Monahan 2004; Biddle et al. 2009; Hope and Thomas 2008). Furthermore, if recognition of ESO expense improves investment efficiency through heightened awareness of such expenses by (particulary inattentive) investors, then the improvement in investment efficiency should be mainly concentrated on overinvesting firms. We examine these specific mechanisms using the cross-sectional regression model below:

$$
\begin{aligned}
AbsAbnINV_t = {} & c_0 + c_1 UnderINV + c_2 POST_t \times OverINV + c_3 POST_t \times UnderINV \\
& + c_4 OverINV \times HFINCR_t + c_5 UnderINV \times HFINCR_t \\
& + c_6 POST_t \times OverINV \times HFINCR_t + c_7 POST_t \times UnderINV \times HFINCR_t \\
& + c_8 OverINV \times HCASH_t + c_9 UnderINV \times HCASH_t \\
& + c_{10} POST_t \times OverINV \times HCASH_t + c_{11} POST_t \times UnderINV \times HCASH_t \\
& + c_{12} OverINV \times HINATTN_t + c_{13} UnderINV \times HINATTN_t \\
& + c_{14} POST_t \times OverINV \times HINATTN_t + c_{15} POST_t \times UnderINV \times HINATTN_t + d_i \\
& + \varepsilon_t \quad , \qquad (4)
\end{aligned}
$$

where $AbsAbnINV_t$ is the absolute value of abnormal investment. *HINATTN* is an indicator variable that equals to one if investor inattention is above the median, and zero otherwise (Hirshleifer and Teoh 2003); investor inattention is a factor created from a principal component analysis equally weighting standardized values for institutional ownership and logarithm of one plus the number of analysts following (we multiple the factor by -1, so a high value means more inattentive investors). *HFINCR* is equal to one if the Kaplan and Zingales (1997) financial constraint index is above the sample median, and zero otherwise. *HCASH* is equal to one if a firm exhibits cash holdings higher than the median, and zero otherwise (Jensen 1986, Blanchard et al. 1994, and Biddle et al. 2009).[12] The rest of the variables are defined under equation (2b). We compute the t-statistics using standard errors, clustered by firm and year.

The discussion in section 2.3 indicates that financially constrained firms are prone to underinvest and firms with large cash holdings tend to overinvest, but that these investment problems can be mitigated with better earnings quality. Indeed, table 7, column (1) shows that the estimated coefficient on *POST*×*UnderINV*×*HFINCR* and *POST*×*OverINV*×*HCASH* are both

[12] We also use excess cash holdings following Harford, Mansi, and Maxwell (2008). Harford et al. define excess cash holdings as the residual from a regression of cash holdings on the natural logarithm of assets, leverage, market-to-book ratio, cash flow-to-assets ratio, working capital-to-assets ratio, cash flow-to-assets volatility ratio, R&D-to-sales ratio, capital expenditures-to-assets ratio, and acquisition-to-sales ratio, as well as industry and year indicator variables. The (untabulated) results are qualitatively similar.

significantly negative, lending support to hypotheses H2.1a and H2.2a that financially constrained firms and firms with large cash holdings exhibit an improvement in investment efficiency after the adoption of SFAS No. 123R. The result for the High-ESO subsample, reported under column (3), is qualitatively similar to that for the full sample. In contrast, the estimated coefficients on *POST*×*UnderINV*×*HFINCR* and *POST*×*OverINV*×*HCASH* are insignificantly different from zero in the Low-ESO subsample (column 2). The difference in the estimated coefficients on *POST*×*UnderINV*×*HFINCR* is -0.006 (*t*-statistic = -2.30) and that on *POST*×*OverINV*×*HCASH* is also statistically negative (-0.012 with a *t*-statistic of -2.37). These results are consistent with hypotheses H2.1b and H2.2b, respectively.

Furthermore, table 7 documents that the estimated coefficients on *POST*×*OverINV*×*HINATTN* are significantly negative at less than the 1% level in the full, Low-ESO, and High-ESO samples. These findings are consistent with hypothesis H3.1a that the recognition of ESO expense mitigates the overinvestment problem of firms with inattentive investors. However, the evidence does not support hypothesis H3.1b, because the difference in the estimated coefficients between the High-ESO and Low-ESO subsamples is -0.003 and not distinguishable from zero.

These results are consistent with recognizing ESO expenses in the financial statements rather than disclosing them in the notes improves firm investment efficiency through the two channels proposed in the literature on the relationship between earnings quality and investment efficiency. The differential effects on investments between firms that use ESOs heavily and those that rely on ESOs to a lesser extent suggest that the improvement in investment efficiency is indeed due to the change in the accounting for ESOs.

6. Investment effect of voluntary recognition of ESO expense

In this section, we supplement our main results reported in section 5 by examining a sample of nonfinancial firms that voluntarily recognized ESO expense at fair value prior to the passage of SFAS No. 123R (i.e., the so called "voluntary adopters"). Based on the premise that recognition of previously disclosed ESO expense improves investment efficiency, we conjecture that these firms would adjust their investment behavior at the time they recognized ESO expense voluntarily, rather than at the time that such recognition became mandatory.

Since these voluntary adopters started recognizing ESO expenses in 2002 or early 2003, we partition the sample period into three sub-periods: 1994-2001 (disclosure), 2004-2005 (voluntary recognition), and 2006-2010 (mandatory recognition).[13] Relative to the 1994-2001 disclosure period, we expect to observe a significant improvement in investment efficiency in the 2004-2005 voluntary-recognition period, when these firms voluntarily recognized ESO expense at fair value (as encouraged but not required by SFAS No. 123). However, we expect no change in investment efficiency between the 2004-2005 voluntary-recognition period and the 2006-2010 mandatory-recognition period, when all firms were required to recognize ESO expense per SFAS No. 123R.

Table 8, panel A, columns (1) to (3) report mean and median *AbsAbnINV* for each of the three subperiods, respectively, while columns (4) and (5) report changes in *AbsAbnINV* over two of the specific subperiods. First, we compare abnormal investments in the voluntary-recognition period (2004-2005) with those in the disclosure period (1994-2001). Column (4) shows a statistically significant reduction in mean *AbsAbnINV* (*t*-statistic of -2.18), but the median change

[13] We exclude the period 2002-2003 because this is the period when the proposal for mandatory recognition of ESO expenses was debated and the Sarbanes-Oxley Act of 2002 was passed in response to the Enron and WorldCom scandals.The exclusion of these two transition years reduces noise in the data.

in *AbsAbnINV* is insignificant (*z*-statistic of -1.01). Next, we test for change in investment efficiency after the adoption of SFAS No. 123R by comparing the mandatory-recognition period (2006-2010) to the voluntary-recognition period (2004-2005). Column (5) indicates that both the mean and median changes in *AbsAbnINV* are indistinguishable from zero (*t*-statistic of -0.38 and *z*-statistic of 1.15, respectively). These results are consistent with our expectation for these voluntary adopters; i.e., that the voluntary recognition of ESO expense enhances investment efficiency, but the mandatory recognition requirement per SFAS No. 123R has no incremental effect because these firms have already recognized ESO expense.

To mitigate the concern of omitted unobservable variables affecting the findings documented above, we also conduct a difference-in-differences analysis. In any given year, we match each voluntary adopter to a firm from the mandatory adoption sample (i.e., firms that did not voluntarily recognize their ESO expense prior to the effective date of SFAS No. 123R). Specifically, for each voluntary adopter, we select from the same 2-digit SIC industry and market-to-book decile of the voluntary adopter a "mandatory adopter" that has a pre-SFAS No. 123R ESO expense similar to the voluntary adopter. Table 8, column (1) indicates that the matched sample of mandatory adopters has mean and median *AbsAbnINV* similar to the voluntary recognition sample during the 1994–2001 disclosure period (untabulated results show that the mean and median are not significantly different across the two samples).

Columns (4) and (5) in panel B of Table 8 report the mean and median changes in *AbsAbnINV* over the three subperiods. In contrast to the results for the voluntary adopters, we find an insignificant reduction in mean *AbsAbnINV* (*t*-statistic of 0.29) and actually a significant increase in median *AbsAbnINV* (*z*-statistic of 2.05) between the disclosure and voluntary-recognition periods. However, we document a significant reduction in both mean and median

AbsAbnINV between the voluntary-recognition (2004-2005) and mandatory-recognition (2006-2010) periods. Taken together, these results indicate that the recognition of previously disclosed ESO expenses enhances investment efficiency.

Table 8, panel C reports the results of the difference-in-differences analysis between the voluntary adopters and their matched mandatory counterparts. Column (4) shows that the reduction in the absolute value of abnormal investment between the disclosure and voluntary-recognition periods is significantly higher for the voluntary adopters than for the matched mandatory adopters (mean of -0.007 with a *t*-statistic of -1.68 and median of -0.016 with a *z*-statistic of -2.98). On the other hand, column (5) indicates that the improvement in investment efficiency between the voluntary-recognition and mandatory-recognition periods is significantly higher for the matched mandatory adopters than for the voluntary adopters (mean of 0.005 with a *t*-statistic of 1.76, and median of 0.011 with a *z*-statistic of 1.94). These results are consistent with our expectation that the enhancement in investment efficiency occurred during the voluntary recognition period for voluntary adopters, but occurred only after SFAS No. 123R took effect for the mandatory adopters.

In sum, the results reported in table 8 corroborate those documented in section 5, that the improvement in investment efficiency is partly attributable to the switch from disclosing ESO expense in the notes to recognizing it in the financial statements. We also add to the findings documented by two related studies. Aboody et al. (2004) show that the stock market reacts positively to announcements made by companies that explicitly stated that the reason they voluntarily expensed ESO expense at fair value was to improve financial reporting transparency. In a supportive experimental study, Frederickson et al. (2006) find that sophisticated users perceived voluntarily recognized ESO expense to be more reliable than disclosed ESO expense.

7. Additional analyses

We conduct several robustness tests to check how sensitive our main results are with respect to various alternative specifications. First, we re-estimate our measure of investment efficiency (or abnormal investment) by modifying our investment regression equation (1) in the following manners: (a) adding lagged terms of *MRET* and *GDPG* to the original model to allow for lagged effects from these two macroeconomic factors; (b) adding lead terms of *MRET* and *GDPG* to the original model to allow for lead effects from the two macroeconomic variables; (c) including the squared terms of *VEGA* and *DELTA* to the model to control for any nonlinear relationship between managerial stock-based incentives and investment decisions; and (d) excluding the voluntary adopters in the estimation of the investment regression. We then redo all the empirical analyses using these alternative abnormal investment measures. Our main inferences remain unchanged.

Second, we mitigate any concern that the financial crisis may have contaminated our results by restricting the sample period to years prior to 2007. In particular, we re-do all the analyses using a shorter post-SFAS No. 123R period (2006-2007). The results (not tabulated) remain qualitatively unchanged.

8. Conclusion

We investigate the implications of recognition versus disclosure on investment efficiency. While prior research has exclusively focused on the value relevance of recognized versus disclosed information, we offer an alternative research approach by exploring the differential implication of recognition versus disclosure on investment efficiency.

Extant theories suggest that recognized amounts are more reliably measured than disclosed amounts and that investors process recognized and disclosed information differently. We test these two implications using the adoption of SFAS No. 123R, which requires recognition of previously disclosed employee stock option (ESO) expense. We find that investment efficiency improves in the post SFAS No. 123R period, especially for heavy ESO users. Firms with less reliably measured ESO expense exhibit a larger increase in investment efficiency, suggesting that the recognition requirement improves earnings quality more for these firms. Moreover, firms with more inattentive investors also experience a larger improvement in investment efficiency. Taken together, our results are consistent with disclosure not being a substitute for recognition, thereby providing triangulating evidence to complement prior studies that examined the valuation implications of recognition versus disclosure.

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Appendix

This appendix describes the construction of the variables used in this study. *Compustat* and *ExecuComp* variable names are given in square brackets.

Variable	Definition
INV	The sum of research and development expense [xrd] and capital expenditure [capx] net of proceeds from sales of property, plant, and equipment [sppiv], scaled by total assets [at].
AbsAbnINV	The absolute value of estimated residuals from equation (1)
AbsAbnINV+	The absolute value of positive estimated residuals from equation (1)
AbsAbnINV-	The absolute value of negative estimated residuals from equation (1)
MB	Total assets [at] minus book value of common shares [ceq] plus market value of common shares [prcc_f*csho], divided by total assets.
SURCH	Surplus cash calculated as net cash flow from operating activities [oancf] minus depreciation and amortization [dp] plus research and development expense [xrd] scaled by total assets [at].
LOGTENURE	Natural logarithm of number of years since the CEO first became the CEO of the firm.
CASHCOM	Total Current Compensation including salary and bonus [total_curr] scaled by total compensation [tdc1].
VEGA	The change in the dollar value (in millions) of the CEO's option holding for a 1% change in the annualized standard deviation of the firm's stock returns.
DELTA	The change in the dollar value (in millions) of the CEO's stock and option holding for a 1% change in the stock price.
LOGSALES	Natural logarithm of sales [sale].
$LOGSALES^2$	Square of *LOGSALES*.
GROWTH	Current year's growth in sales [sale].
LEV	Market leverage calculated as total long-term debt [dltt] divided by total long-term debt [dltt] plus market value of common shares [prcc_f*csho].
ARET	One year holding period return on an investment in the firm's common stock.
ROA	Operating income before depreciation [oibdp] scaled by total assets [at].
STDROA	Standard deviation of *ROA* for the five years ending with the current year.
MRET	Value-weighted market annual return.
GDPG	GDP growth.

(continued…)

Appendix (… continued)

Variable	Definition
TRADE<5	An indicator equal to one if the firm's shares have been traded publicly for fewer than five years, and zero otherwise.
STDHVOL	The logarithm of the standard deviation of the past five annual volatility measures, where annual volatility is calculated from CRSP monthly stock returns scaled by historical volatility measured as the standard deviation of past 60 monthly returns. If the firm has traded for fewer than 60 months, we calculate historical volatility over the firm's trading history. Annual volatility is the standard deviation of monthly returns. If a firm has insufficient trading history to calculate annual volatility for the prior five years, we set this variable equal to the industry mean (Fama and French 48 categories) for that year.
NOTRADEOPT	An indicator equal to one if the firm does not have traded stock options with expiration dates at least 365 days from the beginning of the fiscal year. As the coverage of OptionMetrics starts from 1996, we use the value of this variable in 1996 for 1994 and 1995.
DIFFVOL	The logarithm of the absolute difference between historical volatility and implied volatility. Historical volatility is measured as the standard deviation of past 60 monthly returns. If the firm has traded for fewer than 60 months, we calculate historical volatility over the firm's trading history. The implied volatility is obtained from the firm's longest-time-to-expiration, at-the-money options. If the firm does not have traded options for its shares, implied volatility is set equal to the industry-year median implied volatility, where industries are defined as Fama and French 48 categories. As the coverage of OptionMetrics starts from 1996, we use the value of implied volatility in1996 for 1994 and 1995.
UNREL	Unreliability, calculated as the first principal component of *TRADE<5*, *STDHVOL*, *NOTRADEOPT*, and *DIFFVOL*
HUNREL	An indicator equal to one if *UNREL* is greater than the median, and zero otherwise.
INSTINV	The proportion of shares outstanding, owned by institutional investors, multiplied by minus one.
ANALYINV	The logarithm of one plus the number of analysts following the firm, multiplied by minus one.
INATTN	Investor inattention, calculated as the first principal component of *INSTINV* and *ANALYINV*.
HINATTN	An indicator equal to one if *INATTN* is above the media, and zero otherwise.

Table 1
Descriptive statistics for sample firms (1994–2010)

The initial sample includes all companies, except financial institutions and utilities, in *ExecuComp*. Firm characteristics and CEO compensation data are from *Compustat* and *ExecuComp*, respectively. Research and development expense is set to zero if it is missing in *Compustat*. N=21,424.

($ millions)	Mean	Std Dev	25%	50%	75%
Research and development (R&D)	99.13	337.87	0.00	2.39	43.00
Capital expenditure net of proceeds from sales of PP&E (CAPEX)	275.69	711.55	15.94	50.55	178.19
Investment (= R&D + CAPEX)	391.61	998.24	27.55	78.06	259.07
Sales	4,388.75	9,625.37	431.48	1,153.21	3,469.65
Assets	4,718.30	10,860.66	423.72	1,118.71	3,508.40
Market value of equity	5,979.59	15,626.00	461.34	1,228.35	3,912.37

Table 2
Descriptive statistics on regression variables (1994–2010)

INV is the sum of research and development expense and capital expenditure net of proceeds from sales of property, plant, and equipment, scaled by total assets. Market-to-book ratio, *MB*, is total assets minus book value of common shares plus market value of common shares, scaled by total assets. Surplus cash, *SURCH*, is net cash flow from operating activities minus depreciation and amortization plus research and development expense, scaled by total assets. *LOGTENURE* is the natural logarithm of the number of years since the CEO first becoming the CEO of the firm. Cash compensation, *CASHCOM*, is total current salary and bonus, scaled by total compensation. *LOGSALES* is the natural logarithm of sales. Sales growth, *GROWTH*, is the growth in current year's net sales. *LEV*, leverage, is total long-term debt divided by the sum of total long-term debt and market value of common shares. *ARET* is one-year holding period stock return. *STDROA* is the standard deviation of *ROA* in the past five years, where *ROA*, return on assets, is operating income before depreciation scaled by total assets. *VEGA* is the change in the dollar value (in millions) of the CEO's option holding for a 1% change in the annualized standard deviation of the firm's stock returns. *DELTA* is the change in the dollar value (in millions) of the CEO's stock and option holding for a 1% change in the stock price. *MRET* is annual CRSP value-weighted market return. *GDPG* is the annual growth in the domestic gross product. N=21,424.

Panel A: Summary statistics

Variable	Mean	Std Dev	25%	50%	75%
INV	0.097	0.080	0.041	0.075	0.127
MB	2.057	1.369	1.229	1.616	2.339
SURCH	0.088	0.097	0.032	0.078	0.135
LOGTENURE	1.639	0.985	0.982	1.720	2.367
CASHCOM	0.453	0.288	0.213	0.392	0.650
VEGA	0.141	0.377	0.000	0.035	0.129
DELTA	1.597	34.747	0.070	0.191	0.539
LOGSALES	7.127	1.586	6.067	7.050	8.152
GROWTH	0.091	0.227	-0.003	0.081	0.181
LEV	0.176	0.190	0.010	0.121	0.271
ARET	0.160	0.557	-0.175	0.087	0.371
STDROA	0.047	0.047	0.018	0.031	0.056
MRET	0.099	0.201	-0.013	0.154	0.252
GDPG	0.025	0.020	0.019	0.030	0.041

(continued…)

Table 2 (… continued)

Panel B: Correlation Matrix

	INV	*MB*	*SURCH*	*LOGTENURE*	*CASHCOM*	*VEGA*	*DELTA*	*LOGSALES*	*GROWTH*	*LEV*	*ARET*	*STDROA*	*MRET*
MB	0.303*												
SURCH	0.318*	0.526*											
LOGTENURE	0.022*	0.048*	0.031*										
CASHCOM	-0.052*	-0.122*	-0.134*	0.113*									
VEGA	0.038*	0.174*	0.158*	-0.013*	-0.501*								
DELTA	0.029*	0.410*	0.242*	0.347*	-0.228*	0.397*							
LOGSALES	-0.229*	-0.095*	-0.039*	-0.059*	-0.257*	0.349*	0.402*						
GROWTH	0.128*	0.315*	0.132*	0.121*	-0.002	0.045*	0.221*	-0.065*					
LEV	-0.267*	-0.578*	-0.470*	-0.044*	0.015*	0.005	-0.143*	0.319*	-0.151*				
ARET	-0.031*	0.382*	0.170*	0.027*	0.006	0.077*	0.254*	0.026*	0.199*	-0.168*			
STDROA	0.254*	0.132*	0.090*	-0.047*	0.003	-0.118*	-0.141*	-0.400*	0.030*	-0.222*	-0.048*		
MRET	0.019*	0.109*	-0.017*	0.023*	0.086*	-0.007	0.039*	-0.023*	0.030*	-0.024*	0.380*	-0.019*	
GDPG	0.122*	0.117*	-0.056*	0.028*	0.186*	-0.002	0.039*	-0.052*	0.221*	-0.003	0.073*	-0.009	0.305*

* denotes statistical significance at the 10% level (using a two-tailed test).

Table 3
Regressions of investment on firm characteristics (1994–2010)

This table summarizes the estimation of the following equation:

$$INV_t = a_0 + a_1 MB_t + a_2 SURCH_t + a_3 LOGTENURE_t + a_4 CASHCOMP_t + a_5 VEGA_t + a_6 DELTA_t + a_7 LOGSALES_t + a_8 LOGSALES^2{}_t + a_9 GROWTH_t + a_{10} LEV_t + a_{11} ARET_t + a_{12} STDROA_t + a_{13} MRET_t + a_{14} GDPG_t + \varepsilon_t \quad , \qquad (1)$$

where *INV* is the sum of research and development expense and capital expenditure net of proceeds from sales of property, plant, and equipment, scaled by total assets. Market-to-book ratio, *MB*, is total assets minus book value of common shares plus market value of common shares, scaled by total assets. Surplus cash, *SURCH*, is net cash flow from operating activities minus depreciation and amortization plus research and development expense, scaled by total assets. *LOGTENURE* is the natural logarithm of the number of years since the CEO first becoming the CEO of the firm. Cash compensation, *CASHCOM*, is total current salary and bonus, scaled by total compensation. *VEGA* is the change in the dollar value (in millions) of the CEO's option holding for a 1% change in the annualized standard deviation of the firm's stock returns. *DELTA* is the change in the dollar value (in millions) of the CEO's stock and option holding for a 1% change in the stock price. *MRET* is the value-weighted market returns. *LOGSALES* is the natural logarithm of sales. *GROWTH* is the percent change in current year's sales. *LEV*, leverage, is total long-term debt divided by the sum of total long-term debt and market value of common shares. *ARET* is one-year holding period stock return. *STDROA* is the standard deviation of ROA for the five years ending with the current year. *GDPG* is GDP growth. Equation (1) is estimated using ordinary least squares by industry. The table reports the means and *t*-statistics (in parentheses) of the estimated coefficients across twelve Fama-French industries. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

(continued…)

Table 3 (… continued)

	Pred. Sign	*INV*	
Intercept		0.219	***
		(5.13)	
MB	+	0.010	***
		(4.26)	
SURCH	+	0.147	***
		(4.05)	
LOGTENURE	-	0.001	
		(0.80)	
CASHCOMP	*?*	-0.006	*
		(-1.75)	
VEGA	*?*	-0.012	**
		(-2.43)	
DELTA	+	-0.001	
		(-0.49)	
LOGSALES	*?*	-0.042	***
		(-3.45)	
$LOGSALES^2$	*?*	0.002	***
		(3.06)	
GROWTH	+	0.006	
		(0.87)	
LEV	*?*	-0.001	
		(-0.12)	
ARET	-	-0.016	***
		(-7.21)	
STDROA	*?*	0.146	**
		(2.50)	
MRET	+	0.009	***
		(3.77)	
GDPG	+	0.275	***
		(4.31)	
Adjusted R^2		0.220	
N		21,424	

Table 4
Abnormal investment in the pre- and post-SFAS No. 123R periods

This table reports summary statistics on the absolute value of abnormal *INV* (*AbsAbnINV*) , the absolute value of positive abnormal *INV* (*AbsAbnINV*+), and the absolute value of negative abnormal *INV* (*AbsAbnINV*-) over the period from 1994 to 2005 (pre-SFAS No.123R) and the period from 2006–2010 (post-SFAS No. 123R) for mandatory expensing firms. *INV* is the sum of research and development expense and capital expenditure, scaled by total assets. Abnormal investment is the residual from regressing *INV* on firm-specific and economy-wide characteristics in equation (1). The *t*-value for the mean and *z*-value for the median are reported in the table. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

		(1) Pre-SFAS 123R (1994–2005)	(2) Post-SFAS 123R (2006–2010)	(3) Post-period vs. Pre-period Difference	t/z-statistic
AbsAbnINV	Mean	0.045	0.040	-0.005***	-9.145
	Median	0.034	0.032	-0.002***	-5.976
	N	14,076	6,571		
AbsAbnINV+	Mean	0.054	0.046	-0.008***	-6.291
	Median	0.036	0.031	-0.006***	-6.536
	N	6,223	2,558		
AbsAbnINV-	Mean	0.039	0.037	-0.002***	-4.215
	Median	0.033	0.032	-0.001*	-1.830
	N	7,853	4,013		

Table 5
Abnormal investment around the adoption of SFAS No. 123R

This table summarizes the estimation of the following equation:

$$Dep\ Var_t = b_0 + b_1 POST_t + d_i + \varepsilon_t \qquad (2)$$

where *Dep Var* is the absolute value of abnormal investment (ABS*AbnINV*), the absolute value of abnormal underinvestment (*AbsAbnINV-*), or the absolute value of the abnormal overinvestment (*AbsAbnINV+*). *POST* is equal to one for years 2006–2010, and zero otherwise. Fama-French 12 industry fixed effects are included (d_i). High (Low) ESO users are firms with ESO use greater (less) than the sample median. We calculate the ESO use as the average of ESO expense divided by total assets over the period 1994–2005 for each firm. Columns (1), (2), and (3) present the estimation of equation (2) for all firms, firms with high ESO use, and firms with low ESO use, respectively. Columns (4) and (5) present the estimation of equation (2) for underinvesting firms with high ESO use and low ESO use, respectively. Columns (6) and (7) present the estimation of equation (2) for overinvesting firms with high ESO use and low ESO use, respectively The *t*-statistics (in parentheses) are computed using standard errors clustered by firm and year. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	Pred. Sign	(1) *AbsAbnINV* Full	(2) *AbsAbnINV* Low ESO	(3) *AbsAbnINV* High ESO	(4) *AbsAbnINV+* Low ESO	(5) *AbsAbnINV+* High ESO	(6) *AbsAbnINV-* Low ESO	(7) *AbsAbnINV-* High ESO
POST	H1a (–)	-0.006***	-0.002	-0.011***	-0.005	-0.014***	0.001	-0.008***
		(-3.41)	(-1.01)	(-4.83)	(-1.46)	(-4.03)	(0.49)	(-3.46)
Constant		0.050***	0.049***	0.052***	0.064***	0.066***	0.037***	0.046***
		(23.18)	(15.67)	(21.58)	(12.03)	(14.17)	(19.73)	(23.61)
POST: β[High] – β[Low]	H1b (–)		-0.009***		-0.009***		-0.009***	
			(-6.79)		(-3.48)		(-5.40)	
Industry FE		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations		20647	10332	10315	4163	4618	6169	5697
Adj. R-squared		0.099	0.116	0.067	0.111	0.060	0.168	0.089

Table 6
Absolute abnormal investment around SFAS No. 123R: Estimate reliability vs. investor inattention

This table summarizes the estimation of the following equations:

$$Dep\ Var_t = c_0 + c_1 POST_t + c_2 HUNREL_t + c_3 POST_t \times HUNREL_t + c_4 HINATTN_t + c_5 POST_t \times HINATTN_t + d_i + \varepsilon_t \ , \quad (3a)$$

$$\begin{aligned} Dep\ Var_t = {} & c_0 + c_1 POST_t + c_2 TRADE<5_t + c_3 POST_t \times TRADE<5_t + c_4 STDHVOL_t + c_5 POST_t \times STDHVOL_t \\ & + c_6 NOTRADEDOPT_t + c_7 POST_t \times NOTRADEDOPT_t + c_8 DIFFVOL_t + c_9 POST_t \times DIFFVOL_t \\ & + c_{10} INSTINV_t + c_{11} POST_t \times INSTINV_t + c_{12} ANALYINV_t + c_{13} POST_t \times ANALYINV_t + d_i \\ & + \varepsilon_t \ , \end{aligned} \quad (3b)$$

where *Dep Var* is the absolute value of abnormal investment (*AbsAbnINV*), the absolute value of abnormal underinvestment (*AbsAbnINV-*), or the absolute value of abnormal overinvestment (*AbsAbnINV+*). *POST* is equal to one for years 2006 – 2010, and zero otherwise. *TRADE<5* isan indicator variable that equals to one if the firm's shares have been traded publicly for fewer than five years, and zero otherwise. *STDHVOL* is the logarithm of the standard deviation of the past five annual volatility measures, where annual volatility is calculated from CRSP monthly stock returns scaled by historical volatility measured as the standard deviation of past 60 monthly returns. *NOTRADEOPT* equals to one if the firm does not have traded stock options with expiration dates at least 365 days from the beginning of the fiscal year, and zero otherwise. *DIFFVOL* is the logarithm of the absolute difference between historical volatility and implied volatility where historical volatility is measured as the standard deviation of past 60 monthly returns. *HUNREL* equals one for firms with above the median *UNREL*, and zero otherwise where *UNREL* is the first principal component of *TRADE<5*, *STDHVOL*, *NOTRADEOP*, and *DIFFVOL*. *INSTINV* is the proportion of a firm's shares outstanding that is owned by institutional investors, multiplied by -1. *ANALYINV* is the logarithm of 1 plus the number of analysts following the firm, multiplied by -1. *HINATTN* is an indicator variable that equals to one for firms with *INATTN* above the median, and zero otherwise where *INATTN* is the first principal component of *INSTINV* and *ANALYINV*. Fama-French 12 industry fixed effects are included (d_i). High (Low) ESO users are firms with ESO use greater (less) than the sample median. We calculate the ESO use as the average of ESO expense divided by total assets over the period 1994–2005 for each firm. The *t*-statistics (in parentheses) are computed using standard errors clustered by firm and year. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Summary statistics

Variable	Mean	Std Dev	25%	50%	75%
UNREL	0.000	1.060	-0.694	-0.133	0.510
TRADE<5	0.039	0.194	0.000	0.000	0.000
STDHVOL	-1.399	0.434	-1.651	-1.362	-1.100
NOTRADEDOPT	0.768	0.422	1.000	1.000	1.000
DIFFVOL	-1.261	0.441	-1.561	-1.268	-0.962
INATTN	0.000	1.047	-0.875	0.049	0.652
INSTINV	-0.341	0.405	-0.756	-0.001	0.000
ANALYINV	-1.879	1.101	-2.708	-2.197	-1.099

(continued…)

Table 6 (continued)

Panel B: Regression Analyses

	Pred. Sign	(1) *AbsAbnINV*	(2) *AbsAbnINV-*	(3) *AbsAbnINV+*	(4) *AbsAbnINV*	(5) *AbsAbnINV-*	(6) *AbsAbnINV+*
POST		-0.004**	-0.004*	-0.005	-0.016***	-0.011*	-0.024***
		(-2.47)	(-1.69)	(-1.58)	(-2.91)	(-1.90)	(-2.75)
HUNREL		0.010***	0.007***	0.011***			
		(6.70)	(5.38)	(4.56)			
POST×HUNREL	H2 (–)	-0.004**	-0.005**	-0.001			
		(-2.34)	(-2.05)	(-0.51)			
TRADE<5					0.009**	0.010***	0.007*
					(2.35)	(2.66)	(1.75)
STDHVOL					0.012	0.018**	0.009
					(1.48)	(2.08)	(0.76)
NOTRADEDOPT					-0.002	-0.002	-0.001
					(-0.57)	(-0.94)	(-0.22)
DIFFVOL					0.012***	0.007***	0.016***
					(7.91)	(4.41)	(6.55)
POST×TRADE<5	H2 (–)				0.018	0.014	0.025
					(1.45)	(1.42)	(1.50)
POST×STDHVOL	H2 (–)				-0.006	-0.017	0.002
					(-0.48)	(-1.53)	(0.10)
POST× NONTRADEDOPT	H2 (–)				-0.010***	-0.009***	-0.010
					(-3.13)	(-2.79)	(-1.58)
POST×DIFFVOL	H2 (–)				-0.005**	-0.007**	-0.004
					(-2.40)	(-2.29)	(-1.13)
HINATTN		0.008***	0.007***	0.010***			
		(4.41)	(3.42)	(4.33)			
POST×HINATTN	H3 (–)	-0.010***	-0.004	-0.017***			
		(-4.38)	(-1.33)	(-7.44)			
INSTINV					0.007**	-0.001	0.016***
					(2.54)	(-0.60)	(4.01)
ANALYINV					0.002**	0.004***	0.001
					(1.96)	(3.01)	(0.74)
POST×INSTINV	H3 (–)				-0.008**	0.005	-0.021***
					(-2.30)	(1.39)	(-4.81)
POST×ANALYINV	H3 (–)				-0.004**	-0.005**	-0.004**
					(-2.31)	(-2.09)	(-2.04)
Constant		0.042***	0.038***	0.053***	0.070***	0.058***	0.089***
		(16.71)	(16.44)	(10.47)	(17.47)	(13.48)	(14.12)
Industry FE		Yes	Yes	Yes	Yes	Yes	Yes
Observations		10315	5697	4618	10315	5697	4618
Adj. R-squared		0.085	0.106	0.080	0.093	0.118	0.092

Table 7
Cross-sectional variation in absolute abnormal investment around SFAS No. 123R: Mechanisms

This table summarizes the estimation of the following equation:

$$\begin{aligned} AbsAbnINV_t = {} & c_0 + c_1 UnderINV + c_2 POST_t \times OverINV + c_3 POST_t \times UnderINV + c_4 OverINV \times HFINCR_t \\ & + c_4 UnderINV \times HFINCR_t + c_4 POST_t \times OverINV \times HFINCR_t + c_4 POST_t \times UnderINV \times HFINCR_t \\ & + c_4 OverINV \times HCASH_t + c_4 UnderINV \times HCASH_t + c_4 POST_t \times OverINV \times HCASH_t \\ & + c_4 POST_t \times UnderINV \times HCASH_t + c_4 OverINV \times HINATTN_t + c_4 UnderINV \times HINATTN_t \\ & + c_4 POST_t \times OverINV \times HINATTN_t + c_4 POST_t \times UnderINV \times HINATTN_t + d_i + \varepsilon_t \quad , \end{aligned} \tag{4}$$

where $AbsAbnINV_t$ is the absolute value of abnormal investment (*AbnINV*). *POST* is equal to one for years 2006 – 2010, and zero otherwise. *UnderINV* (*OverINV*) is an indicator variable that takes the value of one if *AbnINV*<0 (*AbnINV*>0), and zero otherwise. *HFINCR* is equal to one if the Kaplan and Zingales' (1997) financial constraint index is above the median, and zero otherwise. *HCASH* is equal to one if a firm exhibits cash holdings higher than the median. *HINATTN* is equal to one if investor inattention is above the median, and zero otherwise. Investor inattention is the factor created from a principal component analysis equally weighting standardized values for institutional ownership and logarithm of one plus the number of analysts following, multiplied by -1. Fama-French 12 industry fixed effects are included (d_i). High (low) ESO users are firms with ESO use greater (less) than the sample median. We calculate the ESO use as the average of ESO expense divided by total assets over the period 1994–2005 for each firm. The *t*-statistics (in parentheses) are computed using standard errors clustered by firm and year. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

(continued…)

Table 7 (continued)

	Hypothesis (Pred. sign)	(1) Full	(2) Low-ESO	(3) High-ESO
Constant		0.049***	0.049***	0.052***
		(17.51)	(12.39)	(17.79)
UnderINV		-0.013***	-0.012***	-0.017***
		(-5.19)	(-4.48)	(-5.65)
POST× OverINV		0.004*	0.004	0.001
		(1.85)	(1.46)	(0.28)
POST× UnderINV		-0.000	0.001	-0.002
		(-0.22)	(0.65)	(-0.65)
OverINV× HFINCR		0.008***	0.005***	0.008***
		(6.95)	(3.90)	(4.52)
UnderINV× HFINCR		0.005**	0.010***	-0.003
		(2.29)	(4.10)	(-0.97)
POST× OverINV× HFINCR		-0.004	-0.003	-0.001
		(-1.42)	(-0.84)	(-0.13)
POST× UnderINV× HFINCR	H2.1a (–)	-0.006***	-0.000	-0.007***
		(-4.28)	(-0.25)	(-3.06)
OverINV× HCASH		0.005***	0.006***	0.003**
		(5.07)	(5.50)	(2.00)
UnderINV× HCASH		0.007***	-0.004	0.009***
		(2.89)	(-1.48)	(2.59)
POST× OverINV× HCASH	H2.2a (–)	-0.009***	0.001	-0.011**
		(-2.88)	(0.36)	(-2.17)
POST× UnderINV× HCASH		0.002*	0.002	0.001
		(1.68)	(1.25)	(0.85)
OverINV× HINATTN		0.006***	0.005***	0.009***
		(5.39)	(3.69)	(4.27)
UnderINV× HINATTN		0.008***	0.005***	0.013***
		(4.55)	(2.67)	(4.72)
POST× OverINV× HINATTN	H3.1a (–)	-0.015***	-0.015***	-0.017***
		(-6.12)	(-4.52)	(-6.09)
POST× UnderINV× HINATTN		-0.004	-0.003	-0.006*
		(-1.36)	(-1.12)	(-1.94)
Industry FE		Yes	Yes	Yes
Observations		20647	10332	10315
Adj. R-squared		0.139	0.156	0.105
POST× OverINV× HFINCR: β[High] – β[Low]			0.002	
			(0.41)	
POST× UnderINV× HFINCR: β[High] – β[Low]	H2.1b (–)		-0.006**	
			(-2.30)	
POST× OverINV× HCASH: β[High] – β[Low]	H2.2b (–)		-0.012**	
			(-2.37)	
POST× UnderINV× HCASH: β[High] – β[Low]			-0.000	
			(-0.17)	
POST× OverINV× HINATTN: β[High] – β[Low]	H3.1b (–)		-0.003	
			(-0.71)	
POST× UnderINV× HINATTN: β[High] – β[Low]			-0.003	
			(-1.19)	

Table 8
Changes in abnormal investment for firms that voluntarily recognize ESO expenses prior to SFAS No. 123R

This table summarizes the mean and median absolute value of abnormal investment (*AbsAbnINV*) in three sample periods: 1994–2001 (disclosure), 2004–2005 (voluntary recognition), and 2006–2010 (mandatory recognition). Columns (4) and (5) present the changes in *AbsAbnINV* for firms that voluntarily recognized ESO expenses in 2002 or early 2003 (voluntary adopters in panel A), and the changes in *AbsAbnINV* for a matched sample of firms that did not recognize ESO expenses until SFAS No. 123R took effect (matched mandatory adopters in panel B). The mandatory adopters are matched to the voluntary adopters by 2-digit SIC industry, market-to-book decile, and ESO expense. Panel C reports the difference-in-differences estimates of the changes in *AbsAbnINV* between the voluntary adopters in panel A and matched mandatory adopters in panel B. The corresponding *t*-value for the mean and *z*-value for the median are reported in parentheses underneath the estimate. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1) Disclosure 1994 – 2001	(2) Voluntary Recognition 2004 – 2005	(3) Mandatory Recognition 2006 – 2010	(4) (2) – (1)	(5) (3) – (2)
Panel A: Voluntary Adopters					
Mean	0.035	0.028	0.027	-0.006** (-2.18)	-0.001 (-0.38)
Median	0.028	0.020	0.024	-0.008 (-1.01)	0.004 (1.15)
Panel B: Matched Mandatory Adopters					
Mean	0.036	0.036	0.030	0.001 (0.29)	-0.006*** (-2.79)
Median	0.028	0.036	0.028	0.008** (2.05)	-0.008*** (-3.28)
Panel C: Difference-in-Differences					
Mean				-0.007* (-1.68)	0.005* (1.76)
Median				-0.016*** (-2.98)	0.011** (1.94)
N	281	92	174		